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Environmental Issues Affecting the Forestry and Forest Products Industries in the Eastern United States

August 24-26, 1994
Baltimore, Maryland

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Proceedings

**Environmental Issues
Affecting the Forestry and
Forest Products Industries in
the Eastern United States**

**August 24-26, 1994
Baltimore, Maryland**



**Edited by
J. Daniel Dolan
and
Angela Riegel**



PREFACE

These proceedings are the result of a two and one-half day conference that was sponsored by the **Forest Products Society, the Department of Wood Science and Forest Products and College of Forestry and Wildlife Resources at Virginia Polytechnic Institute and State University, USDA Forest Service's Northeast Forest Experimental Station and Region 8 Cooperative Forestry**. In addition, American Plywood Association, American Pulpwood Association, Inc., American Wood Preservers' Association, Association of Consulting Foresters of America, Inc., Audubon Society of New York State, Champion International Corporation, Chesapeake Forest Products Company, Environmental Law Institute, Forest Farmers Association, Forest History Society, Inc., Lake States Forestry Alliance, Maryland Forests Association, Massachusetts Forestry Association, National Association of Conservation Districts, National Association of State Foresters, National Association of University Fisheries and Wildlife Programs, National Council of the Paper Industry for Air and Stream Improvement, Inc. (NCASI), National Hardwood Lumber Association, National Oak Flooring Manufacturers' Association, National Particleboard Association, National Recreation and Park Association, National Wildlife Federation, Northeastern Loggers' Association, Inc., Piedmont Environmental Council, Rawles-Aden Lumber Corporation, Smart Wood Program-Rainforest Alliance, Society of American Foresters, Society for the Protection of New Hampshire Forests, Southeastern Dry Kiln Club, Southeastern Lumber Manufacturers Association, Inc., Southern Forest Products Association, Southern Pine Inspection Bureau, Tall Timbers, Tennessee Valley Dry Kiln Association, Timber Framers Guild of North America, Truss Plate Institute, Virginia Department of Conservation and Recreation, Virginia Department of Forestry, Virginia Forestry Association, Virginia Native Plant Society, West Virginia Forestry Association, Wildlife Management Institute, Woodworkers Alliance for Rainforest Protection, and World Forestry Center lent their assistance by providing mailing lists and other non-monetary assistance.

The steering committee consisted of **Derb Carter**, Attorney at Law, Southern Environmental Law Center; **J. Daniel Dolan**, Department of Wood Science and Forest Products, Virginia Polytechnic Institute and State University; **J. Michael Foreman**, Chief, Forest Resources Utilization, Virginia Department of Forestry; **John Godbee**, Manager, Environmental Compliance, Union Camp Corporation; **Russ Lea**, Interim Associate Vice Chancellor for Research, Outreach, and Extension, North Carolina State University; **Jeff Olsson**, Director, Bolle Center, Wilderness Society; **Edith Petrick**, Deputy Director, Cooperative Forestry, Southern Region U.S. Forest Service; **W.D. Ticknor**, President Forest Consultant, Inc.; **Cynthia D. West**, Research Project Leader, USDA Northeast Forest Experimental Station, **Anne Heissenbittel**, Director of Forest Planning and Policy, American Forest and Paper Association.

The conference addressed the broad issues concerning environmental policies affecting the forestry and forest products industries, the driving forces behind them, and the effects they have on the national and global environment. A paradigm of three general factors or forces that drive environmental policy was proposed based on: 1) Society's Wants and Needs, 2) The Need to Maintain the Integrity of the Eastern Forest Ecosystems, and 3) The Role of Forest Management,

Forest Products Research and Development, and the Associated Improved Utilization of the Harvested Resource in satisfying forces (1) and (2). Within this system, it was recognized that the two drivers, Regulation and Incentive Systems, are used to provide direction for the paradigm to function.

This paradigm was investigated, and the strengths and weaknesses of the current policy for management of the forest resource and industry of the Eastern United States were highlighted. Representatives for consumers, industry, government, environmental organizations, academia, and private land owners met together to assess current policy and worked toward recommendations for how future policy might better serve all parties affected.

The objectives for the conference that were met and addressed during the conference were:

- A forum for discussion of environmental issues affecting forestry and forest products industries of the Eastern United States, based on more scientific observations and rational thinking, rather than emotions was provided.
- A fairly balanced review of the methods and policies used to direct the use of the eastern forest resource over the past 50 years was provided.
- Direction for future policy makers in government, industry, and environmental organizations was provided. These included topics that affect local, regional, national, and international environmental quality.
- Environmentally sound forestry operation was clarified.
- Examples of how groups can cooperate for mutual gain of all groups involved were presented.
- Steps for improvement of forestry operations of all scales were identified.
- Multi-disciplinary research and problem solving were identified as the “best” approach to environmental understanding and problem solving.
- Several incentive for good practice were identified as preferable to continued disincentive approaches to problem resolution.

The conference could be deemed a success based on the response of those attending. Most of the participants stated that they gained a tremendous amount of respect and understanding for the opposing parties on the issues of concern. A better understanding of the rationale behind the rhetoric and actions was gained. Finally, most participants agreed that a more optimistic view of environmental negotiation was in order, and the extreme views held by parties on both sides of the issues were usually not the view held by the majority of interested parties.

The surprising result of the conference was definitely the willingness of all participants to listen intently to what individual speakers were saying, give credit to all view points without discounting out of hand, and openly discussing the topics without a loss of tempers. While no earth-shattering agreements were arrived at, with few exceptions, cooperation and compromise was seen as achievable.

These proceedings provide some of the discussion that took place during the conference. The first section contains the manuscripts for the formal plenary presentations and the second section contains the extended abstracts for the poster session presentations given during the meeting. It was impossible to document all of the discussions, however, the moderators for each of the work sessions have provided their interpretation of the work session discussion. It is hoped that these proceedings will continue to provide a basis for further discussion and foster further cooperation and compromise when negotiating solutions to future problems related to those discussed at the meeting.

J. Daniel Dolan
Conference Chair

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Opening Speech

For

Environmental Issues Affecting the Forestry and Forest Products Industries of the Eastern United States

J. Daniel Dolan

Conference Chairman

Welcome to the National Conference on Environmental Issues Affecting the Forestry and Forest Products Industries of the Eastern United States. My name is Dan Dolan and I am Chairman of this conference. If there are any questions you may have, or any problems that I, or my assistants, can help with during the next 2-1/2 days, please feel free to contact either myself, Angela Riegel, our conference secretary, or any of those assisting with the registration and audio visual aids. We all will do our best to make your stay as enjoyable, educational, and productive as possible.

I would like to introduce the Steering Committee that helped plan this conference. Since my specialty is structural engineering, I hardly qualify as an expert in environmental issues. This topic is a personal interest of mine. I might add that the Steering Committee members were the ones that conceived most of the ideas. The Steering Committee consists of:

- ◆ **Mr. Derb Carter**, an attorney with the Southern Environmental Law Center;
- ◆ **Mr. Michael Foreman**, Chief of Forest Resources Utilization, with the Virginia Department of Forestry;
- ◆ **Mr. John Godbee**, Manager for

Environmental Compliance, with Union Camp Corporation;

- ◆ **Ms. Anne Heissenbuttel**, Director of Forest Planning and Policy, with the American Forest and Paper Association;
- ◆ **Dr. Russ Lea**, Associate Dean of Research at North Carolina State University;
- ◆ **Mr. Jeff Olsson**, Director of the Bollie Center, with the Wilderness Society;
- ◆ **Ms. Edith Petrick**, Deputy Director of Cooperative Forestry, Southern Region U.S. Forest Service;
- ◆ **Mr. William Ticknor**, President of Forest Consultant, Inc.; and
- ◆ **Ms. Cynthia West**, Project Leader, USDA Northeast Forest Experimental Station.

Would you please join me in giving these fine individuals the recognition they so deserve. All members of this Steering Committee will be moderating and facilitating the various sessions during this conference. I would also like to thank our conference secretary, **Angela Riegel**, for her tremendous efforts in making this conference a success, as well as our assistants who are helping out with the audio visual aids and registration.

The conference is being sponsored by the following contributors:

- ◆ the Carolina-Chesapeake Section of the Forest Products Society;
- ◆ the College of Forestry and Wildlife Resources, the Department of Wood Science and Forest Products, and the Division of Continuing Education at Virginia Tech;
- ◆ the Division of Cooperative and Private Forestry for the Southeast Region of the Forest Service, and
- ◆ the Northeast Experimental Station of the Forest Service.

I would like to extend our thanks to all our sponsors for the financial support that kept registration fees to a minimum, and made this conference possible. Finally, a thank you should be given to the myriad of cosponsors that have lent their assistance in announcing the event to their members and lending their general support to the effort.

Now, you may wonder why we conceived this forum for discussion. I would like to take this time to provide some background, and to outline some of our expectations.

As you know, the environmental issues in forestry, for the western part of the United States, have been in the spotlight for some time. I believe this is because the federal and state governments control the vast majority of the land directly affected by changes in forest policy in the western United States. Therefore, most of the effort to change practices in forestry and forest products have been concentrated on issues such as preventing cutting of old growth forests in the west. This is partially because the different interest groups had to deal with a single landowner, the U.S. government, and could avoid other issues associated with private landownership. However, some of the environmental issues

affecting the eastern United States are just as important and, possibly, have far more reaching ramifications. In some ways, the decisions reached, in an effort to address the environmental issues in the eastern United States, may have severe impact on the industry and society, as a whole. For instance, in the State of Virginia, most of the forest land affected by the forestry and forest products industry is privately owned. Therefore, if government policy changes such as to protect endangered species, water quality, to create recreation opportunities, or to address other societal requirements, the policies will directly affect the individual freedoms associated with private land ownership. The potential precedents this could set for all aspects of American society are immense, and due consideration must be given to ensure the changes will be effective in improving the environment, and any costs or restrictions placed on land owners are justifiable. On the other hand, doing nothing has adverse effects on the environment and the economy. If uncontrolled development is allowed to continue, the forestry resource will be fragmented into small plots. This would have immediate adverse effects on the wildlife, water quality, and economy, in addition to problems manifesting themselves years into the future. Since the forest products industry is one of the **largest** employers in the Eastern United States, and the fact that the fragmentation of the forest will also reduce the availability of the raw material required to maintain the employment level currently experienced, the impact of policy decisions is important.

In addition to these national problems, U.S. environmental policy indirectly affects global forestry practices. Since the demand for forest

products will not decrease, due to policy changes, and restricting our resources will only transfer the impact of demand to another location in the world. This may not be the "best" management technique, from a global environmental policy standpoint. It is, therefore, important to provide a forum for these issues to be discussed, where areas of agreement for potential cooperation between the parties involved can be highlighted. It is just as important to highlight the areas of disagreement so that the differences can be discussed in a rational manner, and an effort towards compromise can be made.

Some of the issues facing the government, corporations, and other interested parties include chlorine by-products such as dioxines, mono-cultures, bio-diversity, ecosystem management, point source and non-point source pollutants, endangered species, clear-cutting vs. selective cutting, general punitive vs. incentive regulation, recreational vs. wilderness, vs. commercial uses of the land, and the list goes on and on.

I agree with many of the ideas and statements made by representatives of Federal and State agencies, environmental groups, and industrial concerns. At times, I have felt like I was being drawn and quartered by my desires to defend the various positions. My hope is that more co-operative efforts, such as **the model exemplified** by the Greater Yellowstone Coalition, might be formed to work on long-term use and development plans, on a regional basis. The Greater Yellowstone Coalition is a combination of ranchers, ski resort developers, miners, the National Park Service, environmental groups, logging companies, and state and federal forest service. The group is working on a long-term plan for land use in the Yellowstone River drainage basin. More

cooperative groups like this need to be formed to work on regional problems.

I have as many concerns about how each of the parties act and react as I have feelings of support. **Should forest companies be able to function in a laissez faire political environment?** I doubt it, a few bad apples will spoil the barrel. **Should all the forest lands be off limits to logging?** Again, I do not think this is wise either because of the importance of forest products to society. **Should battles over these political issues be continuously fought with no intent of compromise?** The only ones that benefit from this standpoint are fund raisers, politicians, and lawyers. **We need to begin to co-operate and compromise on a much larger scale.** The environmental concerns of society are here to stay. But, are the assumptions made by society correct? Hopefully, this conference will help clarify some of these points.

I heard a story a short while ago that concerned me. A colleague of mine related an incident where children at their church were performing a skit or prayer that included the idea of protecting the environment. Included in the idea was protection of the trees -- meaning not cutting trees. While this might sound like success to many, it concerns me. If we take this idea to the extreme, we would shut down forests to logging, which in turn shuts down the entire forest products industry. **No more lumber to build homes, no paper to learn to write on, or books and newspapers to read, a loss of pharmaceuticals, and chemicals that are used in our everyday lives.** Will society remain committed to this type of protection? Not likely, at this current time. We must realize that living in the United States provides us the luxury of being concerned about the

environment. Anyone who has travelled to the developing world can attest to the lack of concern for the environment in communities where the major concern is how to feed one's family in order to survive on a day-to-day basis. **If environmental concerns cause one of the United States largest industries to become non-competitive and large numbers of jobs are lost, the pendulum of concern would swing away from environmental concerns, and all the improvements and gains made over the past 50 years would be lost.** At the same time, if industry does not change to co-operate and embrace environmentalism, society will push it into extinction. We **must** work together to re-shape our thinking and actions.

This conference was conceived around a paradigm. The paradigm consists of 3 general factors, or forces, that drive environmental policy. It is based on 1) Society's wants and needs; 2) The need to maintain the integrity of the eastern forest ecosystems, and 3) The role of forest management, forest resources research and development, and the associated improvement in utilization of the harvested resource in satisfying forces 1) and 2). Within this system, there are 2 drivers: Regulation and Incentives. These drivers provide direction for the paradigm to function. The question is: **is this paradigm valid? Should there be a major paradigm shift to improve how we interact with the biosphere we live in called earth?** Your task for the next 2-1/2 days is to answer these questions. Please provide input on how our current system can be improved.

In holding this conference, we strive to take a pro-active stance towards environmental concerns, and potential resolutions and

solutions, in order to get leaders from all sides of the issues to sit down together and begin addressing how long solutions may be obtained. The Forest Products Society, a group of forest products professionals in government, academia, and industry, will use this forum to gather information and provide direction for future research towards technical solutions to some of the problems. We also strive to provide direction for policy makers at the Federal and State government levels, as well as for corporations and other interested parties.

I believe that this conference is an opportunity for all of the general issues concerning environmental policy and forest use to be addressed by parties on all sides, in a more or less rational manner. This is one of the few attempts made to examine past successes and failures, as well as where the opportunities for future cooperation exist. The areas of severe contention, where avenues for compromise need to be found, will be discussed. We no longer have the opportunity to ignore the issues. **Global environmental pressures on forests have grown, and the focus on the forests of eastern North America has been affected.** These issues are no longer simply regional in nature, and decisions made to address these problems have become global, in importance. We hope that you are willing to assist us in this endeavor and will provide your views for inclusion in the discussions. We welcome your active participation and I, personally, look forward to hearing from you during the various plenary sessions, the technical forum this evening, and especially during the break-out sessions tomorrow afternoon. We have an opportunity to set aside our political baggage, roll up our sleeves, and work toward providing an even-handed,

broad directive for future policy makers to follow. Let us see how effective we can be.

To help you keep track of your ideas during the conference, the program has been printed with a blank column alongside each speaker's abstract. Please use this to take notes that might assist you during the break-out sessions, where each of you is expected to participate in formulating a critique of current policy and practices, a directive for how to improve upon the current policies and practices, and a statement on how to foster more co-operation between interested parties, rather than continuing in the current confrontational mode.

Again, thank you for your time and effort in participating in this conference. Let's get started. At this time I would like to introduce the moderator for the first session on Society's Wants and Needs, Ms. Edith Petrick, Deputy Director for Cooperative Forestry, Southwestern region U. S. Forest Service.

Society May Not Always Want What it Needs

James W. Giltmier, Executive Vice-President, Pinchot Institute for Conservation

In a lifetime of study of American politics I have determined that sometimes things do happen for no apparent reason whatever.

Ordinarily, through the democratic processes of consensus building, progress is obtained by taking three steps forward, and than two steps backward. It is a maddeningly tedious way of getting things done. It makes ordinary people claim that they despise politics and politicians. But the process keeps anarchy from occurring, and the society remains intact.

But sometimes -- not often thank heaven -- things just evolve, so that things that were shades of gray yesterday are today clearly black and white.

The Cold War was a thing like that. For more than 50 years the Soviet Union and the West engaged in the most expensive conflict in the history of our species. Then it was over and there was no longer a place called the Soviet Union.

The background for everything we did as a nation for half a century was the Cold War. Tens of thousands of Americans lost their lives in Korea, Viet Nam and elsewhere. A significant percentage of our national treasure for the foreseeable future was mortgaged to fight that war.

And then, as if by magic, it was over.

But it wasn't magic was it? In the simplest terms, our side out spent their side in dollars and scientific ingenuity. And as their side struggled to keep up, their economy collapsed.

As I said, that magic trick took 50 years for the payoff to occur.

Today I am going to talk about another magic trick that is now playing itself out in terms of the

management of the world's forests, and when the trick is over, people will say, "How is it that it took so long for us to come to agreement almost over night?"

Ever since the creation of the national forest reserves in 1891, forests and forestry have been items of considerable controversy in American political thought.

As early as 1864 George Perkins Marsh was writing about the "profligate waste" of the forests causing drought floods and erosion.

But America was not listening.

A little over five years ago I worked for a law firm as a non-lawyer consultant on foreign trade. I read some-where then that there is nothing in America that is not for sale.

I believed that then, and I suppose I still believe it to a considerable extent today.

Another spin on that theme is that America is a nation of shoppers. Look for the best deal you can find and then snap it up before someone else grabs it.

The Japanese feel like traitors when they purchase foreign goods. In this country there is no stigma in buying less expensive foreign goods instead of U.S.-made products.

Our country has a cheap food policy. We are the best-fed country on earth, and our food is less expensive than anywhere else in the world. The public has felt badly that family farms have given way to industrial agriculture.

But those are the breaks. WalMart is cheaper than mom and pop stores, and cheap, abundant food is better than family farms.

Am I being critical of the American fondness for the marketplace?

I am not!

The market may be a ruthless place that cares nothing about human values and nuances. But we know that it usually works for the benefit of the majority.

But when it comes to forests, some new values come into play that interfere with market-oriented, utilitarian ideas.

It's this!

God or some spiritual value like a god is in the forest.

Before you write me off as a nut, let me explain.

Some people look at a forest and they see commodities.

Others look and they see in their minds' eyes works of art carved from walnut and other precious wood materials.

Other see cities created from the wilderness.

But all of us -- whether we admit it or not -- have personal spiritual values that we get from forests. These are values that transcend the uses that we may make of the products of the land.

My friend Herb Schroeder, a sociologist in Chicago who studies such things, says that throughout history, human cultures have used trees, forests, animals and other elements of the natural environment to symbolize their most basic spiritual values and beliefs.

Those of you who have no use for "touchy-feely" kinds of ideas won't like what Herb says next, but here goes: "If we really want to understand and appreciate the spiritual values of forests, we have to be willing to explore the intuitive/feeling side of the mind on its own terms. In doing this, we cannot rely exclusively on rational, scientific methods. On the intuitive side of the mind, experiences of beauty, love, and imagination carry more weight than scientific data and statistics."

Be careful now before you write Herb and me off as a couple of liberal humanists.

I could argue that it is the intuitive side of our intellect that has kept us going as a species. In its narrowest terms after all what is human love? We use it to procreate, and we use it to work together so that we won't be picked off one by one.

As for beauty I won't mention Michelangelo or Frank Lloyd Wright.

As for imagination, I won't ask how it was that some of us were smart enough to figure out how to cultivate wheat and rice so that we could stay put and build cities.

What is important to society's wants and needs today is that human beings think a lot more about what forests are than products for the wood yard.

In a nationwide public opinion poll taken this year, Americans said they want healthy forests, above all else. With regard to the federal lands, people say they want the government to balance recreational forest uses off with commodity uses.

The public says it wants to be involved in forest management decisions, and that long-term health of the public forest should not be compromised for short-term gains.

What happened here? What happened to the market-loving Americans who want things on the cheap?

When it comes to forests you can forget all of that utilitarian stuff.

Think about the word, "majesty."

Think about "grandeur," "magnificence," "splendor" and "stateliness."

These terms once were used in connection with royalty. But there aren't many kings and queens around anymore. And now those words are used most often in connection with mature trees and forests.

My colleague William Shands said last November: "In the field of natural resources, polarization among interest groups is accompanied by a deterioration of civil debate as groups attack government agencies and each other in the media and other public forums. The acrimony over management of old-growth forests and protection of the northern spotted owl in the Pacific Northwest moved a *Seattle Times* reporter to write:

'Even the Civil War produced a kind of community between rival armies. Here, any sense of cooperation and compromise has lagged far behind self-righteousness, myopic interest and legal stalemate.'

"That description applies to many areas of the country and many issues where, to quote John Gordon (of Yale University), 'We would rather fight than win.' 'Win' means mutually beneficial outcomes."

There is so much more to this than I can say here. Look me up and we can talk. But human beings do not think of forests the way they think of other land forms. Those who persist in believing otherwise will continue to get their scientific forest formulas shoved down their throats.

Forests were the original home of our species. Don't try to give people economic efficiency. They don't care. They will buy good forest science to a point. But in their guts -- in a secret chamber of their

subconscious -- they know what's good for forests, and they want to have a say.

The trouble with this is that most of the people in the Northeastern states are two or three generations removed from any personal identification with the land and water resources. Despite that secret chamber of remembrance, they are detached from an understanding of the vital importance of soil and water to human survival as a result of succeeding generations of city living.

Therefore, if you want rational decisions from the public about the uses of forested land, they need a better understanding from someone about what conservation management means, and what an important part of nature human beings are.

If terms like biodiversity and ecosystem management are to be of any value to the judgement of people who buy forest products and pay taxes to manage forest reserves, the forestry community had better find a much more effective way to carry these concepts across the city limits into urban America, because that's where the voters are.

Now it is time for me to end the story about the magic trick.

Grey Towers, the family home of Gifford Pinchot, is the home as well of the Pinchot Institute for Conservation. In late 1990 the first event of the celebration of the 100th anniversary of the creation of the national forest reserves was held there. Several thoughtful people met for a workshop on "Land Stewardship in the Next Era of Conservation."

The result was the "Grey Towers Protocol," which said:

(Forest) management activities must be within the physical and biological capabilities of the land, based on comprehensive, up-to-date resource information and a thorough scientific understanding of the ecosystem's functioning and response.

The intent of management, as well as monitoring and reporting, should be making progress toward desired future resource conditions, not on achieving specific near-term resource output targets.

Stewardship means passing the land and resources -- including intact, functioning forest ecosystems -- to the next generation in better conditions than they were found.

Land stewardship must be more than good "scientific management;" it must be a moral imperative.

In 1992, the Pinchot Institute cosponsored with the Northeastern Area Office of the Forest Service a Duluth, Minnesota conference on stewardship.

Following that conference, Bill Shands, Bill Ticknor and Perry Hagenstein developed the idea for what has come to be called the Duluth Manifesto, a nine point set of principles that addresses the posture of the United States in world forestry. The first principle is most important:

"Humans are part of nature and the forest environment. All forests will continue to be affected by human actions."

More than 50 influential foresters have become signers of the manifesto.

This is a part of the magic, don't you see?

I'm tooting the horn of the Pinchot Institute, but there have been many others involved in the creation of the magic, including the Society of American Foresters.

Here's how the magic plays out:

Last January the Tropical Timber Agreement was renewed by a United Nations conference, but no one walked away from the table happy.

The Southern Hemisphere countries wanted the

Northern Hemisphere nations to accept the same standards of sustainability that the Northerners wanted to impose on the tropical forests.

Instead the northern nations would only agree on a vague, sustainable management agreement for their forests, while offering their poor relations to the South what were termed "appropriate resources" for future forest conservation programs.

Under the old politics that is what might be expected. Three steps forward and two steps backward.

But on June 22 this year a group of foresters and other scientists met in Geneva, Switzerland to determine what "sustainability" means in terms of the temperate and boreal forests. Represented were Australia, Canada, Chile, Finland, Germany, Japan, Korea, Mexico, New Zealand, Russia and the United States.

The United States announced at the meeting that it would cosponsor with the Rockefeller Brothers Fund a technical conference September 7-10 on criteria and indicators for sustainable forests.

But there is more to the magic.

On the following day in Geneva there was a European Union ministerial conference to work on the development of "quantitative indicators for sustainable forest management" in the European Community. The agenda included management of forest resources for their contribution to global carbon cycles as well as non-timber forest values.

Insofar as I understand global politics, big countries never acknowledge to little countries what concessions they might make to be less incommodious.

That's magic folks!

Here's some more.

On August 25, my pal John Heisenbuttal of the American Forest and Paper Association will reveal a set of "Sustainable Forestry Principles and Implementation Guidelines." The guidelines will address biodiversity, ecosystem management, forest acreage, logger training and performance monitoring.

The initiative has the support of the major executives of the largest forestry corporations.

If these events do not constitute magic for you...

Then you don't know what magic is.

But I do.

Thanks for your attention and time.

The Miracle Resource

Robert F. Legg, President & CEO, Temperate Forest Foundation, 14780 S.W. Osprey Drive, Suite 355, Beaverton, Oregon 97007

Of the world's natural resources - petroleum, coal, natural gas, wood - only one is renewable. That same material is biodegradable, recyclable, non-toxic and requires the least amount of energy to convert to useful products. Plus, it is beautiful.

From the trees in the forest, to the lumber in your home, to the paper you read after a long day's work, wood and wood products dominate our lives. But there's more to wood than meets the eye.

Not only is wood an abundant resource which has thousands of uses, it is a unique product of nature in many ways. Perhaps most important is that wood is a resource which holds tremendous opportunity as we work to meet the growing needs of populations around the world in a sustainable manner. But first, what is wood? As much as we depend on wood, very few people know what it is or how it is produced.

The cycle begins in the forest factory

We know that wood products are made from trees which come from the forest, but how is wood, the hard, fibrous substance beneath the bark, produced? When it comes to wood, the forest is really the 'factory' where trees produce this miracle resource. Not only is the product of trees renewable, so is the process by which trees themselves are made - it's called photosynthesis. And just like fossil fuels power a factory, the sun is the energy which powers the forest's production.

In the forest's factory, healthy, growing trees capture free energy from the sun and carbon dioxide from the atmosphere, then combine them with water to produce carbohydrates, or sugars. The carbon which is captured becomes the main ingredient of wood: the miracle resource. Even after harvesting

and manufacturing, wood still retains its carbon level, again contributing to our healthy atmosphere.

Beautiful, versatile wood

You'd be surprised at the number of products we use each day which come from wood. Mills today process every part of the tree into a variety of products. In fact, there are an estimated 10,000 uses for wood! Many are obvious like dimension lumber, panels, roofing, telephone poles, railroad ties, fencing, chairs, desks, cardboard, newspapers, magazine, milk cartons, landscape bark, toilet paper, park benches, pianos and popsicle sticks.

Others are not so obvious, because they are made with wood residues, fibers and chemicals. These everyday, but not so obvious, products include frames for prescription glasses, cosmetics, photographic film, rayon, acetate, cellophane, chewing gum, medicines, sausage casings, artificial vanilla flavoring, vinegar, poultry feed, paint, hair spray and even the thickener in milkshakes!

Advancements in wood technology have resulted in engineered wood products which are made by combining several types of wood to make new products that have more uniform properties than the wood from which they are made. For example, several sheets of wood veneer are glued together to make one piece of plywood, a strong, dimensionally stable product. Wood shavings, scraps and sawdust can be glued together to form oriented strand board, fiber board, and particle board, products that have many structural and non-structural applications.

Wood waste can also be used to generate electricity or steam to power manufacturing processes. This is called co-generation and the paper industry generates 60 percent of its power this way.

As we look around our natural and constructed environments, it is possible to see wood in use virtually everywhere - from the home we live in, to our food, clothing and medicine. Look around your home, office or school. What items do you use which are made with wood, the miracle resource?

Wood: The environmental choice

Everything we use comes from a natural resource. And it takes energy from coal, natural gas, petroleum, water, or uranium to produce the things we use. Because our burgeoning world population demands more and more material goods, demand for energy continues to rise.

We do not have an endless supply of energy. Hydropower is threatened by increasing regulations designed to recover fish species, and nuclear power has not met its promise due to problems with cost, plant safety and hazardous toxic waste. Alternative sources, such as wind and solar power, are not yet technologically advanced to supply enough energy to major industries. Consequently, we are currently dependent on dwindling supplies of fossil fuels. If we hope to stretch current reserves of non-renewable resources as far as we can, we need to choose products which are energy conservative instead of energy intensive.

In other words, we can choose products which take little energy to produce and ones which conserve energy once they are in use. It's a choice we make many times a day. When you stop to consider the alternatives, one product stands above the rest - wood.

First, wood requires less energy to produce than alternative building materials.

A study commissioned by the National Research Council involved a comprehensive analysis of wood, plastic, steel, aluminum and concrete and its findings are chronicled in what is known as the CORRIM report. The results reveal that it takes 21 times more energy to produce a 4" thick concrete

slab floor than a raised wood floor. It takes 9 times more energy to produce a steel stud than a wood stud; 5 times more energy to produce aluminum siding than wood siding; and 3 times more energy to produce a concrete block than to produce its equivalent weight in wood.

Wood also excels when comparing energy efficiency as measure by R-value, or resistance to heat transfer. Again, wood retains heat more efficiently than alternative materials. The CORRIM tests revealed that wood has 413 times the R-value of steel, 2000 times that of aluminum, and eight times that of concrete.

Then, of course, wood is recyclable. So is steel. But steel, both new and recycled, is energy-intensive in refining, manufacturing and fabricating. In fact, even a 60 percent recycled steel stud uses three times more energy to produce than a wood 2 X 4. Aluminum recycling also is energy intensive; and not all plastic can be recycled.

Though paper has long been recycled, as have wooden pallets and barn siding, recent research and development efforts have led to many exciting, new, versatile products which combine renewable and non-renewable resources.

Without a doubt, wood's greatest asset is that it is renewable. Furthermore, wood is the only natural resource which is increasing in reserve volume each year. As an example, the total volume of wood growing on forestlands in the United States is 25 percent greater today than it was in 1952! Knowing that makes you feel good about choosing wood.

As consumers, we are always choosing between products made from renewable and non-renewable raw materials. The best choices are those made based on a solid understanding of our role on this planet, especially in the face of exponential growth in world population and consumption alike.

The world's population currently totals 5.7 billion people and is projected to double within the next 50 to 70 years. The task to sustain ourselves

environmentally and economically is challenging, but not insurmountable.

Wood for the world

The solution is called sustainability and we must all be involved if sustainability is to be achieved.

Living sustainably means using our own resources and living within our means.

If we are to save this planet for coming generations, we need to decrease our reliance on the resources that are irreplaceable, and increase our use of renewable resources. We also need to avoid the use of energy-intensive products, choosing instead materials such as wood that can be converted to useful products with little use of energy. Choosing a product made of wood is a choice for an ecologically and economically sustainable future. It is also a choice for well-managed forests.

Intensified management of our private forestlands is our only alternative as larger and larger tracts of public forests are set aside in reserves for uses other than wood production. Managed forests, whether they be small woodlands or industrial forestlands, are diverse and complex ecosystems. They contain abundant wildlife habitat, as well as recreational opportunities and structural diversity. Managed forests contain healthy trees which are less susceptible to insects and disease. As such, the trees found in a managed forest create strong wood products which, in turn, contribute to a sustainable economy and society.

Today, we need to produce more from less - less raw materials, less waste and less pollution of the air, water and soil. One tool to help us produce more from less is the computer. This is witnessed today in the forest products industry where computers have dramatically improved efficiency and quality of wood production at every level.

Nearly all wood product manufacturers in North America use computerized technology in their mills

to maximize product yields. Efficiently produced wood products are the most cost-effective both to the producer and the consumer.

The advantages of choosing wood are clear - wood is biodegradable, recyclable, energy efficient and renewable. Our challenge is to both conserve and develop this natural resource. Such a task takes responsible producers and consumers working together to make a difference. It's a difference in which producers are able to manufacture the wood products because consumers choose to use the thousands of products made from wood: the miracle resource.

Sources

Building Material in the Context of Sustainable Development, Phase II Summary
Report by Foregntec.

CORRIM Report, National Research Council

The Globalization of Wood: Supply, Processes, Products, and Markets. Papers presented at the conference sponsored by the Forest Products Society and the Oregon Forest Resources Institute, November 1993.

Wood Product Demand and the Environment, The Forest Products Research Society, 1992. ISBN 0-935018-54-9

Fix The Dented Fenders: Society's Wants and Needs in Relation to Forests of The Eastern U.S.

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Abstract

To provide an effective managerial bridge between forests and the human communities of interest on whose behalf resource professionals manage forest resources, societal values must be understood and considered in decision processes. Both quantitative and qualitative values, logical and subjective views must be incorporated in the manager's perspective if society's interests are to be adequately served. A strategy to integrate a social view into traditional resource management programs is presented.

When I first agreed to participate in this discussion of society's wants and needs in relation to forestry and the forest products industry in the eastern U.S., I really thought it was going to be a pretty easy job; I have given a lot of thought to the subject over the last several years, and felt I had a pretty good grasp of the fundamentals.

But after sitting down at my computer to begin putting words on paper, as it were, I realized that what I was preparing to describe for you under the rubric of "society's wants and needs" were things which *you* have told *me*; in other words, the scientific community's estimate of society's wants and needs.

I wanted to try to do better. Over the years I have looked at a lot of surveys of the public's opinions about forests and forestry. Many of these queries have taken the form of lists of forest attributes, amenities and products which respondents were asked to rank or score. Somehow, while they usually seemed reasonable enough, they did not seem to add significantly to our fundamental understanding of underlying public values, nor have they been particularly useful predictive tools. It

seemed to me that we were missing an important key to the public attitude.

I think its true that as individuals who are involved in resource management, research, and the academic dimension of forestry, we tend to visualize the forest in terms of components and products; wildlife, wood products, recreation, water, air, soil, non-commercial plants and animals, etc. We constantly deal in these individual elements, and in combinations thereof.

The public has a different view altogether. My thesis is that the public views a forest as an integrated whole, which is not the same as an aggregation of parts, or even the sum of parts. The concept I'm describing is clear if we think of people; we conceive people as integrated organisms, not composites of their anatomical parts or personality traits. Unless you are a mechanic, your view of your car is an integrated view; when you look at the car you are looking at a single object. Now, if I were to ask you, what do you like most about your car, and give you a list of components, you might say almost anything on any given day. How do you like the overhead valves? The tires? The paint job? The dashboard? The point is, your answers to these questions about components don't really tell me very much about your affection for the *car*.

Now let's suppose your son comes home one day and says, "Dad, I hate to tell you this, but I put a wrinkle in the back fender of your car!" How do you feel? "Don't worry about it; it's buffered by the rest of the car, I won't see it that often...and after all, the car has four fenders, and only one is bent. Besides, it's just cosmetic, not functional. Don't worry about it!"

No, no. That's not the way it works for most of us. If the fender's bent, the car is broke, and we're not comfortable 'til it's fixed. Likewise for the public; if part of the forest they know is dysfunctional or visually impaired, the whole is somehow affected.

Ralph Waldo Emerson helped me to understand the holistic view I'm trying to describe for you. In his essay, "Nature," penned in 1836, he wrote,

"When we speak of nature in this manner, we have a distinct but most poetical sense in the mind. We mean the integrity of impressions made by manifold natural objects. It is this which distinguishes the stick of timber of the wood cutter from the tree of the poet. The charming landscape which I saw this morning is indubitably made up of some twenty or thirty farms. Miller owns this field, Locke that, and Manning the woodland beyond. But none of them owns the landscape. There is a property in the horizon which no man has but he whose eye can integrate all the parts...This is the best part of these men's farms, yet to this their warranty deeds give no title."

Against this background, trying to see clearly through the mist of preconceived notions, I have decided that society's wish list for eastern forests is fundamentally very simple: maintain a stable, healthy forest. In this context, "stable" means subject to very little change: in equilibrium. "Keep it the way it is right now."

Translating "stability" to terms which may be useful to us as managers and planners, its essence is captured in maintaining three things:

-- First, abundance...the area in forest cover, the question of *how much*.

-- Second, distribution...the question of *where*, the issue of local abundance by comparison to historic norms.

-- And third, character...the question of *what kind*, also compared to some historic norm.

When abundance, distribution or character change, society becomes distressed.

The second major category of social concern is health. As I use the term here, it means sufficiently vigorous so that, with a little help, the forest can maintain its abundance, distribution and character.

Stability and health, then, comprise priority number one on the public agenda for eastern forests. It represents their primary "want."

The second priority is for professional resource managers capable of translating the first priority into action specifics.

The resource professional society visualizes embodies the same characteristics we want in our doctors: understanding, judgment, skill, and a commitment to excellence. Honesty goes without saying. Collectively, these attributes engender trust, and a high comfort level with the decisions the doctor helps us make, and the numerous decisions he or she makes on our behalf. Essentially, once we have reached a level of trust in the relationship, we decide what it is we *want*, and depend on the doctor to decide what we *need*.

Right now, in this country, public trust of both the public and private institutions which make forest stewardship decisions for us is at a low ebb, to say the least. The public has difficulty trusting its own employees--foresters on the public payroll--to do "right." And of course, we don't believe a thing industry says. Even corporations which have earned some degree of credibility are tainted by association with the corporate culture which can say, "We see no evidence that tobacco causes cancer."

I don't want to turn this discussion into a meaningless barrage of sociological concepts, but

there are three things we are going to have to do if we want to obtain the public trust as resource manager and stewards. They are right at the center of what the public wants and needs, and, I might add, deserves:

1. First, we must learn the value systems and language of people on whose behalf resource management decisions are made, and to whom communications are addressed. Foresters are the handshake, the bridge between society and its forest resources. Tom Bonnicksen (1991) has observed, "Resource management takes place in an environment of continuous social and ecological change. Managers must adjust to these changes and guide them, where possible, to meet the needs of society. So a resource manager acts as a mediator between society and the physical environment from which resources are derived."

As mediators, we must recognize that society parses its resource wants and needs in terms of *values*, not the forest practices needed to obtain or preserve values. To make matters even more difficult for the practicing resource manager, many of the values are subjective. The manager's job, really, is to interpret societal values in terms of practical forest stewardship alternatives, a very perplexing task.

Mitchell and others (1993) have made a significant contribution toward better understanding and managing objective and subjective forest values; they make the distinction between "use orientation" and "attachment orientation." Use orientation stresses "the importance of the environment in relation to the activities [or uses] pursued." Attachment orientation derives from "a strong emotional bond to places." While Mitchell et al were addressing *places*, the same distinctions apply to *phenomena*, like old growth. Some people value old growth for its species composition and ecosystem dynamics; others, for a warm feeling they get just thinking about it.

As we consider society's wants and needs, we need to hear the authors' conclusion: "At the heart of today's forest management issues is emotion. The 'felt' perceptions of the forest are as real and as important as 'scientific facts.' Both should be incorporated into public land management planning. To do this, public land managers need to follow a process that integrates rational, objective science with the 'felt' perceptions of the forest." My only reservation about this statement is that it should not be limited to public land.

The bottom line is that we must learn to practice objective forestry in a subjective world (Ticknor, 1989). To the many voices expressing concern that warm, fuzzy feelings are replacing hard, cold logic, my response is that the logic must be supportive of and include a place for the emotional side.

There is no better model for the kind of scientific, philosophic and poetic integration I'm talking about than Aldo Leopold. His much revered *Sand County Almanac* seamlessly blends science and poetry. It has been widely quoted as a source of wisdom by partisans of both wilderness and "wise use."

Now what does all of this have to do with the eastern forest? A lot, because there are very few acres of the eastern forest which do not have a strong emotional attachment of one sort or another to many, many people. Forests manifest many qualities increasingly difficult to find in modern urban life. They radiate serenity, stability, a certain sense of security. Thoreau (said it thusly, "There is something indescribably inspiring and beautiful in the aspect of the forest skirting and occasionally jutting into the midst of new towns...The very uprightness of the pines and maples asserts the ancient rectitude and vigor of nature. Our lives need the relief of such a background, where the pine flourishes and the jay screams."

"Our lives need the relief of such a background." I can't say it any better, I can't define it any more precisely. Sure, society wants and needs fresh air and clean water and lumber and paper and recreation and hunting and fishing and hiking and birding and

morels....But more than anything, we need the emotional sustenance we derive from just knowing forests are there. Thus, the yearning for stability of which I spoke reflects a desire to preserve the contributions forests make to the quality of life. And I believe--although I cannot prove--that in an increasingly crowded, urbanized world, this contribution of forests becomes increasingly important. Weekend traffic patterns and the second home phenomenon are outspoken reminders of this truth.

Professional managers will ignore the flow of psychic goods and services at their peril.

2. The second in my trio of mandates to meet social expectations is to communicate forthrightly. I think a major part of the problem in the perceived lack of candor in communications from institutions in both the public and private sectors reflects the devotion of much energy to "spin doctoring," trying to put a good face on anything an agency or company has to say. As a result, the content and its meaning are often lost or at least, confused. Incidentally, if you're looking for a good, old-fashioned synonym for "spin doctoring," try "dissimulation," which, to Webster, means "hiding under a false appearance." In their advertising, their annual reports, their press, American institutions ultimately say anything they please. It is a license which does not serve them well. This observation, incidentally, comes from a person who used to take great pride in crafting statements for release by corporations: the point was to be truthful in what was said, but to omit qualifying phrases which would make both a statement *and its implications* true.

In case you are not certain what I'm talking about, here's an example: a company proudly reports the huge number of trees it plants annually, but nowhere mentions that stifling competition means very few of the survivors are free to grow.

I don't intend to demean or detract from the skill of "PR" professionals and "public information specialists." But my experience tells me something very special and important happens when a professional resource manager or researcher, not coached by a PR intermediary, shares his or her views and knowledge directly with the public.

What society wants and needs, I believe, is access to unabridged information, information unadulterated by the intrusion of ulterior motives.

3. The third element of this triad of initiatives to meet public wants and needs is a proven axiom for success in an organizational context. Avoid unhappy surprises! We can't avoid unhappy *experiences*, but we *can* mitigate the element of surprise.

A couple of years ago, shortly after I had acquired my woodlot in Ohio, I was out one Saturday afternoon with my tractor and my chainsaw cutting an interior trail around the property not far from the boundary. At one point, I looked up, and there, perhaps 20 feet away on the other side of the fence that defined the property line was another human being, a man, glaring at me with a look that absolutely snarled with antagonism and anger.

"Who are you?" he says. I told him.

"What are you doing?" I told him.

"You know who owns this property?"

"Yes," I told him, "I do. I bought it from Martin Stahl."

"I didn't know he had it for sale. What did you pay for it?"

It turned out he was my neighbor, and that the trail I was cutting was in an area he had hunted in (with permission) for years and years. He was very attached to my property, and took extreme umbrage at the change he thought I was making in this part of "his" landscape.

I came away from this experience with a bitter taste in my mouth. Later, once I got to know him a little better, it dawned on me if I had just told him about what I planned to do before the fact, it would have disarmed the whole nasty scene.

I am sure many of you have experienced that same sinking feeling seeing a lowboy loaded with logging equipment pull off the road opposite your house or camp. Or, discovering that your view has been "destroyed" by the unexpected intrusion of harvesting activity into your line of sight. These things are going to happen, they can't be avoided. But what we can avoid is the element of surprise. We can telegraph our intentions with signs; by talking with neighbors; by having information-sharing meetings before the fact on site, with a dialogue between interested individuals and the "forester in charge."

When I was a kid and was dropped off at the dentist, after cleaning my teeth and mumbling something unintelligible to himself the dentist would get to work undoing the damage wreaked by six months worth of Necco wafers and Baby Ruth bars. Today, after my chops are clean and have been X-rayed and examined, the dentist invites me into his office for a "fireside chat" to cushion the unhappy surprises and share treatment alternatives with me. We forestry professionals need to do the same thing for our constituencies.

We have asserted that the public wants two things; a stable healthy forest, and resource doctors they can trust.

As the doctors, then, what will we prescribe?

Take two tranquilizers and call me in the morning!

Seriously, here is my prescription:

1. First, we will want to make our intrusions into the forest as inconspicuous as possible, our treatments light-handed. The public is saying not just that aesthetics are important, but also that stability is important. We don't

like change, especially in scenery and landscapes to which we have strong emotional attachments.

Now, as professionals, as the landscape doctors, we know that change is inevitable. The forest is dynamic. But we spend fortunes on the cosmetic dimension of life in this country, on the appearance of things. And the public wants us to be as fussy about preventing the visual deterioration of forest landscapes as we are about upscale residential neighborhoods, our architecture, our bodies. When change *is* prescribed, we would like it to be incremental, out of site and intended for some longer term purpose consistent with maintaining abundance, distribution or character..

This fussiness and public preference also translates into longer rotations, larger trees, and more frequent, less radical selection harvests in parts of the forest region. The public seems to accept the concept that in order to maintain our flows of tangible forest products, it will be apropos to practice intensive forestry on part of the landbase, extensive forestry on the remainder. What they don't want is one unbroken even-age plantation stretching from Jacksonville to Fort Kent.

2. Maintaining stability also means keeping all the parts and systems. It means maintaining biological diversity. Yes, we recognize that in the normal course of events, species will become extinct. What we must avoid is an *abnormal* course of events, a course that accelerates the demise of critical ecosystem components. And it may well be, perhaps often, that moderating "normal" events to preclude the extinction of species which might otherwise have occurred is a significantly better outcome than the obverse.

Mankind will leave his indelible imprint upon the face of nature; we are suggesting that there will be times when the imprint can be an improvement upon the outcome of chaotic chance.

Preservation of systems and their components has implications at every geographic scale; we are not just talking about preserving specimens, as in a global zoo or botanical garden. We are talking about maintaining viable ecosystems within their natural range of occurrence. This is an aspect of the distribution and character concerns I have alluded to earlier.

3. The application of best management practices to preserve soil and water resources must become routine, just like maintaining aseptic conditions in an operating room. Forestry activities conducted under the supervision of professional resource managers should consistently attain very high marks for attention to these details. There is no excuse for anything less.
4. We must become very sensitive to "special places," places that have particularly high value for aesthetic reasons, because they support unusual natural curiosities, or have value as historical or archeological sites. If any of these sites is neglected or destroyed, the credibility of managers plummets, to say nothing of the damage itself.
5. I think the eastern public has great capacity to learn, in terms of both willingness and the ability to grasp complex subject matter. As we better understand the importance of coordinated management of certain features across ownerships, as we develop an economics that is supportive of ecosystem management, I believe the public will also be supportive. Preserving water quality and the special characteristics of streamside zones, maintaining connectivity, minimizing further fragmentation, safeguarding critical species habitat--all are consistent with the public's commitment to stability and health.

But we will need to involve the publics we serve in a variety of learning experiences--learning for them and for us. We can teach ecological basics; they can

teach us the priorities identified by the local community, so that where there is a wide variety of options, all consistent with good fundamentals, the choices can reflect their preferences.

Let me summarize and close.

We have asserted that society's wants and needs in relation to the eastern forests are typically experienced most urgently at the level of emotions. They don't have a shopping-list mentality that says they need one of this and one of that. Their wish list, then, is for a holistic approach that delivers the entire package of individual amenities, plus the package itself. We have summarized by suggesting that society's *wants* boil down to health and stability. Their *need* is for professionals who can manage the resource in a manner consistent with their wants.

These social aspirations for the forest are by no means antithetical to a "new forestry" that integrates a more intense focus on ecosystems, landscape-scale phenomena and sustainability. In fact, they are eminently complementary; I can imagine no forest management scenario that could come closer to meeting society's wants and needs than the evolving ecosystem management paradigm. However, those who aspire to positions of responsibility in the new era of resource stewardship will need to convey scientific realities in the language of the humanities. Not an easy task, but by no means impossible. Let me close with just one more illustrative anecdote.

Not long ago, I did some work for a client in southern Mississippi who was terribly afraid that I "just didn't get it;" that I didn't understand what was important to him as I worked to help him develop a management plan for about 2,500 acres of forestland. But his anxiety disappeared when, in the preface to my plan I summarized what his place is all about in these words:

"The forest and agricultural landscape makes a number of profound statements about Piney Woods;

- It is an island of *peace* in turbulent world;
- It is a *diverse* community...young trees commingle with old trees, hardwoods with pines;
- It is a place where *beauty* is respected, cultivated;
- It is a product of the *patience* and *devotion* and *hard work* of an earlier generation;
- It is a constant, eloquent reminder of underlying *spiritual* values."

I daresay that society is hoping that it will hear us affirm these same realities so far as the eastern forests of the US is concerned. They may then begin to feel, "These resource managers have finally got it!"

References

1. Ralph Waldo Emerson, 1836. In *Selected Essays*, L. Ziff, Ed., 1982. Penguin Books, New York, pp. 37-38.
2. Bonnicksen, Thomas M., 1991. Managing biosocial systems: A framework to organize society-environment relationships. *Journal of Forestry* (89)10.
3. Mitchell, M. Y., J. E. Force, M. S. Carroll, and W.J. McLaughlin, 1993. Forest Places of the Heart: Incorporating Special Spaces into Public Management, *Journal of Forestry* (91)4, p. 38.
4. Ticknor, W. D., 1990. Practicing Objective Forestry in a Subjective World. Paper presented at the Future of Forestry Conference, Washington, D.C., October 16.
5. Thoreau, Henry David, 1849. In *The Concord and Merrimack; Excerpts from A Week on the Concord and Merrimack Rivers*, 1954, arr. by Dudley C. Lunt. Little Brown, Boston.

ECOSYSTEM MANAGEMENT IN THE SOUTHERN APPALACHIANS: OPPORTUNITIES FOR BIODIVERSITY CONSERVATION ON FEDERAL LANDS

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Abstract

Ecosystem management can be described as the "process of achieving sustainability." If it is to meet the requirements of the Brundtland Commission definition, ecosystem management must "meet the needs of the present without compromising the ability of future generations to meet their own needs." Because we cannot know the needs of future generations, providing for their needs means maintaining options, the *potential* of the ecosystems upon which we depend. Ecosystem potential can be partitioned into genetic potential, the living biological diversity of ecosystems, and productive potential, for example, soil fertility, clean air, and clean water. Ecosystem management is the process of maintaining the biological diversity and productive potential of ecosystems.

One place that provides a tremendous opportunity to protect the biological diversity of a regional ecosystem is on the federal lands of the Southern Appalachians. There, most of the rare elements of the forest ecosystem, including endangered species, old growth forests, and remote interior forest are found on the 16% of the regional landbase in national forests and national parks. Unique among the ecological regions of the eastern United States, the Southern Appalachians possess a central core of federal lands that could provide the basis for regional biodiversity conservation upon which to build a regional strategy of ecosystem management.

Introduction

The Wilderness Society's Bolle Center for Forest Ecosystem Management was established in 1991 to promote sustainable management of the forest lands of the United States. At The Wilderness Society, we are interested in ecosystem management as a process to achieve sustainability, where sustainability implies maintaining biological diversity and the productive capacity of ecosystems.

The Brundtland Commission (1988), in their landmark report Our Common Future, defined sustainable development as "providing for current needs without compromising the ability of future generations to meet their needs." They recognized the relationship between healthy ecosystems and the ability to meet the needs of current and future societies and concluded that saving species and their ecosystems is "an indispensable prerequisite for sustainability." However, because it is impossible to know the needs of future generations, it is difficult to know if a sustainable condition has been attained. A useful goal, in the absence of such knowledge, is to maintain options by maintaining ecosystem potential.

Ecosystem potential resides in two qualities of ecosystems: biological diversity and productive potential (Franklin 1993). Biological diversity encompasses the entire variety of life, including genetic, species, ecological community, and landscape diversity. Productive potential includes tangible things, like clean air and water and soil fertility, but it also includes intangibles, such as solitude and spiritual values that one might find only

in wilderness. As ecosystem management represents the process of achieving sustainability, its objective must be the conservation of biodiversity and productive potential of ecosystems.

Principles of ecosystem management

Virtually every paper written about ecosystem management has included some statement of basic principles. Recently, a few authors (Grumbine 1994, Moote et al. 1994) have attempted to distill

recurrent themes from the literature. Many of the so-called principles are more statements of what should be, rather than fundamentals upon which to base a new approach to management. Here, I will attempt a distillation of fundamental principles to serve as a foundation for the further development of ecosystem management (Table 1). These five principles do not describe what should be; they are statements of fact about ecosystems, people, and knowledge. They do not define ecosystem management, but they do provide a basis for its development.

Table 1. Principles of Ecosystem Management.

Ecological Integrity - All parts of ecosystems are interconnected through ecological processes, including interrelationships, such as predation and competition, and dynamic forces, such as population growth. Pattern, the kinds and quantities of ecosystem elements and their arrangement, is a function of the processes occurring in ecosystems. A healthy ecosystem retains its patterns and the processes that bind the system together.
Change - Ecosystems continually change in response to key processes. For example, disturbance processes, including fire, insect outbreaks, and extreme climate, are known to affect dramatically ecosystem structure and function.
Scale - Ecosystems occur at all spatial scales from the rotten log on the forest floor to the entire globe. Ecosystems are structured in a hierarchy such that large ecosystems are composed of smaller ecosystems. Ecosystem boundaries rarely follow political or ownership boundaries. Ecological processes also occur at a variety of rates represented in a temporal hierarchy.
Uncertainty - The remarkable complexity of ecosystems ensures a perpetual gap between what is known about ecosystem behavior and how ecosystems actually behave. Adding to the resulting uncertainty about the future are unpredictable changes in environmental factors (for example, climate) and societal preferences (for example, management objectives). Modern management has often treated land and water as simple systems with a static goal of commodity production, which has had negative effects on native ecosystems in some places. Managing in the face of uncertainty requires a commitment to constant learning, both about the environment and about society. Acknowledging uncertainty reflects a humility toward the environment that has been missing from past management philosophy.
Humans As Part of Ecosystems - People, like all organisms, are members of, and are dependent on, their ecosystems. Ecosystem condition affects all aspects of human life from health to the economy. People also have a tremendous ability to influence the quality of the ecosystems in which they live.

The first principle of ecosystem management is the **principle of ecological integrity**, which affirms the complexity and interconnectedness of ecosystems. This principle captures the notion so well expressed by John Muir when he said, "When we try to pick out anything by itself, we find it hitched to everything else in the Universe." Ecosystem management acknowledges and maintains the fundamental interconnectedness of all life.

The second principle is the **principle of change**. Through processes of birth, death, growth, migration, etc., ecosystems are constantly changing. The relatively recent scientific acceptance of the pervasiveness of disturbance in ecosystems (White 1979, Pickett and White 1985, Botkin 1990) is forcing managers to reconsider traditional approaches that focussed on maintaining an optimal state in favor of one that accommodates processes (Mladenoff and Pastor 1993).

The **principle of scale** simply states that ecosystems exist in all sizes. Small ecosystems combine to make larger ecosystems, and these combine into still larger ecosystems. Likewise, the processes that bind and change ecosystems proceed at various rates, with some processes, like germination or fire, taking place in a matter of minutes or hours and others, such as climate change or soil development, taking place over thousands of years. Management that focusses on only one scale will fail to account for important phenomena at other scales.

It has been said that ecosystems are not only more complex than we know, they are more complex than we can know (Noss and Cooperrider 1994). The **principle of uncertainty** acknowledges the challenges that ecosystem complexity, random chance, and changing public values create for management. It highlights the danger of believing that what we know now is all we will ever need to know, and it makes explicit the need to approach management as a learning process to try to reduce future uncertainty.

The final principle, the **principle of humans as part of ecosystems**, recognizes the vital connections between people and their environment. People function within ecosystems and are both affected by, and have an effect on, those ecosystems. Everything we do, from breathing and eating to our livelihoods and leisure activities, is influenced by the quality of our ecosystems. Ultimately, ecosystem management reflects human values; the choice to live sustainably derives from an ethically-based vision of the ecosystem we want to live in and pass on. Ecosystem management is at the center of attention because it offers some hope of meeting a common objective: a diverse, healthy, productive ecosystem in which to live.

Elements of ecosystem management

The foregoing five principles serve as simple statements of fact regarding the nature of ecosystems and the place of people in those ecosystems. Further, these principles lead logically to a set of recommendations as to what must be included in a strategy of ecosystem management. Inclusion of these "elements" (Table 2) in an ecosystem management plan ensures that the plan has accommodated the fundamental principles.

The principle of ecological integrity requires that managers and planners provide for the continued existence of all of the biological and physical elements of ecosystems. This does not require enumeration of every element, but it does require deference to ecosystem complexity in planning; the management objective can no longer simply be the maximization of any single element of the system. Where certain elements of the ecosystem are at risk, such as endangered species or old-growth forest, ecosystem management must provide short-term protection until conditions are established that ensure the continued existence of those elements.

The principle of change requires the accommodation of important ecological processes into the management plan. The strategy must provide for such processes as dispersal and migration, plant succession, and disturbance, such as fires, floods,

Table 2. Elements of Ecosystem Management

1. An analysis of the distribution of elements of biodiversity and a short-term strategy to protect critically imperiled elements.
2. An analysis of the processes that sustain diversity and productivity and a long-term strategy to maintain or restore key ecosystem processes.
3. A hierarchical classification system that recognizes regional ecosystems.
4. A rigorous process of adaptive management aimed at improving our understanding of ecosystems over time.
5. A land system that includes the entire spectrum of human needs, from wilderness to dominantly human use, with allocations made based on conservation needs.

and population irruptions. A key goal of ecosystem management must be the restoration and maintenance of these processes.

The principle of scale demands that an ecosystem management strategy take into account the hierarchical nature of ecosystems and address patterns and processes at large as well as small scales. This requires a land classification system that recognizes ecosystems at multiple scales.

The principle of uncertainty highlights the need to improve understanding as we proceed. Approaching management as a learning process does not overcome the challenges imposed by ignorance, but it begins to address them. The scientific process of "learning to manage by managing to learn" is called adaptive management (FEMAT 1993); it requires integrating research into the design of management experiments. Managers must become researchers; scientists must be involved in management.

The principle of humans as part of ecosystems requires that peoples' needs, from the concept of wilderness to the concrete of the city, be accounted for in ecosystem management plans. One simple way of providing this spectrum is to allocate land to three land management classes: reserves, multiple-use lands, and production or urban areas (Hunter and Calhoun 1993). Production areas are needed for obvious reasons; reserves are necessary for the

conservation of some elements of biodiversity, for their cultural, educational, and scientific value, and for their "ecosystem services", such as flood control and water purification. Multiple-use lands can contribute to both the conservation of nature and to the production of goods.

An ecosystem management strategy that incorporates all five of these essential elements will be well on the way to achieving sustainability. Several efforts have already fulfilled certain of these requirements, but no plan has combined them all. For example, the Chesapeake Bay Program has taken a regional perspective with an open acceptance of people as part of the ecosystem, but it has concentrated more on water quality than on regional biodiversity or ecological processes and has shied away from comprehensive land use designations within the watershed. The effort to restore the Everglades has focussed on reestablishment of hydrological processes as a means of maintaining ecosystem integrity over a broad region, but it is far from implementation. Perhaps the most comprehensive approach was that used by the Forest Ecosystem Management Assessment Team (FEMAT 1993) to resolve the forestry impasse in the Pacific Northwest. Their plan has a regional perspective, utilizes land use designations (including reserves), assesses and seeks to protect species, and explicitly includes adaptive management. However, it has been

criticized for failing to account for ecosystem dynamics by assigning successional stages to static places on the landscape. Progress is being made, but we are still awaiting a plan that incorporates all five elements of ecosystem management.

Conserving biodiversity on the federal lands of the Southern Appalachians

The Southern Appalachian Mountains present both an opportunity and an imperative to pursue sustainability through ecosystem management. This region has been called "one of the two great centers of forest diversity [in] the United States" (along with the Siskiyou Mountains of southwest Oregon) (Whittaker 1972). The Southern Appalachians form the headwaters of all of the South's major rivers, and they provide recreation and respite for millions of people. Great Smoky Mountains National Park, at the heart of the regional ecosystem, is the most visited park in the system. The Park combines with parts or all of six national forests to form the greatest concentration of public land east of the Mississippi River. Various statutes and the Forest Service's own policy of ecosystem management provide the mandate to protect ecosystem integrity, while the core of public lands provides the opportunity to do so with a minimum burden on adjacent landowners.

The Wilderness Society's Bolle Center for Forest Ecosystem Management recently completed an analysis of the Southern Appalachian region to provide some of the elements of an ecosystem management strategy (Boone and Aplet 1994). Using data obtained from federal managers, state natural heritage programs, and the Forest Service's Forest Inventory and Analysis Program, we assessed the status and distribution of various elements of biodiversity at the regional scale and recommended short-term protection measures for at-risk components. We also provided recommendations to begin restoration of ecosystem patterns and processes. It is our hope that these elements will inform other efforts at ecosystem management in the region.

We analyzed the 24 million acre region approximating the southern portion of the Blue Ridge and Ridge and Valley Physiographic Provinces identified by Bayer (1983). It is essentially the same area identified by the United Nations Southern Appalachian Man and the Biosphere Program to help coordinate land-use and land management issues and by the U.S. Forest Service to study regional timber supply. The area extends from the "Roanoke Gap" in west-central Virginia southwest to the Georgia-Alabama border. About one third of the area (8 million acres) is without forest cover, and about one million acres of forest are protected in Great Smoky Mountains National Park (500,000 acres), designated wilderness, and other areas withdrawn from timber production. The remaining 15 million acres are classed as "timberland", meaning that the Forest Service considers them capable of producing commercial timber; approximately 22 percent of the timberland is federal. Overall, the national forests and national parks of the region constitute 3.8 million acres, representing approximately 16 percent of the study area's land base.

We assessed the status and distribution of the four levels of biodiversity (genetic, species, community, and landscape) to the extent that data were available. We found that the federal lands, despite representing only one-sixth of the region, housed the majority of some important elements of biodiversity.

- *Species diversity.* Of the 690 vertebrate species and 2,245 higher plant species native to the Southern Appalachian study area, 551 (80 percent) of the vertebrates and 1,833 (82 percent) of the plants are found to some extent on the region's national forests and parks. Ninety vertebrate species and 225 plants are globally rare, occurring in fewer than 100 known locations worldwide. Sixty-eight percent of these globally rare vertebrates and 66 percent of the plants have been recorded on federal lands. In addition, 60 native vertebrate species and 83 plant species are listed as threatened or endangered or are candidates for listing under the federal Endangered Species

Act. Seventy-two percent of these vertebrates and 61 percent of these plants occur on federal lands.

- *Genetic diversity.* Trees and salamanders are among the most ecologically significant groups of species in the Southern Appalachians. We examined the patterns of distribution of the 159 tree species and 54 salamander species in the study area to try to understand the distribution of genetic diversity in the region. Fifteen tree species and 23 salamander species are endemic to the Southern Appalachians; they are found only in the study area or have more than half of their range in the study area. The genetic diversity represented by these species is unique to the Southern Appalachians. Fourteen of the endemic tree species and 20 of the salamanders are found on federal lands. In addition, 40 tree species and three salamander species occur in populations that are separated from the main range of the species. These populations have evolved in isolation and likely contain unique genes. Thirty-one of these 43 disjunct species occur on federal lands. Other species exhibit different distributions that suggest a need for special conservation. All distributional classes are well represented on the national forests and national parks of the region.
- *Community diversity.* With the exception of low-elevation riparian forest types, the major native forest communities are well represented on federal and non-federal lands; the most prevalent are oak-hickory and shortleaf-loblolly pine. In North Carolina's western mountains, where a more in-depth classification has been done than in the rest of the region, federal lands support 90 percent of all recognized plant communities, including many that are globally rare or found only in the Southern Appalachians. In addition, national forests and Great Smoky Mountains National Park contain over half of the scarce old forest habitat currently existing in the region, despite their relatively small contribution to the land base.

- *Landscape diversity.* Forest fragmentation caused by farming, roads and other developments has resulted in a prevalence of edge conditions across the landscape. Scarce blocks of continuous forest cover are concentrated on the federal lands. Nearly 90 percent of privately owned and industrial timberland is within a half-mile of nonforested farmland, whereas less than 40 percent of federal timberland is that close to an agricultural edge. (Virtually no timberland is located beyond two miles from agricultural fields.) In relation to roads, 99 percent of all timberland is located within one mile of a road. Of the 1.2 million acres of timberland beyond a half mile of a road (about five percent of the region's timberland base), more than 60 percent is on federal lands, though federal land represents only 22 percent of the region's 15 million acres of timberland. Great Smoky Mountains National Park and wilderness areas also contribute crucial large blocks of mature forest to the landscape mosaic.

Conclusions and recommendations

Our assessment of the region indicates that a major share of regional biodiversity can be conserved on the federal lands of the Southern Appalachians. The Endangered Species Act, the National Forest Management Act, and the Forest Service's fledgling policy of ecosystem management provide the mandate to conserve biodiversity. The ecosystem recovery that has taken place since the deforestation and fires of the turn of the century and the concentration of critical elements of biodiversity on the federal estate present federal managers with a tremendous opportunity to contribute to the long-term sustainability of the regional ecosystem. A few key changes in policy would go a long way toward ensuring that end.

Our analysis identified the large block of complex, mature forest as the most immediately threatened element of biological diversity in the Southern Appalachians. The destruction and fragmentation

of interior forest threatens all four levels of biodiversity. Migratory songbirds, wildflowers, native genetic architecture, old-growth habitat, and landscape pattern are all harmed by the fragmentation of intact blocks of older forest. Planned even-aged timber management and road construction on the national forests will continue to fragment the few remaining blocks of intact forest, exposing interior-dwelling species to hostile conditions, isolating and reducing populations, destroying uncommon communities, and homogenizing the landscape. A strategy to protect biodiversity and productive potential through ecosystem management should provide short-term protection to rare mature forest interior. Adopting the following four recommendations would immediately slow the rate of deterioration of Southern Appalachian biodiversity caused by planned timber harvest activities and help conserve this vital element of the landscape:

- o Significantly reduce timber harvest levels and change forest plans to relieve the pressure to cut older forest;
- o Institute a moratorium on all road construction;
- o Halt forest type conversions and associated artificial regeneration;
- o End the cutting of potential old-growth forest.

Our analysis provides a regional perspective on biodiversity and recommends short-term protection. It does not provide the assessments of ecological processes, the multiscale analysis, the prescription for adaptive management, or the land-use allocations that would complete an ecosystem management strategy. We hope that as others undertake ecosystem management in the region, they will consider our findings and work to provide additional essential elements.

References

- Bayer, K. C. 1983. Generalized structural lithologic and physiographic provinces in the fold and thrust belts of the United States (Exclusive of Alaska and Hawaii). Map at 1:2,500,000 scale. USDI Geological Survey, Reston, VA.
- Boone, D. D. and G. H. Aplet. 1994. Sustaining biodiversity in the Southern Appalachians. *The Living Landscape*, vol. 4. The Wilderness Society, Washington, D.C.
- Botkin, D. B. 1990. *Discordant harmonies*. Oxford University Press, New York, NY.
- Brundtland Commission. 1988. *Our common future*. Report of the World Commission on Environment and Development, Gro Harlem Brundtland, Chairman. Oxford University Press, Oxford.
- FEMAT. 1993. *Forest ecosystem management: an ecological, economic, and social assessment*. Report of the Forest Ecosystem Management Assessment Team. Portland, OR.
- Franklin, J. F. 1993. The fundamentals of ecosystem management with applications in the Pacific Northwest. Pp. 127-144 in *Defining sustainable forestry*, G. H. Aplet, N. Johnson, J. T. Olson, and V. A. Sample, eds. Island Press, Covelo, CA.
- Grumbine, R. E. 1994. What is ecosystem management? *Conservation Biology* 8:27-38.
- Hunter, M. L. and A. Calhoun. 1993. A triad approach to land use allocation. In *Proceedings of a conference on biodiversity in managed landscapes*. Oxford University Press, New York, NY.
- Millar, C. I. and W. J. Libby. 1991. Strategies for conserving clinal, ecotypic, and disjunct population diversity in widespread species. In *Genetics and conservation of rare plants*, D.A. Falk and K.E. Holsinger, eds. Oxford University Press, New York, NY.
- Mladenoff, D. J. and J. Pastor. 1993. Sustainable forest ecosystems in the Northern Hardwood and

Conifer Region: concepts and management. Pp. 145-180 in *Defining sustainable forestry*, G. H. Aplet, N. Johnson, J. T. Olson, and V. A. Sample, eds. Island Press, Covelo, CA.

Moote, M. A., S. Burke, H. J. Cortner, and M. G. Wallace. 1994. Principles of ecosystem management. Water Resources Research Center, University of Arizona, Tucson, AZ.

Noss, R. F. and A. Y. Cooperrider. 1994. Saving nature's legacy. Island Press, Covelo, CA.

Pickett, S. T. A. and P. S. White. 1985. The ecology of natural disturbance and patch dynamics. Academic Press, San Diego, CA.

Whittaker, R. H. 1972. Evolution and measurement of species diversity. *Taxon* 21:213-251.

White, P. S. 1979. Pattern, process and natural disturbance in vegetation. *Botanical Review* 45:229-299.

Defining Ecosystem Management

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Different people have different definitions and impressions of the term "Ecosystem Management." One definition is not necessarily better than another. It is important to define how you are using the term.

When the Chief of the Forest Service announced his Ecosystem Management policy back in June 1992, he used the phrase "taking an ecological approach to the multiple use management of the National Forests and Grasslands."

There is an even simpler and more applied definition, namely that Ecosystem Management means "*Managing by Ecological Unit*," and understanding associated patterns and processes.

An Ecological Unit is a defined area on a map. An Ecological Unit has a particular combination of climate, landform, soil, and vegetation. It also has a predictable successional pathway, from pioneer to climax species. We can, and in many cases, already are, "Managing by Ecological Unit," "Managing by Ecological Unit" seems far less presumptuous, and far more pragmatic than saying we "manage ecosystems."

The Ecological Classification System provides a framework for mapping Ecological Units at different scales. This framework allows larger landscape units that cover multiple ownerships to be progressively subdivided into smaller units depending on the issues and types of decisions that need to be made.

At the largest scale, Dr. Bob Bailey has mapped the Ecoregions of the United States. At the next finer scale, the Province and Sections have been mapped for the eastern United States. Sections are not being subdivided into Subsections at a multi-States statewide scale.

In 1990, the Upper Great Lakes Biological Diversity Committee formed a coalition of 17 representatives from Federal and State agencies, the forest industry, environmental groups and the academic community. They reached consensus and have prepared an Ecological Unit map of the tri-state area of Michigan, Wisconsin and Minnesota. Similar efforts are now underway for the Central States, the New England area, and the Middle Atlantic States. Most National Forests in the east have subdivided these Units into three finer levels, namely Land Type Associations, Ecological Land Types and Ecological Land Type Phases. These finer levels are suitable for Forest Plan and project level decisions.

This "nesting" or "subdivision" of Units is described in the *National Hierarchical Framework of Ecological Units* adopted for service-wide use by Acting Chief of the Forest Service, Dave Unger in November 1993. Many other Federal and State agencies have adopted or are evaluating this system for their purposes.

This *Hierarchical Framework* is a way to organize our thinking, our analysis, and our decision making on the landscapes we manage. Larger units are used to address issues at the landscape level across large areas of multiple ownerships and multiple jurisdictions, such as the migration of wolf packs from the Boundary Waters Canoe Area Wilderness into western Wisconsin and the Upper Peninsula of Michigan. Another example at the large landscape level is the management of Jack Pine and the restoration of native prairies and oak savannas across Michigan, Wisconsin and Minnesota.

Smaller units are used to make project level decisions at the local level, such as individual timber sales or the protection and restoration of scarce, endangered or unique species.

The hierarchical framework of Ecological Units is a "tool" for managers to use to relate decisions at one level to those at another level. "Managing by Ecological Unit" is also a way to address the complex issue of sustaining and enhancing biological diversity.

Operating principles for ecosystem management

There are some simple operating principles for Ecosystem Management.

- Manage ecological systems, not individual resources
- Manage habitats, not individual species
- Humans are part of the ecosystem, and their needs must be met
- Concept of relative scarcity or abundance
- Concept of managing across larger landscapes

The last two principles or concepts need further definition.

The concept of "relative scarcity and abundance" is key to the issue of conserving or enhancing biological diversity. This is the underlying issue in the Pacific Northwest with the Spotted Owl. For the general public, the issue is protecting and preserving that cute little owl. For the more informed, the issue is protection and preserving the entire old growth habitat which the owl occupies. It's not just the owl, but rather all of the associated plants and animals. Old growth habitat is relatively "scarce." Other habitats are relatively "abundance." It seems logical that to determine relative scarcity or abundance, you must first put it in the context of the Ecological Unit in which it occurs.

Picture an Ecological Unit of several thousands of acres. To maximize biological diversity, you would want all serial stages to be represented on that landscape, from pioneer to climax. If you inventory the current vegetation, or areas in different serial stages, it should give you a feeling of what's relatively abundant, and what's scarce or missing.

Now you can develop some management strategies. On those areas that are relatively abundance, you have a wider range of management options, including timber harvest. For those areas that are relatively scarce or underrepresented, perhaps your management strategy should be to protect or restore those areas.

We can build on this concept of "relative scarcity or abundance and move to the concept of managing across larger landscapes. Picture again that Ecological Unit of several thousands of acres. It crosses multiple ownerships and multiple jurisdictions. It includes Federal lands, State lands, corporate lands and private lands. Each are contributing some type of habitat and each contributes to the overall biological diversity. So then the question becomes "Who should supply what portion of which ecological systems at what successional stage?"

Consider a very simplistic example. An Ecological Unit half of which is in corporate ownership and half of which is National forest. Suppose the corporate portion is being managed for shorter rotation species that provides a pioneer to mid-successional habitat. Perhaps, then, the National Forest portion should emphasize a mid-to-late successional habitat. The net result is that all serial stages are represented within the Ecological Unit, resulting in the highest degree of biological diversity.

This does not infer in any way, shape or form, any implication of regulation of private property rights. That's not the point. The point is that we have an opportunity to look at complimentary management strategies across larger landscapes and multiple ownerships.

All natural landscapes contribute something to biological diversity, whether they may be public, private, or corporate. The National Forests can not provide 100% of society's needs for biological diversity.

East of the Mississippi, only 8% of the forested landscape is in National forests. Not all ecological systems are represented on National Forests.

East of the Mississippi, less than 30% of the forested landscape is in public ownership. Not all ecological systems are represented on public lands.

Furthermore, public lands serve a variety of purposes. How much of these public lands should be managed for those species needing minimally disturbed conditions - a highly controversial issue as we know from the Spotted Owl controversy in the Pacific Northwest. What should be the role of the 70% of private and corporate lands?

The Northern Forest Lands Council, commissioned by the Governors of Maine, New Hampshire, Vermont and New York has been addressing that question for the past 3 years. Their Biological Resources Subcommittee is working on a biological diversity assessment of the New York and New England area, and characterizing those representative ecological systems that occur on public land, and those found only on private and corporate lands.

In conjunction with this study, the State of Maine recently mapped the State's dozen or so major biophysical provinces or ecological units. They then listed the State's 130-140 or so "ecological systems" and inventoried how many of these systems were represented on public lands. They concluded that *less than half* of the States' ecological types occurred on public lands. That means that *more than half* of the State's ecological types occur only on private lands. The Report of the Northern Forest Lands Council outlines in great detail a number of strategies for preserving representative areas of these ecological types.

There are other examples of how Ecosystem Management is being applied at a landscape scale. The Mark Twain National forest and the Missouri Department of Conservation have recently completed a statewide assessment of biological diversity. It identifies and maps the major

ecological units in the State. It describes each ecological unit in terms of topography and soils, pre 1850 vegetative communities, present vegetative conditions, the unit's contribution to Statewide diversity, and a conservation strategy for each Ecological Unit.

There are many other collaborative efforts that we can point to.

In the Midwest, 20 Federal and State agencies have come together and formed an Interagency Committee on Ecosystem Management. The purpose of this Committee is to reach consensus and develop strategies for: a common Ecological Classification and Inventory system; sharing Data bases and GIS systems; transferring Research technology; internal and external education programs; developing complimentary multiple agency management strategies for large areas of adjoining public lands; and assessing regional biological diversity.

The State of New Hampshire, in cooperation with the White Mountain National Forest is developing a comprehensive Forest Management Plan for all lands within the State.

In Michigan's Upper Peninsula, the Hiawatha National Forest in cooperation with the Michigan Department of Natural Resources, the Seney Wildlife Refuge, the Pictured Rocks National Lakeshore and Mead Paper Company are developing complimentary management strategies for the entire eastern half of the Peninsula. Similar efforts are underway in Wisconsin and Minnesota.

Another strategy of Ecosystem Management is ecological restoration. Major ecological restoration projects are underway on many public lands, particularly in the Midwest, where 98% of the original pine barrens, oak savannas and native tall grass prairies have disappeared.

For example, on the Mark Twain National Forest in Missouri, 10,000 acres of native tall grass prairies is being restored through the use of prescribed fire

and removal of encroaching red cedar. On the Chequamegon National Forest in northwestern Wisconsin, 6,000 acres of native grass prairie and oak savanna have been restored. A similar project is underway on the Hiawatha National Forest in northern Michigan to restore sharp-tailed grouse habitat.

Native tall grass prairies and open oak savannas are even being restored in the suburbs of Chicago through a cooperative project with the Forest Preserve District of Cook County, the Forest Service, the Nature Conservancy and the Illinois Department of Conservation. Forty miles southwest of Chicago is Joliet Arsenal, which is due to be closed as a military installation. This 23,500 acres tract has tremendous potential for restoration. This tract and the adjoining 20,000 acres of corporate and State of Illinois lands could form the largest prairie and wetland complex east of the Mississippi.

Ecosystem management - strategy

Ecosystem Management should also be discussed in another context. Ecosystem Management is not a Goal. You don't say "our Goal is to do Ecosystem Management." You can say that our Goal is to maintain healthy and sustainable forests; or, our Goal is to protect threatened and endangered species; or, our Goal is to enhance biological diversity. You don't just jump in your pickup truck in the morning and say "I'm going out to do Ecosystem Management today."

Ecosystem Management is really a *Strategy*. It is a way of thinking about the landscapes we manage. It is a way to organize our thinking and maybe our land management plans. It is thinking about things like Time and Space, or as some more eloquent associates would say - "spatial and temporal relationships."

Consider *spatial* relationships for a moment. As we look across the landscape, we know that areas transition from: wet to dry; from cold to warm; and from high elevation to low elevation. We also know

plants and animals change in response to these physical changes.

There are also *temporal* changes. Landscapes change over time - we call it natural succession. A typical successional pathway in the midwest would be aspen in the early seral stage, transitioning to oak and maple after 60-80 years, and possibly to maple/hemlock after several hundred years. Ecosystem Management should imply an understanding of these Time and Space relationships, and their consideration in our management decisions.

Incorporating ecosystem management into land management plans

The final topic to be discussed is Incorporating Ecosystem management strategies into Forest Plans. This is a key and essential element to insure that Ecosystem Management principles are consistently reflected in on-the-ground management decisions.

Our vision is that as we revise our Forest Plans for the second decade, we will adjust our current Management Area boundaries to correspond with Ecological Units. We will describe the natural successional pathway for each Ecological Unit. We will specify Standards and Guidelines by Ecological Unit. By comparing the existing vegetation with the potential vegetation (Ecological Unit map), we will be able to identify off-site species. Through public involvement, we will identify the Desired Future Condition in terms of a desired seral stage, and a balance of seral stages within an Ecological Unit.

Using silviculture treatments and techniques such as prescribed fire, we can move the Unit toward the desired seral stage. A flow of forest products to meet society's needs will be one of the considerations in determining Desired Future Condition.

One of our biggest challenges will be to define management opportunities and limitations by Ecological Unit.

Summary

In summary, taking an "Ecological Approach to Management" has been described in terms of:

- defining Ecosystem Management as "Managing by Ecological Unit"
- describing some Operating Principles and examples of applying Ecosystem Management at the landscape level
- defining Ecosystem management as a Strategy rather than a Goal
- sharing our vision of how to incorporate Ecosystem Management into Forest Plans

Finally, it is important to reinforce why we are moving to an ecological approach to multiple use management. Ecosystems are great integrators, and a way to reflect the combined effects of soil, water, geology, climate, landform and vegetation. Ecosystem Management appears to be the next logical step in the evolution of our thinking about the landscapes we manage.

Ecological Units can tell us: what can be, what will be, or what should be!

THE USDA FOREST SERVICE PERSPECTIVE ON ENVIRONMENTAL FORESTRY ISSUES IN THE EASTERN UNITED STATES

(Remarks prepared for Jack Ward Thomas, Chief, Forest Service)

I appreciate the opportunity to address you this morning on a topic that is central to the future of this region, the country, and the world. The health, diversity, and productivity of all ecosystems is being threatened for a variety of reasons. This conference, and the many ongoing actions by individuals, groups, and governments, are key steps to ensuring that future generations can enjoy the bounty of these resources. If never before, the adage "no person is an island" stands as testament to the nature of task lying before us. We got into this together, we must get out together!

Today, I want to briefly address the challenges facing us, share with you the path the Forest Service is taking as stewards of our National Forests, and finally, stress the partnerships needed to achieve the goal of sustainability. I also want to hear from you, and will leave time for us to discuss some issues of special interest to you.

Why worry about eastern forests?

Certainly forests of the eastern United States have evolved from how they looked 200 years ago. Having worked in the northeast earlier in my career, I have observed the changes brought about by this evolution. Conditions today are not always as we want the, yet the forests of the East are among the most beautiful in the country and provide a wealth of values and uses for a growing population. A testament to resilience of these forests. You will be hearing about the evolution of these forests later in this conference.

As we look to the future, and more carefully at the structure, diversity, and demands being placed on eastern forests, all is not well. Pressures on the forests to provide a broad range of values and uses are increasing, and will continue to do so. If for no

other reason, the number of people wanting to share the wealth of these ecosystems is increasing. In many areas, people are moving to the wooded areas to enjoy solitude and quietness not afforded by our cities. The wildland/urban interface, as it is often called, further exacerbates an already tough job for decision makers and managers. Protection from fire is just one implication that comes to mind.

There is also an increasing call to preserve forests to protect the many natural attributes they provide. A common concern expressed by these interests is that continued use and "exploitation" will degrade both esthetics and health. The extent we can "preserve" current conditions may be a question. What is not in doubt, however, is that additional acres in protected status will push many demands and uses to other areas, thus raising the intensity of trade-off questions.

There is another situation that may affect eastern forests in the near future, if it is not already underway. As you are aware, the production of wood products from western forests is down considerably from previous levels. Following this down trend has been an increase in harvesting of softwoods in the south. This has raised concern among some that the increased rate of harvest is not consistent with long term ecological health of southern forests. Eastern forests have considerable productive potential that is generally overlooked, particularly for hardwoods. Should we see an increase in harvesting of those forests, issues associated with ecosystem health and productivity will become more heated. A question is healthier for what? Or maybe sustainable for what?

Sustainability as the base issue

There are many separate issues identified with the management and use of eastern forests. During this

conference you will be identifying, assessing the impacts, and searching for possible solutions to some of these issues. While we must examine each issue carefully to ensure that appropriate actions are taken, there is an overarching issue that can provide a philosophical foundation for more effective and far reaching collaborative efforts. That issue is *sustainability*. There are various definitions and applications of sustainability. It is less important to reach consensus on a specific definition, that it is to grasp the underlying tenet. That is -- we must sustain ecosystems and we must sustain people. Both must be achieved if we are to pass on the legacy of our forests to future generations. The old adage of protecting the "goose that lays the golden eggs" comes to mind. We certainly like the eggs, therefore, it makes a lot of sense to protect the goose. It takes considerable care and feeding, but more on that later. Using sustainability as a base tenet will provide useful in keeping the debate on specific issues in the proper context.

Challenges to a simple solution

There has not been a more challenging time facing our country and the world. Providing for the needs and values of some 275 million people in the U. S. and over 5 billion in the world tells us this is a situation calling for immediate attention. The problem, however, is that this thing is COMPLEX! Ecosystems are exceedingly complex, as are humans and societies. The rules, laws, and agreements that govern and guide management of our forests are also complex, and are sometimes at conflict with one another. Although beltway politicians like to reduce issues to seductively simple solutions, we recognize that real life solutions are not simple, but neither are they intractable, unless WE make them that way.

As if this was not enough to complicate new approaches, we have learned through the evolution of ecosystem management that we need to think and act at larger scales and over longer time frames than in the past. This may well be the most significant factor separating good practices from the past from

sustainable practices of the future. In some cases a given practice may have looked good at the site level, but had detrimental effects when applied at the landscape level. We also need to monitor activities very carefully to make sure they continue to provide the forest conditions we desire over the long haul.

We need to listen very carefully to the public--to better understand their needs and values, and what they want the forests to look like. We also need to increase the flow of information provided the public, to ensure they have the best possible basis for understanding the issues and making choices. As you know, this is quite a challenge in itself. A further complication is that management activities will continue to be challenged by people and groups with tightly defined objectives and values -- a single issue mentality.

Another challenge is a financial one. We need to recognize and accommodate as best possible the reality that activities needed to sustain ecosystems will cost, and in some situations without a return from commodity values. In a recent article in the *Journal of Forestry*, John Gordon and "the central issue regarding EM emerges: when can we afford to apply it?" A very good question, but we are facing another truth, that is, we cannot afford not to apply it! Our agency, and I am sure others, is now examining the financial implications of funding activities under the ecosystem management umbrella.

While the task is formidable and seemingly impossible at times, I remain optimistic. Change never comes easy, certainly change that alters the very understanding of social, physical, and biological interactions. Yet, we are on the correct path. Demonstrated by this conference, and similar activities elsewhere, is the recognition that collaborative efforts provide the only sound approach. This is well summarized by comments of Barbara Todd, President of NACo (National Association of Counties), at an Earth Day celebration this past April. Her statements put the context of our challenge clearly into perspective.

She said "while federal and state governments will play a role, sustainability is not a federal problem with a federal solution; our future will be defined by our local actions."

What the Forest Service can and will do

As Ms. Todd so aptly put it, no agency will provide the silver bullet for sustainability. Even if the Forest Service had such a solution for the National Forests, it would not suffice to ensure sustainability for all ecosystems. I am confident, however, that the evolution of ecosystem based management in the Forest Service can provide some good examples and experiences for building a broader based approach.

Before I begin outlining the principles associated with our Ecosystem Management policy, let me first bring another perspective to the table. All of our natural resources are undergoing pressures unknown in the history of human existence. Which leads me to what I believe is a cornerstone of sustainability. Before we do anything else *we must begin with conservation*. Though conservation cannot ensure sustainability, I believe it is a necessary condition. We must take the best use of every resource. When we undertake an activity, we must conduct it as efficiently as possible. Once we are sure on-site needs are met, we must effectively utilize wood that is available to meet peoples needs. We must make each product last as long as possible; recycling as often as possible for example. Like other goals, conservation is not always easy, inexpensive, or without detractors. Doing otherwise, however, would simply be foolish.

The Forest Service is committed to ecosystem based management. Recognizing that is not a goal unto itself, but a process for attaining the goal of sustainability. We have a mandate from the public, supported by legislation, that establishes the benefits and values for which we are to manage. Through ecosystem sustainability, present and future generations will reap the benefits that healthy, diverse, and productivity that these ecosystem provide. While we will not put ecosystems at risk,

our land ethic includes the active use of ecosystems, both through preservation and manipulation. EM is not an euphemism for preservation! Active management is essential if we are to meet our goals.

Our strategy, which is evolving and will continue to do so, integrates the human, biological, and physical dimensions of forest resources. Only through this integration and by managing across a larger scale than in the past can we be successful. Strategically, we are applying our EM principles to achieve three desired outcomes. These are:

1. Enhance protection of ecosystems
2. Restore deteriorated ecosystems
3. Provide a variety of benefits within the capabilities of ecosystems

I am sure you recognize the complexity and challenges associated with achieving these outcomes. We still have a lot to learn about ecosystem management, and we will make some wrong turns. But we cannot wait all the uncertainties become clear. We are moving ahead as quickly as possible, keeping the ultimate goal of sustaining our ecosystems clearly in front of us.

I would like to say a little more about the third outcome; providing a variety of benefits. Managing for multiple benefits is certainly not a new concept for the Forest Service. We are currently guided by the Multiple-Use Sustained Yield Act in doing this. There is no inconsistency, however, between this guiding act and ecosystem based management. Ecosystem based management is a process to achieve our goals, not an end in itself. The difference today is that we recognize that sustaining ecosystems is the underlying principle to ensure the benefits are available for future generations.

Will harvesting trees be a component of our strategy? Yes, where consistent with sustainability. We will not be target driven as in the past. What is often overlooked, however, is that recovery of wood products will be an option during activities aimed at providing other resource values. Meeting many of our resource goals will require vegetation

management. Thinning to improve forest health is one that quickly comes to mind. We are not sure today what the flow of wood products from these activities will be, just that it makes sense. Not taking advantage of removing wood products could have negative effects, such as creating a fire hazard or precipitating insects infestations. Thinking back to the "golden goose," this may be one way to help buy food for the goose. Taking advantage of wood markets can provide financial incentives to undertake our activities. Possibly a partial answer to John Gordon's question of "when can we afford to apply it?"

An underpinning of science is mandatory for us, anyone for that matter, to achieve our management goals. We will continue to emphasize use of the best science and technologies available in all decisions and actions. We will also continue to support fundamental and applied science across all disciplines to close the gap between what we want to do and the knowledge of what to do and how to do it. We will probably never have complete knowledge needed to undertake ecosystem management, but we cannot wait. Thus, through a process we call *adaptive management* we are moving ahead all activities to achieve our management objectives. Adaptive management means we will identify a strategy and appropriate technologies, monitor to see if the results were as intended, adapt if otherwise, and then move ahead. Innovation, uncertainty, and risk will be companions along this path, as will be successes.

This is a path that we cannot travel alone. Achieving ecosystem sustainability is not within the purview of us or any single organization. Only by working together can we hope to find answers for that worthy goal. This brings me to my last point. The role of partnerships.

Fostering partnerships

It is often said, but important to keep in mind, that ecosystems do not recognize boundaries. The implications of this understanding are far from trite.

It tells us that if we want to sustain ecosystems we must work together. It is not required, or necessarily desirable, that all owners follow the same plan and undertake the same activities. Our forest ecosystems and benefits derived from them are too variable for such a solution to exist. It does mean that we need to act with a better understanding of those plans and look for ways in which we can collectively make our actions more effective in attaining sustainability.

The term partner can have different meanings, depending on the reasons for and nature of the relationships. Without getting into semantics of the term, I see four reasons why partnering is critical to achieving the Forest Service mission and goal of ecosystem sustainability.

First among these is developing a better understanding of the values, needs, and perceptions of the owners of our National Forests -- the American public. As stewards of these lands we must understand as fully as possible what benefits the public desires and what they want their forests to look like. Management means undertaking actions to achieve stated objectives. The public defines our objectives.

The second type of partnering is undertaken to help gain a better understanding of what others are planning and doing. Our decisions depend to some degree on the plans and management strategies of other land owners. If we are to maintain diversity across the landscape, for example, our strategy needs to take into consideration that of our land owners within that ecosystem.

The third reason for partnering is to share information and provide assistance. We have a long history of this, among and between the public and private sectors. Ecosystem sustainability, however, requires a greater intensity and scope of information and sharing than we have ever encountered.

Within the Forest Service, our State & Private Forestry arm has been playing a key role in assisting land owners, and we see this growing in importance.

The fourth reason for developing partnerships is to work together to jointly plan and implement ecosystem management strategies. This has and will continue to occur where managers share common goals. We also need to extend these partnerships into the rule and regulation arena, to ensure that these mechanisms consider ecosystem perspectives.

Conclusion

Few things have been untouched by the evolution of sustainability. The entire world is wrestling with the concept of sustainable development, trying to find a balance between meeting peoples needs and sustaining the very source of those needs. Here in the east, and throughout our country, pressures will continue to mount on our forest resources to meet the needs of a growing populace. Fortunately, we now understand that sustaining these ecosystems requires new thinking and approaches. As my friend John Gordon indicates, we need a new paradigm to deal with this new order, I suggest it is well underway.

The Forest Service is ready to join you and others across the country to accomplish the goal of sustainability -- of our ecosystems and of our people. As this conference demonstrates, we cannot afford to wait until all questions are answered. Through our Ecosystem Management policy, we will direct our management to restore and protect ecosystems and provide the multiple benefits desired by society. Always starting with conservation as the cornerstone for this mission. We are committed to being an active manager of our resources.

We are fully dedicated to being an active partner in this new frontier. We will share our knowledge and

technologies and assist others who want our help. We will develop and use the latest science in this endeavor, and share this with all people. We will employ adaptive management and share both our successes and failures. We will work across boundaries to develop better understanding of the collective strategies for managing our ecosystems. We will gladly work to develop collaborative management strategies with partners sharing common objectives. Finally, we are reaching out more aggressively to the American public to help learn their needs and desires for the National Forests.

Historical - Future Performance Panel - An Academic Perspective on Environmental Issues

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The academic perspective on environmental issues must encompass the "big picture." Academicians are charged with training the next generation of resource managers and providing at least a portion of the basic research on which responsible resource management rests. Critical to accomplishing this task are: 1) an understanding of the forces that shape natural resource conditions, and 2) a "vision" as to what the desired future landscape condition should be. While study and research can equip us with the necessary understanding of the forces that drive ecosystem dynamics, lack of consensus as to what future landscape conditions should be will continue to confuse both academicians and resource managers. Compromises between production concerns and the aesthetics of landscape condition will likely characterize the output of bargaining sessions into the foreseeable future.

A source of much of the confusion/disagreement stems from fuzzy semantics - in particular, implications of the word "natural." While its use is deeply imbedded in our rhetoric, its meaning is vague. We are, after all, natural resource managers, and certainly we manage for the natural attributes of our environment; the food we eat and cosmetics we use are full of natural ingredients. Of the 15 definitions given in the unabridged version of Webster (1983), the best fit for its apparent meaning in the environmental arena is "..., without man-made changes;.." (e.g., no cultural influence). Examples of its use in this context are found in National Park management guidelines and the Wilderness Act. A misconception inherent in the development of these directives was that the North American landscape was without cultural impacts prior to 1492.

That the pre-Columbian landscape was as much the result of cultural impacts as it was of natural processes (with their interactions determining landscape design over most of the continent) is

firmly documented in recent archaeological, geographical and historical literature (Butzer 1992, Fiedel 1992 and Williams 1989). Further complicating the scene were the rapid changes underway in both the natural and cultural components. In the 18,000 years since full-glacial conditions of the Wisconsin Ice Age climatic periods warmer than today's have prevailed. Superimpose on this cultural impacts that go back at least 12,000 years (Chapman 1985) - prior to the arrival of the extant vegetative cover, and the dynamic disequilibrium of the system becomes apparent.

In Eastern North America the "natural" (no human impacts) landscape will be a closed forest generally having 2 or more canopy layers. This condition essentially precludes grasses - the primary food source for large animals which, in turn, were the primary food source for the early cultures of North America. Preventing stand closure was, and continues to be, an essential activity necessary for human survival in this (or any other) region.

Fortunately, the original settlers of North America brought with them across Beringia the tool that allowed them to maintain an open landscape - fire (Fiedel 1987). Interacting with natural processes, human-caused fires were a primary vector shaping the pre-Columbian landscape of Eastern North America, which was likely a mosaic of grasslands, open woodlands and closed forests. This diversity in landscape components provided habitat diversity that, in turn, accommodated wide species diversity of both plants and animals.

The "wilderness" described in early American writings (Williams 1989) depict closed forests, a condition that likely developed only after European diseases killed most of the native American population (Dobyns 1983, Josephy 1992) during the early part of the 16th century (mortality estimates

go as high as 90 percent). This was some 150-200 years prior to the earliest historical writings (late 18th century), on forest conditions in the interior regions (Van Doren 1928) - ample time for the development of the wilderness conditions commonly described.

The exploitation of the forest resource during the 19th and 20th centuries is a matter of historical record, as is its recovery over the past half century. Contributing significantly to the rapid recovery has been the large population of pioneer species that were dispersed throughout the landscape - species that are well-suited to disturbed conditions enabling them to rapidly occupy disturbed sites. These species were maintained in the pre-historic landscape by both natural and cultural disturbances.

As we go about molding future forested landscapes it is important that we realize that the "hand of man" has been a part of the landscape dynamic for as long as the extant trees have been here. That future forested landscapes will have a strong cultural component - "is a given," if not by intent, then by default. The measure of responsible stewardship will be the extent to which these landscapes are attractive, healthy and productive of the goods and services needed by society.

Literature Cited

Butzer, Karl W. 1992. The Americas before and after 1492: Current Geographical Research. Annals of the Assoc. of American Geographers. Vol 82, No. 3, pp. 343-568.

Chapman, Jefferson. 1985. Tellico Archaeology. Occasional Paper No. 5, Frank H. McClung Museum. Tennessee Valley Authority. 136 p.

Dobyns, Henry F. 1983. Their Number Become Thinned. The University of Tennessee Press, Knoxville. 378 p.

Fiedel, Stewart J. 1987. Prehistory of the Americas. Cambridge University Press. New York. 400 p.

Joseph, Alvin M. Jr. (Ed.) 1992. America in 1492. Alfred Knopf, New York. 473 p.

Van Doren, Mark (Ed.) 1928. Travels of William Bartram. Dover Publications, Inc., 414 p.

Webster, Noah 1983. 2nd Ed. Webster's New Universal Unabridged Dictionary. New World Dictionaries, Simon & Schuster, New York. 2129 p.

Williams, Michael 1989. Americans and Their Forests. Cambridge University Press, New York. 599 p.

"Past, Present and Future of Industrial Forestry"

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As an industry, we are currently facing unprecedented pressures. We are challenged with managing our forests in an environmentally sound way without compromising our competitive position in a global market for forest products. We have embraced the concept of forest sustainability, but forest sustainability has to be integrated with long-term economic goals.

Today, I will provide you with a perspective on industrial forestry -- reviewing the history of the forest industry and industrial forestry in this country --- then looking at the current challenges facing the industry and how we plan to address those challenges. Population growth, regulatory programs, taxation, and shifts in public opinion -- when combined with the growth of the industry -- have had major impacts on land-use and the practice of forestry. Over the years, the industry has had to modify its practices and management in response to these factors.

The early history of industrial forest management and land use was "utilitarian" in focus. People used the land for economic gain -- for production. Over the last 50 years, as our society has changed from an agricultural-based rural society to an urban society, the utilitarian view of land use and management has given way to a biological-centered point of view which is often incompatible with economic or utilitarian land use. This shift has definitely affected forest management in the United States

The forest industry currently owns and manages more than 71 million acres of forest land in North America -- with an estimated investment value of \$82 billion dollars (Shallau, American Forest & Paper Assoc.). As we review the past, present and future of industrial forestry, the one thing that must remain constant is the industry's ability to manage its forests for an economic return. We are committed to forest sustainability, but we must seek

a position of "competitive sustainability" that balances the need for environmental and economic stability. A reasonable balance can assure sustainability.

With that in mind, I'll begin today by taking a brief historical look at industrial forest management and the forest products industry.

Total forest land area in the United States has decreased to roughly 70 percent of that which was present in the year 1600. Much of this forest conversion occurred between the years 1850 and 1910, when American farmers cleared about 190 million acres (MacCleery, 1992).

By 1920, the clearing of timberlands for agricultural use had begun to stabilize. The 1920s also marked the beginning of interest in industrial forest management. Before that time, timber companies often sold cutover tracts for farmland or let ownership revert to local governments for non-payment of taxes.

It was often considered folly to buy these cutover lands. Ben Cone, a private landowner near Wilmington, N.C. currently manages 7,000 acres of prime forest land and red-cockaded woodpecker habitat; however, when his grandfather bought this cutover acreage around the turn of the century, people referred to it as "Cone's Folly," a name that has stuck to this day.

G-P's Crossett Forest in southeast Arkansas and Northern Louisiana, where I had the privilege of working during my career, is an example of this emerging interest in industrial forest management. The family-owned Crossett Company began to invest in timberlands around the turn of the century and Southern pine management was practically pioneered there in the early part of the century.

It really wasn't until the end of World War II that tree planting and extensive industrial forest management came into existence. Many factors influenced this new emphasis on forest management. States began to modify tax codes making them more favorable for timberland investment --- government laws and programs provided an impetus for reforestation. Increased demand and prices for wood and wood products also gave landowners -- industrial and non-industrial -- an incentive for managing timberland. Timber became viewed as a valuable commodity.

The increased emphasis on industrial forest management was also largely driven by the development of the forest products industry during this same era. The industry, as we know it today, is relatively young.

Wood was not widely used as the primary raw material for papermaking until the last half of the 19th century. Once the technology was developed to process wood fiber for production, it was quickly accepted as the preferred raw material for paper production. By the turn of the 20th century, the age of economical, mass-produced paper was launched in America. (American Forest & Paper Assoc., 1993.)

The paper industry began in the northeastern United States. In fact, quite a few of these mills built in the early part of the century are still in operation today. Paper production and capacity expanded westward to Wisconsin, Michigan and Minnesota -- and then later to the Pacific Northwest. It was not until the late '20s and '30s that the sulfate paper industry became firmly established in the South.

The demand for lumber and other building products was fueled by the two World Wars. The period following World War II was a time of rapid economic growth in the United States. To meet this demand, the forest products industry went through a major expansion period -- building mills at every crossroads in the nation's woodbaskets. The '50s and '60s brought rapid growth for the industry in the Pacific Northwest.

Then, in the early '60s, manufacturing processes were developed to utilize fast-growing Southern yellow pine for the production of pine plywood. Structural panel production, utilizing Douglas fir as the preferred species, was a west coast business. Southern pine was eventually accepted as an alternative to fir panels, thus beginning a major shift in industry production capacity and adding to industrial forest land ownership in the east.

My early career paralleled the growth of the solid wood products industry in the '60s and '70s. I had started my career in Springfield, Oregon making plywood and lumber from Douglas fir, but moved to the South in the '70s to work in this emerging woodbasket.

The role of industrial forestry was evolving during this same time period. Government initiatives like Soil Bank and the Conservation Reserve Program encouraged reforestation on the nation's private lands. Tree planting on industrial forest lands grew from 7,000 acres annually in 1945 to more than 1.2 million acres a year during the 1980s. Industrial forest ownership grew to its present level of 71 million acres, representing 14 percent of the nation's commercial timberlands.

Although there was a greater emphasis on reforestation and improving forest growth and productivity, the resource was largely viewed as plentiful by the industry. For the most part, in the '60s and '70s, new mills were built without the kind of comprehensive resource availability study that we consider necessary today.

Industry manufacturing capacity expanded rapidly to meet growing consumer demand for wood and paper products which was fueled by 20th century population growth. During this time, there were companies who took a long-term view of resource use and availability; however, a short-term view was often taken. As the industry's growth stabilized, our business has had to become more deliberate and take a longer-term view in its planning, especially as it relates to issues of resource use and availability.

Many other outside factors influenced the need for greater resource planning. U.S. population more than doubled from 1920 to 1990, growing from 106 million people to more than 250 million people today. Eastern states like Florida experienced tremendous population growth, increasing from less than a million people in 1920 to almost 13 million in 1990. (U.S. Census Data)

The corresponding increase in development and urbanization affected the state's timberland, with a loss of almost 3.5 million acres occurring between 1952 and 1987 (Powell, Faulkner, et al., 1993).

In the '70s and '80s, an industry that had been generally self-regulated began to cope with new regulatory programs at the state and national level. Protection of water quality and endangered species were lead issues.

Following the passage of the Federal Clean Water Act in 1972, states began to develop voluntary forestry Best Management Practices to address non-point source pollution. BMPs are still voluntary in a few states in the Southeast. On the heels of the Clean Water Act came the Endangered Species Act a year later.

State laws regulating forestry on private lands became prevalent in the Pacific Northwest and the Northeast. These new regulations were largely a reflection of population growth pressures and the changing view of how national forests should be managed.

Environmental activism grew rapidly beginning in the '70s. An urban populace challenged traditional multiple-use management of national forests. Recreation, species protection, biological diversity, and wilderness designation were advocated over timber production.

Earlier in the century, the federal government endorsed special forestry laws to encourage "good" forestry and long-term investment in timberlands. In the last 20 years, the tax structure has been less favorable for long-term timber investments

especially, as it relates to capital gains treatment. Uncertainty around tax considerations has often discouraged investment in timberlands.

This brings us to our current situation and challenges. The industry has changed -- it has gone high tech -- and it's gone global. And the industry has improved resource use and efficiency. A classic example is the growth of engineered wood products like OSB, wood I-joists and other engineered lumber products. New technology has allowed the industry to make high-quality engineered wood products with the lower-quality, smaller and faster-growing trees that are available in the eastern half of the U.S.

Many of these new products use less wood fiber. An engineered wood I-joist or I-beam uses half the wood fiber of a sawn 2x10 or 2x12 wood beam. In 1994, composite panels like oriented strand board represent 36 percent of the total demand for structural panels; growing from only 26 percent in 1991 (American Plywood Association, 1994).

Just as we have improved manufacturing efficiencies, we have also improved growth and productivity on industrial forest lands. The nation's 71 million acres of industrial ownership is concentrated in the East -- with 55 percent in the South and 23 percent in the North. Another 18 percent is located on the Pacific Coast and another four percent in the Rocky Mountains.

Forest industry lands represent 14 percent of the nation's commercial timberland, but account for one-third of the total timber harvest. In terms of softwood volumes, national forests represent 41 percent of the total volume; non-industrial private lands have 32 percent; and industry lands represent 27 percent of the volume (Powell, Faulkner, et al., 1993).

Increasing reductions in timber harvests from government lands logically means that industry has a vested interest in ensuring the productivity of its lands in the future as well as the productivity of all private lands.

Eastern forest lands are under increasing pressure to offset the reduction in timber harvest in the West. By 1992, it was becoming clear that softwood inventories for the South, as a whole, were declining.

In a time when forest productivity is critical, the industry and all private landowners are faced with the potential of increased environmental constraints related to federal regulatory programs.

Single-issue programs like endangered species protection and wetlands are moving to comprehensive landscape management concepts embracing forest sustainability and ecosystem management. These concepts challenge even the most brilliant scientific minds and have spawned more definitions than we could review in this three-day session.

The biologically-centered definition of ecosystem management focuses on the desired state of the total forest, not on the forest outputs; (Moote, et al., 1994) whereas, some definitions do recognize economic and human needs.

With private lands making up the largest share of commercial timberlands in the East, these landscape management concepts immediately raise questions related to private property rights like "Who has the authority -- or the knowledge -- to make landscape level decisions that can ultimately impact all ownerships? And, how do landscape management concepts like ecosystem management affect the productivity of industrial and other privately-owned forests?

Industrial foresters have traditionally measured forest management success based on sustaining a given forest's timber production and yield over a period of time. Managing for other non-timber values can reduce the acre-by-acre productive capacity of industrial forestlands.

Industry realizes that some of the non-timber values are essential and should not be ignored, but we cannot forget that the purpose of industry ownership

is to supply raw materials to manufacture forest products.

As I indicated earlier, for industry to continue to invest in timberland management, we have to continue to produce acceptable levels of wood fiber to generate an economic return either recognized on the forest management or manufacturing balance sheets.

We need to maintain the ability to replant and manage pine plantations and to intensively manage them and improve their productivity with site-specific silvicultural applications like forest fertilization, prescribed burning or herbicide applications. Hardwood sites will also have to be managed in a manner that economically produces fiber for pulp, paper and wood products.

These types of forest management practices have made the Southeast and the East one of the most productive timber-growing regions of the country. An example of that can be found in recent production figures related to Southern yellow pine lumber.

In 1993, a modern day record for southern yellow pine lumber was set with the production of 14.4 billion board feet (Southern Forest Products Assoc., 1994). Lumber production had not reached that level since 1914. This truly demonstrates the renewability of our forests; yet, we recognize that sustainability of these forests in the face of declining Southern pine inventories will require site-specific management of pine forests on industry and other private lands.

However, as resource managers, we are challenged with building credibility with an increasingly vocal segment of the population that does not understand forestry --- some of whom think that all timber harvesting should be increasingly regulated or even stopped completely.

Although industrial forest lands should not be expected to provide the same level of non-timber values as currently expected from federally-owned

forests, we are having to demonstrate that our industry forests do provide other non-timber values like wildlife habitat, recreation and species diversity.

Forest products customers and the ultimate consumers of the products we produce are also wanting proof of environmental performance.

As owners and managers of forests, we must move into a mode of thinking that is both deeper and broader than evidenced by our past history of land use. And our planning must be economically and environmentally sound.

As an industry, we have to collectively develop guidelines and principles for forest management into the future. In a recent lecture at the University of Idaho, Gene Bryan, president and founder of Decision Dynamics in Lake Oswego, Oregon, encouraged the industry to embrace the type of "principle-centered" leadership as advocated by Stephen Covey, author of the book by the same name.

Principle-centered leadership is an approach to business and life based on natural social laws and principles including such things as fairness, equity, honesty, trust, integrity, reason and balance.

I have known Gene over 25 years and have seen his business and life prosper with this kind of view. He knows our industry and makes a strong statement.

Industry leadership has recognized the need for comprehensive planning to deal with the emerging issues related to resource management and land use. Over the past nine months, through the American Forest & Paper Association, groups of forest industry and private forestry leaders have been working to develop governing principles and guidelines based on the concept of sustainable forestry.

For industry lands, we have defined sustainable forestry as: "The practice of forestry that integrates the reforestation, growing, nurturing and harvesting of trees for useful products with the conservation of

soil, air and water quality, wildlife and fish habitat, and aesthetics."

Our commitment is much broader than anything we have ever attempted and will be supported with implementation plans. The industry, as represented by American Forest & Paper Association members will finalize its work on the new principles and implementation plans within the next few months.

The effort is being led by Scott Wallinger of Westvaco Corp. In recent correspondence, he communicated the intent of the new program:

"This is an AT&PA program, devised by the association and mandatory for its members, which is designed to perceptibly change a number of forestry practices on member companies' forest land. Its objective is to broaden the practice of sustainable forestry on member companies' forest land.

These practices all effect the ability of members' forests to produce sustainable crops of wood and fiber while addressing broad public concerns about how industrial forests are managed with respect to water and wildlife and the needs of future generations."

In addition to addressing specific requirements for AT&PA members on their own land, a parallel objective of the program is to change the impact of AT&PA member companies wood procurement practices on private non-industrial forest land by encouraging member companies to promote similar initiatives with loggers and private landowners.

For industry member lands, the program will embrace a wide range of issues and objectives including reforestation, forest health and productivity, water quality, and biodiversity. It will also provide for a greater emphasis on forestry research and managing lands with special biological, geological or historical significance.

Specific issues addressed on private non-industrial lands will include: reforestation following harvest;

adherence to forestry BMPs; and reduction of poor visual impacts of harvesting.

Forest land ownership and management is fragmented in the east ---representing large and small landowners with varying forest management objectives. Our plans recognize that the advocacy program we initiate with other private forest landowners and independent logging contractors will take time to implement.

This new set of principles will become the cornerstone for defining industrial forestry as we move into the next century. It is a significant effort that you will be hearing more about as we begin to implement the program over the next year.

It is in the industry's best interests to sustain our forest land. Gene Bryan, in the speech I mentioned earlier refers to Aesop's fable about the goose and the golden egg. When the greedy farmer killed the goose to get golden eggs more quickly, he found no eggs and sadly realized he had destroyed his production capacity. Gene points out that "our forests are like the goose; we must guard and manage their health if they are to remain available to produce the products that are so important to our life on earth."

At the same time, we must also provide economic incentives that encourage private landowners, industrial and non-industrial, to continue to invest in timberlands -- regenerating and managing their lands for the future.

As the Business Council for Sustainable Development recently pronounced: "Business will play a vital role in the future health of this planet. As business leaders, we are committed to sustainable development . . . This concept recognizes that economic growth and environmental protection are inextricably linked, and that the quality of present and future life rests on meeting basic human needs without destroying the environment on which all life depends. New forms of cooperation between government and business,

and society are required to achieve this goal." (Schmidheiny, S., Changing Course)

The industry is willing to cooperate. Within the last few years, we have seen companies like Weyerhaeuser, Westvaco, Boise Cascade, Georgia-Pacific and many more, work with public and private interests to protect endangered species habitat, unique areas and entire watersheds.

The forest industry wants to be part of the solution. The industry's 71 million acres of forest land is not the problem, but part of the solution -- providing green buffers from increasing pressures of urbanization and population growth --- providing wildlife habitat and recreation opportunities -- and efficiently growing and managing forests for forest products that our society needs.

References Cited

1. Shallau, Con., American Forest & Paper Association.
2. MacCleery, Douglas W., 1992. American Forests: A history of Resiliency and Recovery.
3. American Forest & Paper Association, 1993. Paper and Paper Manufacture.
4. MacCleery, Douglas W., 1992, page 37, Fig. 10: Annual planting reports, USDA - Forest Service.
5. U.S. Census Data.
6. Powell, D. S., Faulkner, J. L., Darr, D. R., Zhu, Z., MacCleery, D. W., 1993. Forest Resources of the United States. USDA Forest Service, Timberland area in the U.S., 38p. Ownership of Timberland and Harvest, 2-3p. General Technical Report RM-234, 1992,
7. American Plywood Association, 1993.
8. Moote, M. A., S. Burke, H. J. Cortner, and M. G. Wallace, 1994, Principles of Ecosystem Management. Water Resour. Res. Center, Univ. Arizona, Fort Collins, Col., 19p.
9. Southern Forest Products Association, 1994.
10. Schmidheiny, S., Changing Course, Business Council for Sustainable Development.

Environmental Change in Forestry: Perspectives of a Forest Auditor & Certifier

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Introduction

The Rainforest Alliance and other regional non-profit organizations in the United States, and elsewhere in tropical and temperate forests, are currently developing and implementing forest management certification as a tool for improving forestry from silvicultural, ecological and socioeconomic perspectives. To these organizations, timber harvesting represents an important economic option. In most cases, the question is not if timber harvesting or logging will take place, but how.

The topic of this presentation is independent forest auditing, monitoring and certification. I am enthusiastic about the topic; however, this enthusiasm does not mean that such certification will be the solution to all forestry problems. It isn't. Rather, certification, and the types of forest auditing and monitoring techniques it requires, may be a valuable tool for forest management. Where is it useful, why, and how?

Before getting into the details on certification, a bit of philosophical background is important. First, there is a fairly common notion that sustainable forest management and economic development are reconcilable, and must be a constant battle between environmentalists and industry. This doesn't necessarily have to be true. Despite what many believe, neither environmentalists or industry represent organized lobbying or voting blocks. Industry representatives can be heterogeneous, contradictory, united on some issues, divided on others. So can environmentalists. There are many that segments of both sectors that are interested in serious long-term forestry can work together - certification may be one example.

In a sense, certification represents an attempt to clarify what are the best forest management practices, from silvicultural, ecological and

socioeconomic perspectives, and give recognition to the best forest managers. From an environmentalist perspective this presents a challenge because it assumes that logging is a viable option; something that many environmentalists might not agree with. From an industry perspective, it singles out the best managers and implies that other forestry organizations or industries may not meet the same standards, thus inserting a potentially divisive wedge between different forest industries. For these and other reasons, certification has not been (and probably won't be) universally welcomed amongst either environmentalists or industry.

Certification can help to address three particular concerns in terms of Eastern forests:

- 1) short-term financial management concerns often determine what happens in forestry; with the current higher prices for timber, and the dire financial conditions of many companies, it is not surprising that there are many companies that are liquidating forestry assets, in some cases high-grading or degrading forests that have been under relatively high quality forest management for the past 50 years and weakening the forest resource as a base for stable communities and economic development;
- 2) there are an increasing number of "low grade fiber" forest industries (e.g. oriented strand board facilities); this is turning the production of low-grade fiber into the primary management objective for some forests or forest lands;
- 3) despite many efforts to protect threatened or endangered species, there is little being done to see how such species, or ecosystems, can be enhanced through biodiversity management techniques in production forests; the dominant

thrust of most efforts to protect threatened species or ecosystems is to preclude logging, when in fact logging can be (but is not always) a tool for improving biological diversity; and,

- 4) at a time when most of the public is skeptical about the environmental claims of forest industry and government, independent certification provides an opportunity for third-party verification of environmental forestry claims, potentially lowering the level of conflict and allowing forest industry to devote resources to forest management, rather than "fighting it out" with environmentalists or other critics.

The start of forest management certification

The original push behind certification occurred during the late 1980's, when the Rainforest Alliance and other groups promoted the concept as a positive market-based incentive for recognizing well-managed tropical forestry operations, and as an alternative to tropical wood boycotts. Since then, certification has "boomeranged" because it was found that consumers were just about as concerned about forest management in the Pacific Northwest, Northeastern U.S. and elsewhere. As a result, there are currently incipient region-specific certification efforts in virtually every region of the U.S. and Canada, as well as almost all other major timber-producing regions of the world.

Key elements of a voluntary forest management certification program

Since the start of voluntary forest management certification efforts in 1989, a better understanding of the basic elements has occurred. Two basic elements for a credible program are realistic region-specific certification standards and a regional inspection capability for covering forest management and "chain-of-custody" (see below)

concerns. Both will be important to develop if certification is to be successful as a tool in Eastern forests.

Realistic region-specific certification standards

Credible certification requires the development of region-specific certification standards. Why?

First, no single set of standards will apply to all situations in Eastern forests. Rather, there should be consistent principles and criteria that form a basis upon which realistic region-specific standards can be developed. Smart Wood is currently working on regional standards for five different regions in the U.S. and Canada, and a number of other countries (e.g. Costa Rica, Brazil, Indonesia, Malaysia), using as a basis the Principles and Criteria for Natural Forest Management of the Forest Stewardship Council and the Smart Wood Generic Guidelines for Natural Forest Management.

A second reason for region-specific certification standards is that, to some extent, credibility of a certifier rests on the degree of public accountability, to scientists, forest industry, environmental organizations, government, national standards organizations, and the general public. The past few years of certification experience indicate that published standards are the best way of achieving this.

Third, a well-designed process for developing region-specific standards will allow for broader input into certification. Such input will increase the likelihood of success for the certification program by facilitating increased local understanding of what certification means and how it works. A careful process can serve a valuable educational role for industry, environmentalists, public sector forestry specialists and the general public.

Fourth, the existence of written region-specific standards will make the work of certification teams much easier. Candidate organizations will better understand how certification decisions are reached, assessment team members will be able to more clearly define and complete responsibilities during an assessment, and the standards provide a consistent basis for discussions.

Successful development of such standards is not easy. Currently, forestry certification is attempting to build on existing federal, state and local forest management and conservation efforts. For example, certification standards are building on non-point source pollution control standards established through EPA, SCS, and state agencies. Such standards also take into consideration requirements set by state and federal agencies, local planning bodies, conservation groups for regional or statewide programs to conserve or manage large forest blocks through tax incentives (e.g. use value taxation). They also incorporate measures to protection of "visible" endangered species, as identified by international and national agencies, or conservation groups.

Setting good standards appears to rely on five basic elements.

First, the right people are involved, including scientists and practitioners from various sectors (industry, environmental organizations, government, landowner groups) and different fields/disciplines (e.g. ecology, forestry, social science, economics, logging, etc.). The key has been to find reputable individuals from diverse sectors. Typically, certification standards are developed by a regional committee made up of the following types of people:

- consulting forester
- social scientist
- logger
- government forester
- wildlife ecologist
- forestry researcher

- businessperson
- landowner

This committee will be required to research existing federal, state and local laws, and administrative requirements of the state forestry agency. Committee members must have a willingness to listen to different opinions from all perspectives. They must have a sense of what ideally should take place (i.e. "leadership standards"), but balanced with a pragmatic sense of what is realistic to achieve for commercial forestry operations in the region.

Second, the standard setting process must take advantage of existing initiatives (e.g. best management practices or BMPs, logger certification, the Tree Farm Program, SAF codes, etc.). In most states there is an ample amount of information on good forestry practices that can be accumulated. The challenge is to take this information and turn it into a set of standards that can be used in a forest auditing framework.

Third, viable standards tend to result from a field-oriented process where there has been near-term (within 3 months) practical application or testing of the standards. There are many examples of standards development processes lasting years; in general the standards from such processes tend to be highly theoretical and/or so complex as to require inordinate amounts of field work or analysis.

Fourth, transparency in terms of how the standards were developed and who participated is extremely important in the standards setting process. Ultimately, different interest groups will want to see that their perspective has been defended in the process. They will also want to have input on drafts, revisions, etc. The guidelines of international standards setting or accreditation bodies (e.g. Forest Stewardship Council or FSC, or International Standards Organization or ISO) indicate that they will require that a continuous process of broad consultation or input has taken place during standards development.

Fifth, standards will have greater legitimacy with the public if there is an equally strong commitment within the standards to silvicultural and environmental issues/factors. Experience in certification indicates that both perspectives are important to consumers.

Ultimately, the development of such standards will require a long-term commitment to constant improvement. Currently, most standards are being revised by the standards committee or the certifier staff on an annual basis.

A final comment on standards - one of the strengths of the certification is that it does not suggest a single definition of sustainable forestry that is transferable to all situations and conditions. Rather, sustainability is a goal, and the process of region-specific standards development is seen as a way of defining what steps might lead towards sustainability. It is crucial to understand that certification does not attempt to definitively quantify or qualify sustainable forestry. Certification attempts to provide a market-based reward to those forestry operations which are consistently making serious, long-term efforts to manage forests keeping in mind silvicultural, ecological and socioeconomic management objectives.

Regional inspection capability for forest management and the chain-of-custody

Certification requires site-specific initial assessments and follow-up audits in terms of forest management and chain-of-custody. Chain-of-custody refers to:

"The channel through which products are distributed from their origin in the forest to their end use" (from Forest Stewardship Council, or FSC, Principles and Criteria for Natural Forest Management, June 1994, Oaxaca, Mexico).

Initial assessments of forest management are usually conducted by a 2-4 person team comprised

of specialists from different disciplines, typically including a forester, ecologist and socioeconomist. Such assessments may include from 7-21 days of field work "in the forest", plus an equivalent amount of writing/analysis time. These assessments also include a process of independent peer review (usually by 3 peer reviewers). Costs for such assessments can range from US\$5,000-\$50,000, depending on the certification organization chosen, the size and complexity of the candidate forestry operation, and the range of ecological, silvicultural, and socioeconomic issues being faced by the candidate operation.

Virtually every major certification program conducts annual, and sometimes random, audits of every operation that it certifies. Chain-of-custody auditing has great similarities with financial auditing - indeed financial auditors are well-suited to the job after training in some aspects of forest products manufacturing. Chain-of-custody requires:

- * office work - review of invoices, general ledgers, bills of lading, the General Agreement on Trade and Tariffs (GATT) Certification of Origin (for international shipments), etc.; and,
- * visits to "in the forest" log yards, lumberyards, transport and shipping centers, primary and secondary processing centers, and wholesale and retail outlets.

Techniques used by forest industry for chain-of-custody within their own operations range from simple field book record-keeping to higher technologies such bar-code labelling. Thus, chain-of-custody auditors should be familiar with this range of technologies, typical shortcomings, and what processes need to be in place in order to ensure that chain-of-custody controls by a specific company are up to certification standards.

Forest auditing requires technical skills in the areas being evaluated. Whereas initial forest certification assessments are conducted usually by teams of 2-4 people, a typical audits is conducted

by one person, usually a forester, who is following up on issues identified during the initial certification assessment.

All of the above should make it clear that the key skills for creating and managing a certification program must include forestry, environmental and socioeconomic assessment, systems analysis, and auditing (financial and environmental).

What is "certifiable forestry"?

In general, certifiable forestry:

- has a multi-year and multi-disciplinary planning framework;
- incorporates reduced impact logging techniques;
- is based on ecologically-sensitive silvicultural techniques;
- has positive, permanent commitments to local communities and people, and,
- has transparent planning and management procedures that facilitate "accountability" by third party auditors or assessors.

It is not necessarily "politically-correct" forestry. Small patch clearcuts (e.g. less than 20 acres) might be "certifiable", if such harvests give strong consideration to biological or ecological implications. Ultimately, certifiable forestry requires that the forest managers plan, manage, and harvest timber with a long-term (over 50 years) perspective and through a process that gives equal value to forest lands as a source of timber, as a biologically diverse resource, and as a social and cultural resource that should have a positive impact on local peoples and communities. This is not an easy balance. The very nature of timber harvesting requires compromises from each perspective.

In the short history of certification, three basic characteristics or tendencies seem to stand out in describing certifiable forestry operations:

1) loggers, foresters, biologists, and other staff work closely together as a team;

2) staff at all levels (even production staff in a manufacturing operation) are educated on, and concerned about, "the issues" (silvicultural, ecological and socioeconomic) and share a common commitment to resolving them; and,

3) certifiable operations tend to be at the "cutting edge" of forestry or forest product manufacturing.

Costing out certification

Certification costs can be divided into two categories, direct and indirect. The direct costs of certification are those of the certification process itself, including initial forest assessments and annual or periodic audits. The indirect costs represent changes to forestry operations that a company may have to make in field operations to meet certification standards. Following are examples.

Direct Certification Costs

Initial Field Assessment:

\$5,000-\$50,000 once for 3 years

Periodic & Random Audits:

\$1,000-\$5,000 per year

Annual Certification Report:

\$500-\$1,000 per year

Indirect Certification Costs

For forest management operations:

- increased supervision/monitoring
- continuous data collection/analysis
- long-term roads & infrastructure
- tagging/identification of logs batches or loads
- decreasing dependence on chemicals
- more biologist/ecologist input into forest management

For manufacturing operations:

- tagging/identification of logs/products
- batch-loading/processing
- record-keeping

4) constant growth in size of equipment which tends to have broad economic and environmental impact and may restrict harvesting options; and,

5) reconciling short-rotation forestry and long-term forest management; there have been few attempts to bridge the conflict between these different perspectives - there may be no easy way of doing this and it may be impossible, but Smart Wood experience from the tropics indicates that there are many ways that even short rotation forestry can make major contributions to biological conservation.

Most challenging technical issues

Based on experience over the past four years, the major challenges being faced in terms of certification in Eastern forests (as well as other regions) today are:

1) addressing "landscape level" biological conservation concerns for either large or fragmented operations; often there is an absence of good field data and many commercial forestry operations are not accustomed to dealing with landscape issues;

2) designing and implementing efficient continuous forest inventory (CFI) for both medium-size and larger operations; Smart Wood guidelines for the Lake States region (Michigan, Minnesota, Wisconsin) request that operations managing over 50,000 acres have CFI systems and most operations of that size that we interact with are moving in this direction; most operations smaller than 50,000 acres do not;

3) organizing private non-industrial landowners (PNIFs); there have been few efforts to organize PNIFs as a commercial resource, most efforts have focussed on PNIFs from a forestry extension or educational perspective;

Technical Studies of Environmental Issues Affecting Forest-Based Manufacturing Industries

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Abstract

The U.S. forest products industry faces many complex environmental issues. This paper identifies four broad groups of issues and describes selected technical studies being conducted by the industry's environmental research arm, the National Council of the Paper Industry for Air and Stream Improvement (NCASI). Forest issues include forest water quality and wetlands, threatened and endangered species, and biodiversity. NCASI is testing options for maintaining and enhancing environmental quality in commercial forests. Mill issues derive mainly from concerns about discharges from manufacturing facilities and their effects on human health and welfare, aquatic communities, and ecological processes. Topics of NCASI investigations include discharge characterization, environmental effects, and costs/benefits of alternatives for complying with existing and proposed regulations. Environmental labeling issues are gaining importance as a result of government and private-sector efforts to promote products with attributes presumed to be beneficial for the environment. NCASI is evaluating the technical basis of environmental labeling criteria that may affect markets for forest products. Sustainable development is a process of balancing environmental and economic considerations to meet current human needs without compromising the ability of future generations to meet their needs. An initial focus of NCASI efforts is to develop a technical basis for sustainable forest management.

Introduction

Interactions of the forest products industry with the environment are highly visible. The industry's manufacturing operations use large amounts of water and energy, and generate large quantities of solid waste. Timber harvest and forest management

activities disturb millions of acres every year. On a volume basis, the world's production of wood for industrial purposes is nearly one and half times greater than its outputs of steel, aluminum, plastic, and cement combined (Schultz 1992).

Environmental issues affecting the forest products industry can be classified in various ways for various purposes. In this paper, we identify four broad groups of issues, discuss current priorities within each group, and describe selected technical studies being conducted by the industry's environmental research arm, the National Council of the Paper Industry for Air and Stream Improvement (NCASI).

Forest issues

Overview

Forests are remarkable natural resources. They provide clean water, habitat for wildlife, recreational opportunities, and inspiration for the human spirit. They also provide the principal raw material for paper and wood products. These products help meet human needs for shelter, communication, personal hygiene, artistic expression, packaging, recreation, and fuel.

World demand for forest products is expected to grow substantially in the future. The United States has the ability to satisfy a substantial portion of future growth in demand at home and abroad. This ability derives in part from a potentially abundant and affordable timber supply. The United States has enjoyed a competitive advantage in wood cost relative to many other countries and can maintain that advantage by investing in forest research and management. Economic and biological factors could support substantial increases in annual timber

growth rates on a sustained yield basis (USDA Forest Service 1982).

Nevertheless, the timber supply outlook in the United States is highly uncertain. Large areas of publicly owned forests are being withdrawn from timber management and allocated to habitat preservation. At the same time, state and federal regulations are imposing severe new restrictions on the management of private lands. Issues such as wetlands protection, endangered species, and cumulative watershed effects are already major factors affecting both the practice of silviculture and timber harvest. Proposals to regulate forest management to enhance biodiversity or influence global carbon budgets could exacerbate the situation if implemented.

Forest water quality

Issues related to forest water quality have significant near-term implications for forest management in the eastern U.S. For example, states participating in the federal Coastal Zone Program must submit new nonpoint source management programs to EPA and NOAA by July 1995. The programs must include "management measures" that are "economically achievable" and "reflect the greatest degree of pollutant reduction achievable through the application of best available nonpoint pollution control practices technologies, processes, citing criteria, operating methods, or other alternatives". Similar requirements would be imposed across the country by Clean Water Act reauthorization bills now before Congress.

NCASI is conducting a special program of investigations to develop information to be drawn on by the industry during Clean Water Act reauthorization. Forestry-related projects include (a) national review of literature on effects of forest management on water quality and the effectiveness of best management practices (BMPs), (b) regional reviews of state programs for controlling nonpoint source pollution from forestry operations, and (c) analyses of costs and benefits of alternative

approaches for controlling nonpoint sources of pollution.

Several conclusions about forests and water quality have been reached. The quality of water from forests is the best in the nation (relative to other land uses) whether the forests are managed or undisturbed. Forestry is a relatively small contributor to the nation's overall nonpoint source problem in terms of both quantity and quality of discharge. Local and watershed-scale effects of forest management on water quality can be severe, but such effects can be prevented in most circumstances by use of basic BMPs such as stream bank protection. Additional control measures beyond the basic BMPs may be necessary in situations that present greater than normal risk of water quality impact (NCASI 1994a).

All states with significant commercial timber harvest activity have nonpoint source control programs for forestry. State programs vary greatly in approach and level of effort. In general, however, it appears that successful nonpoint source programs are those in which loggers, landowners, and foresters perceive themselves to be partners with government agencies in an effort to produce significant environmental benefits and improve the climate for the practice of forestry.

Noncompliance with BMPs by some landowners and loggers is perceived to be the most common cause of forest water quality problems in most states. High BMP compliance rates can be achieved through non-regulatory programs that include extension education and compliance monitoring. Government and landowner costs are substantially greater for regulatory programs than for non-regulatory programs (NCASI 1994b).

Endangered species and biodiversity

Endangered species issues have tremendous potential to affect forestry operations in the eastern United States. Numbers of listed species and subspecies continue to grow rapidly. The Fish and

Wildlife Service (FWS) often mentions habitat modification caused by forest management as a factor contributing to listing (Flather *et al.* 1994). Moreover, FWS has become more aggressive in using the Endangered Species Act (ESA) to regulate private lands and influence the decisions of other federal agencies on regulatory issues affecting forest management. Interest has been heightened by the current national debate about ESA reauthorization.

Public and scientific concerns about biodiversity in eastern forests focus on clearcutting, plantation management, and old growth. Near-term impacts are greatest on National Forests and in Forest Service Research, where timber production has been substantially de-emphasized. In the longer-term, concerns about biodiversity could weaken support for industry positions on a wide range of forest policy issues.

Forest products companies have been working hard to develop partnerships with FWS and other organizations to protect listed species and other wildlife. During the past year, several companies have announced cooperative agreements that provide for special management or preservation of important habitat areas.

NCASI's Wildlife Program is testing assumptions about habitat requirements of listed species and seeking options for accommodating both wildlife and timber production in the major commercial forest regions of the United States. Topics of field studies and other projects in the eastern U.S. are listed in [Table 1](#). The field studies are documenting the occurrence and habitat relationships of a wide variety of birds, mammals, reptiles, and amphibians in managed and unmanaged forests.

Wetlands

Forest wetlands issues have become important in recent years as a result of efforts by environmental lobby groups and some regulators to narrow the scope of the "silvicultural exemption" under Section 404 of the Clean Water Act. Normal forestry

practices are exempt from wetland permitting requirements of Section 404 if the practices are part of an established, ongoing operation and do not significantly affect the reach and flow of waters of the United States. Pine plantation management, including minor drainage, is within the scope of the exemption. The Environmental Defense Fund and others claim plantation management causes severe ecological damage to wetlands and should not be exempt from permitting requirements.

NCASI is conducting a cooperative program of field investigations on environmental effects of forest management in wetlands (Shepard *et al.* 1993). Studies are underway in ten states with participation and co-funding by individual companies, universities, and government agencies ([Table 2](#)). Results show that effects of wetland forest management on water quality are generally minor and transient. Effects on wildlife habitat will take longer to evaluate but some initial results are encouraging. For example, an intensive survey of birds, mammals, reptiles, and amphibians in "pocosin" forest wetlands in North Carolina found similar numbers of species in plantations and unmanaged areas (NCASI 1992). There were some differences in species composition: 65 species were common to both plantations and managed habitats; 18 species were found exclusively in unmanaged pocosins; and 27 species were found exclusively in plantations.

Mill issues

Overview

Mill environmental issues derive mainly from concerns about gaseous, liquid, and solid wastes and their effects on human health and welfare, aquatic communities, and ecological processes. Over the past ten years, there has been a growing emphasis on public disclosure of corporate environmental performance. Companies are being called upon to demonstrate the environmental acceptability of their manufacturing operations to community residents, customers, stockholders, politicians, and

government regulators. Many elements of the National Council's technical studies program are directed towards characterizing the industry's waste streams and investigating their potential impacts on the environment. This information is needed to assist the industry in maintaining its franchise to operate mills.

NCASI efforts related to three current issues of concern to the forest products industry are briefly discussed below.

Chlorinated organics

For many years, chlorine, chlorine dioxide and sodium hypochlorite were the primary compounds used to bleach chemical wood pulps and some recycled fibers. Use of these chemicals for bleaching leads to the inadvertent formation of a wide array of chlorinated organic compounds, by reactions with lignin and hemicellulose (NCASI 1990, 1994c). These compounds may partition to the bleach plant effluent, to the bleach plant vent gases, or to the bleached pulp.

Use of chlorine and hypochlorite for pulp bleaching is now being dramatically reduced as the result of several factors, including a desire to minimize the formation of chlorinated organic compounds, particularly chloroform and dioxin. It appears likely that by the year 2000, chlorine dioxide will be the only chlorine-based compound used in pulp bleaching in significant quantities.

The environmental implications of these changes in bleaching practices are being intensively studied by the National Council (e.g., NCASI 1994d, 1994e, 1994f, 1994g). A considerable effort is being devoted to aquatic community investigations. For over twenty years, the National Council has used controlled streams to study the effects of bleached kraft mill treated effluent on aquatic communities.

Since the mid-1970s, experimental streams have been in place at a bleached kraft mill in New Bern, North Carolina. A second experimental streams site

was set up in the early 1980s in Lewiston, Idaho at a bleached kraft mill. Investigations conducted at these two sites are focused on the response of aquatic communities, particularly fish, to varying levels of effluent concentrations. Although these studies use whole mill effluent, i.e., the bleach plant effluent is only a portion of the total, they have been extremely useful in examining the compatibility of treated bleached kraft mill effluent with healthy and productive aquatic communities (NCASI 1993a).

Since the experimental streams have been in place, the two host mills have made significant changes in their bleaching practices. Biological effects of the changes have been studied intensively in the experimental streams. Measurements of system response have included fish reproduction and morphology, biomarkers, bioassays, and bioaccumulation of selected chlorinated organic compounds.

Other active areas of investigation include detailed chemical characterization of bleach plant effluent and wastewater treatment plant sludges; analysis of bleached chemical pulps and paper products for chlorinated dioxins and furans; simulation modeling for calculation of bioaccumulation factors for selected chlorinated organic compounds; and review of health effects of chlorinated phenolic compounds.

EPA recently proposed revised effluent guideline regulations for the pulp and paper industry as part of the agency's "Cluster Rule" (EPA 1993a). For bleached chemical pulp mills, EPA has proposed limits for total organic adsorbable halides (AOX), certain chlorinated phenolics, and chlorinated dioxins and furans. NCASI has a number of technical studies in progress which are directly related to the proposed EPA limitations. These include studies of effluent variability, sampling and analytical procedures, monitoring data analysis techniques, and achievability of the numerical limits.

Air toxics

Two major EPA regulatory programs have brought about a need for comprehensive information on

emissions of so-called 'air toxics' from pulp and paper mills. These programs are the annual SARA Section 313 reporting of environmental releases from manufacturing facilities and the development of Maximum Achievable Control Technology (MACT) emission standards for industrial sources of 'air toxics'.

In response to this need, the National Council has undertaken very extensive emission characterization studies (NCASI 1993b). Compounds of importance to the industry are acetone, methanol, methyl ethyl ketone, formaldehyde, acetaldehyde, chlorine, chlorine dioxide, chloroform, hydrochloric acid, sulfuric acid, and ammonia.

A detailed study of emissions from chemical wood pulp mills will be completed by the end of 1994. This study, which began in late 1992, involved the development and validation of a new method for sampling gaseous organic compound emissions from a wide array of pulp mill sources. Emission sources at 13 kraft mills, two sulfite mills, and one semi-chemical pulp mill were tested over a period of 15 months. Sources sampled included kraft recovery furnaces, sulfite recovery furnaces, semi-chemical liquor recovery units, smelt dissolving tanks, lime kilns, mud washers, brown stock washers, deckers, knotters, bleach plants, stock storage chests, liquor storage tanks, turpentine storage tanks, tall oil processing sources, oxygen delignification systems, and paper machine vents.

The information generated in this effort will be used to assist EPA in developing MACT emission standards for the 155 chemical wood pulp mills in the United States. EPA hopes to promulgate these standards in early 1996 as part of the Cluster Rule.

Other NCASI study efforts have addressed emissions of chlorine, chlorine dioxide, and chloroform from bleaching operations, as well as their control by scrubbing and process modifications (NCASI 1994h). A study of hydrogen chloride emissions from kraft recovery furnaces will soon be completed.

Future investigations are being planned to characterize emissions from (a) mechanical pulping operations, (b) deinking plants, (c) paper machines,

and (d) boilers burning nonrecyclable paper fuels, wastewater treatment plant sludges, and other nontraditional fuels.

Air permitting issues affecting solid wood products manufacturing

Plants manufacturing solid wood products including lumber, oriented strandboard, medium density fiberboard, particleboard, plywood, hardboard, and other engineered wood products must deal with air quality permitting issues arising from regulatory programs such as New Source Review, Prevention of Significant Deterioration, and state operating permits. Until recently there was very little data on emissions from these facilities, and emission limits contained in construction and operating permits were mainly based on emission factors (NCASI 1994i).

As test data have become available, it has become apparent that emissions of volatile organic compounds (VOCs) from wood drying and panel presses were larger than initially believed. It is also apparent that existing EPA test methods for VOCs, which were not intended for application to sources with significant amounts of condensable organic particulate matter, are yielding inconsistent results for wood drying sources (NCASI 1993c). These findings have led to difficulties in obtaining air quality permits for new and existing plants. It has also resulted in EPA enforcement activities against selected large companies and the installation of VOC control technologies at some panel plants.

Questions about VOC emissions have also led to questions about emissions of carbon monoxide, oxides of nitrogen, particulate matter, and formaldehyde from these plants. Therefore, the industry has an urgent need for better and more comprehensive emissions test data to respond to these questions.

NCASI has undertaken several projects to assist the solid wood sector in meeting its information needs with respect to emissions. First, studies on alternative measurement methods are being conducted for VOCs, total particulate matter, condensable particulate matter, and formaldehyde.

Second, all available test data for solid wood facilities from companies are being compiled into a data base which companies will be able to access when preparing permit applications. Third, a project has been initiated to explore possible methods for estimating fugitive VOC emissions from wood storage piles. Fourth, a suggested protocol for the sampling of emissions from lumber drying kilns is being developed. Lastly, emission factors being developed by EPA for panel plants and lumber drying kilns (for inclusion in the agency's AP-42 emission factors document) are being reviewed for accuracy.

Environmental labeling issues

Environmental labeling is a process by which public or private-sector organizations identify and promote products with attributes presumed to be beneficial for the environment. Some labeling programs consider a single attribute such as "recycled" or "chlorine free" to identify environmentally preferable products (EPPs). Other programs consider several attributes combined into environmental indices.

Interest in environmental labeling and EPPs is growing rapidly. Reasons for interest in the forest products industry include:

Some important customers want EPPs. For example, some large retail chains that sell paper and solid wood products are developing "green marketing" programs and asking suppliers to consider obtaining third-party environmental certifications.

Marketers want to sell EPPs. Companies and associations want to identify forest products as EPPs to support communications and marketing programs. Objectives include (a) improve public perceptions of the industry's products, manufacturing processes, and forest management practices; and (b) respond to competitors' claims of environmental superiority.

Governments, environmental lobby groups, and associations are making rules about EPPs. Federal and state agencies are developing guidelines for purchasing EPPs. The Environmental Defense Fund has formed a task force of paper industry customers to develop EPP guidelines for paper products. ASTM and the American Institute of Architects are developing EPP guidelines for building products. There is potential for EPP guidelines to become EPP regulations.

European criteria for EPPs are becoming de facto barriers to North American exports of forest and paper products. Ecolabel programs are well established in several European countries (EPA 1993b). Efforts to develop international standards for environmental labeling programs and environmental management systems are underway in the European Union (EU) and the International Standards Organization (ISO). Reasons for U.S. industry interest in ISO environmental standards include (a) growing concern about environmental trade barriers, (b) widespread acceptance of ISO 9000 standards for product quality, and (c) perceived opportunity to participate in ISO process on an equal footing with European interest groups and develop credible alternative to national or EU standards.

NCASI is evaluating the technical basis of environmental labeling criteria that may affect markets for paper and solid wood products. Priority topics include:

Life Cycle Assessment. Product life cycle assessment (LCA) is an approach to conducting comprehensive evaluations of environmental burdens associated with the production, use, and disposal of products (Fava *et al.* 1991). In recent years, LCA has gained prominence as a tool for identifying EPPs. NCASI is participating in the development of data bases and model assumptions used in LCAs of forest products (Miner and Lucier 1994).

ISO Environmental Standards. NCASI is providing technical support to the industry in its review of draft ISO environmental standards.

Ongoing Technical Studies. NCASI is investigating technical aspects of key issues being debated in ISO and other organizations that are developing guidelines for environmental labeling and LCA. These issues include environmental impacts of manufacturing operations, solid waste management options, recycling, global carbon budgets, and sustainable forestry.

Sustainable development

Overview

Sustainable development is both a process and a goal. It requires balancing environmental and economic considerations to meet current human needs without compromising the ability of future generations to meet their needs (World Commission on Environment and Development 1987). Sustainable development has gained broad international support because it expresses hope for the future of humanity and recognizes the necessity of making difficult choices among imperfect alternatives. It implicitly rejects extreme positions of both naturalists and materialists and thus may provide a suitable framework for discussions and consensus building among diverse interest groups.

It is too soon to predict the implications of sustainable development for the forest products industry. Meanings of sustainable development may change or expand as the concept is elaborated in national and international forums. It is clear, however, that the leadership of the forest products industry has already embraced the essential element of balancing economic and environmental considerations. The leadership has committed the industry to documenting environmental

performance, setting realistic goals for improving performance, and regaining public support.

Strategies and programs for documenting and improving environmental performance and regaining public support are being developed at several levels including associations, individual companies, and operating units within companies. The following are among the important topics being discussed.

Sustainable forestry

Sustainable forestry has become an important environmental labeling issue affecting international trade and public perceptions of forest products. Criteria of sustainable forestry are being discussed within the industry and in a variety of national and international organizations.

NCASI is developing technical information in support of industry efforts on sustainable forestry. Our research is focusing on three main topics.

Long-term site productivity. Maintaining the productive capacity of forest sites is essential. Determinants include soil fertility, genetic resources, and stand conditions. Soil erosion, nutrient depletion, and other problems can impair the productive capacity of forest lands. An immediate challenge is to develop information systems that will help land managers identify potential problems on a site-specific basis and prescribe effective countermeasures. A longer term challenge is to address public concerns about environmental effects of biotechnology, herbicides, fertilizers, and other tools needed to maintain and increase site productivity.

Forest Environmental Quality. Greater attention to environmental quality is perhaps the most important development in forestry in the past two decades. Components include water quality, wildlife, biodiversity, and aesthetics. An important research task is to develop a practical framework for measuring the environmental costs and benefits of alternative forest management regimes across landscapes and regions.

Wood Supply. There is a need to better define large scale relationships among timber supply, forest products, and environmental quality. For example, NCASI is investigating the role of forests and forest products in the global carbon cycle. A difficult but important task is to determine how carbon dioxide emissions are affected by using forest products in place of nonrenewable substitutes with different life cycle energy profiles. A related task is to develop sound methods for measuring the renewal of timber resources and the effects of environmental regulations on timber supplies. Of particular concern are cumulative effects of regulations and their influence on land use decisions by the nonindustrial private land owners who currently produce half of the timber in the United States.

Mill operating franchise

Public acceptance of manufacturing operations is essential to the sustainable development of the U.S. forest products industry. Public concerns about local, regional, and global environmental effects of manufacturing are expected to grow despite past and ongoing improvements in environmental performance. Industry efforts to respond to public concerns will increase in the form of environmental principles, documentation of environmental performance, further development of the minimal impact mill concept, and communications programs.

NCASI technical studies are supporting industry efforts in several ways. Current studies are providing analytical methods and data bases needed to document environmental performance and optimize environmental control systems. NCASI is also participating in the evaluation of new process and waste treatment technologies to identify any potential environmental concerns. Technologies for controlling chlorinated organics in bleached pulp mill effluent and 'air toxics' are the focus of current efforts. Other longer-term priorities include technologies to increase energy efficiency (e.g., black liquor gasification, biomass drying and combustion), eliminate odorous emissions (e.g., sulfur free pulping), and minimize solid waste (e.g.,

utilization of wastes as soil amendments and chemical feed stocks).

A difficult and important task is to determine the ecological significance of contaminants present at very low concentrations in the environment. Increasingly sensitive tests such as biomarkers and trace chemical analysis are being used to judge the health of ecosystems, often without reference to measures of effects on human health, fish and wildlife populations, or plant communities. Such tests are important because (a) they are influencing regulatory programs and public perceptions, (b) reducing trace concentrations of contaminants can be very expensive, and (c) the industry itself may want to use some of the tests to demonstrate 'minimal impact'. Topics for research include (a) natural background levels of contaminants, (b) factors that influence test response, (c) contribution of industry operations to contaminant levels, and (d) potential for chronic effects of contaminants on ecosystem health.

Solid waste management and paper recycling

The industry has already achieved its goal of 40 percent used paper recovery by 1995 and has committed to a new goal of 50 percent used paper recovery by the year 2000. More recovered fiber will be used at mills not originally designed with recycling in mind. Mills using recovered fiber will attempt to use more contaminated or lower quality grades than are currently used. In addition, increasing amounts of recovered fiber will be put to other uses, such as burning for energy. A substantial fraction of discarded paper will be non-recoverable and disposed in landfills.

Increasing recovery of used paper is generally perceived as beneficial to the environment. There are, nevertheless, some environmental questions that merit examination.

- * Effects of recovered fiber use on mill raw effluent and treatment system performance.

- * Characteristics of emissions and ashes resulting from the combustion of paper-based fuels.
- * Beneficial uses for solid wastes generated from reuse of recovered fiber.
- * Emissions from mills using recovered paper.
- * Environmental fate and effects of trace contaminants present in recovered paper furnishes and final products.

Conclusions

Environmental issues are significant factors affecting the cost structure of the forest products industry and perceptions of the industry's products in global markets. The industry is fully aware of the importance of environmental issues to its future well being and is committed to documenting and improving its environmental performance in order to regain public support.

The industry faces many difficult challenges in the environmental area. Perhaps the greatest is rapid growth and diversification of the environmental agenda. It seems at times agencies and environmental lobby groups are increasing their demands indiscriminately. These demands are consuming a large and growing share of the industry's capital and talent. Globalization of environmental issues will place additional demands on limited resources.

Growing public concern about costs and benefits of regulation combined with broad support for sustainable development will provide an opportunity to rationalize the environmental agenda and regain public support. Attributes of the industry's products such as renewable, biodegradable, and recyclable are important assets.

Environmental research is an essential part of the industry's effort to cope with current issues and find pathways to sustainability. Research is providing objective information about current environmental conditions and the effects of the industry's operations on those conditions. Moreover, research

can discover new ways of producing and balancing economic and environmental values.

Among the more difficult issues facing the industry are those related to (a) effects of forest management on biodiversity and (b) the ecological significance of contaminants present at very low concentrations in industry waste streams and the environment. Progress on these issues requires research that addresses questions of risk and aesthetics in an objective and credible manner.

Literature cited

1. Shultz, H. 1992. The development of wood utilization in the 19th, 20th, and 21st centuries. Plenary paper read on the occasion of the IUFRO Centennial in Berlin, September 1992. Institute for Wood Research, University of Munich, Germany.
2. USDA Forest Service. 1982. An Analysis of the Timber Situation in the United States 1952-2030. Forest Resource Report 23. Washington, D.C.
3. NCASI. 1994a. Forests as Nonpoint Sources of Pollution and Effectiveness of Best Management Practices. Technical Bulletin No. 672. New York, NY.
4. NCASI. 1994b. Benefits and Costs of Programs for Forestry Nonpoint Pollution Control in Washington and Virginia. Technical Bulletin No. 660. New York, NY.
5. Flather, C. H., L. A. Joyce, and C. A. Bloomgarden. 1994. Species Endangerment Patterns in the United States. USDA Forest Service General Technical Report RM-241. Fort Collins, CO.
6. Shepard, J. P., A. A. Lucier, and L. W. Haines. 1993. Industry and forest wetlands: cooperative research initiatives. *Journal of Forestry* 91(5):29-33.
7. NCASI. 1992. Preliminary Report on Mammalian and Avian Species in Managed and Unmanaged Pocosins. Special Report 92-10. New York, NY.

8. NCASI. 1990. USEPA/Paper Industry Cooperative Dioxin Study: The 104 Mill Study. Technical Bulletin 590. New York, NY.
9. NCASI. 1994c. Progress in Reducing the TCDD/TCDF Content of Effluent, Pulps, and Wastewater Treatment Sludges from the Manufacturing of Bleached Chemical Pulp. Special Report No. 94-08. New York, NY.
10. NCASI. 1994d. Characterization of Adsorbable Organic Halide (AOX) Discharge Rates at Kraft Mills Employing Chlorine Dioxide Substitution. Technical Bulletin No. 667. New York, NY.
11. NCASI. 1994e. Aquatic Life Water Quality Protection Values for Chlorinated Phenolic Compounds. Technical Bulletin No. 659. New York, NY.
12. NCASI. 1994f. An Assessment of the Significance of Discharge of Chlorinated Phenolic Compounds from Bleached Kraft Pulp Mills. Technical Bulletin No. 658. New York, NY.
13. NCASI. 1994g. NCASI Technical Workshop — "Effects of Alternative Pulping and Bleaching Processes on Production and Biotreatability of Chlorinated Organics." Special Report 94-01. New York, NY.
14. NCASI. 1993a. Aquatic Community Effects of Biologically Treated Bleached Kraft Mill Effluent Before and After Conversion to Increased Chlorine Dioxide Substitution: Results from an Experimental Streams Study. Technical Bulletin No. 653. New York, NY.
15. EPA. 1993a. Effluent Limitations Guidelines, Pretreatment Standards, and New Source Performance Standards: Pulp, Paper, and Paperboard Category; National Emission Standards for Hazardous Air Pollutants for Source Category: Pulp and Paper Production. Proposed Rules. Federal Register 58 (241): 66078-66216, December 17, 1993.
16. NCASI. 1993b. Compilation of 'Air Toxic' Emission Factors for Boilers, Pulp Mills, and Bleach Plants. Technical Bulletin No. 650. New York, NY.
17. NCASI. 1994h. Stripping of Kraft Foul Condensates: Literature Review, Operating Experience, and Field Studies. Technical Bulletin No. 661. New York, NY.
18. NCASI. 1994i. Information Presented at the October 1993 AT&PA/NCASI Workshop on VOC Control Technologies for Solid Wood Manufacturing Plants. Special Report 94-06. New York, NY.
19. NCASI. 1993c. A Study of Volatile Organic Compound and Condensable Particulate Matter Measurement Methods Used on Furnish Dryers in the Oriented Strandboard Industry. Technical Bulletin No. 657. New York, NY.
20. EPA. 1993b. Status Report on the Use of Environmental Labels Worldwide. U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics. EPA 742-R-9-93-001. Washington, D.C.
21. Fava, J., R. Denison, B. G. Jones, M. A. Curran, B. Vigon, S. Selke, and J. Barnum. 1991. A Technical Framework for Life-Cycle Assessment. Society of Environmental Toxicology and Chemistry. Pensacola, FL.
22. Miner, R. A. and A. A. Lucier. 1994. Considerations in performing life-cycle assessments on forest products. Environmental Toxicology and Chemistry 13(8): 1375-1380.
23. World Commission on Environment and Human Development. 1987. Our Common Future. Oxford University Press. Oxford, U.K.

TABLE 1. Topics of field studies, literature reviews, and technical support activities in NCASI's Eastern Wildlife Program.**Field studies**

- Black bear population status and habitat use in Louisiana, North Carolina, and New York
- Taxonomic basis for designating certain black bear populations as threatened subspecies
- Characteristics of red cockaded woodpecker habitat on industrial timberlands
- Abundance and diversity of birds in managed forests of Arkansas, Maine, and Michigan
- Abundance and diversity of birds, small mammals, reptiles and amphibians in managed vs. unmanaged "pocosin" forest wetlands in eastern North Carolina
- Effects of timber harvesting and residual stand characteristics on habitat selection by pine martens in Maine

Reviews

- National Biological Survey's "Gap Analysis" Program
- Silvicultural options for meeting ecosystem management objectives
- Effects of forest management on amphibians
- Forestry, wildlife, and habitat in the East
- Habitat values of stream side management zones

Technical Support (partial list)

- EPA's Gulf of Mexico Program - Habitat Degradation Committee
- Atlantic salmon habitat restoration - Maine
- Karner blue butterfly - Wisconsin
- Black Bear Conservation Committee - Louisiana
- Management guidelines for red cockaded woodpeckers on private and public lands

TABLE 2. Field Studies Supported by NCASI Forest Wetlands Program

<u>STATE</u>	<u>PROJECT</u>	<u>WETLAND FUNCTIONS INVESTIGATED</u>
Alabama	Impact of harvesting forested wetlands on water quality	Biogeochemistry, hydrology, productivity, herpetofauna
Alabama	Effects of intensive forest management on riparian wetlands	Biogeochemistry, water quality, benthic macro invertebrates
Alabama	Hydrologic and silvicultural responses 7 years after harvesting a tupelo-cypress wetland	Productivity, plant diversity, biogeochemistry, hydrology, birds
Florida	Hydrological relationships between cypress wetlands and pine flatwoods	Hydrology, biogeochemistry, plant diversity, herpetofauna, hydric soils, wading birds, benthic macro invertebrates
Georgia	Assessment of logging road construction and silvicultural systems on Flint River wetlands	Water quality, hydrology, biogeochemistry, productivity
Michigan	Sturgeon River wetland silvicultural impact study	Biogeochemistry, water quality, hydrology, productivity
Mississippi	Characterization of hydric soils	Hydrology, soil chemical and physical properties
Mississippi	Long-term effects of harvesting practices on floristic and structural diversity of bottomland hardwood stands	Plant diversity and structure, soil properties, productivity, birds
Mississippi	Restoration of bottomland hardwood forests on a Sharkey soil	Plant diversity and productivity, soil properties
North Carolina	Water management study	Hydrology, water quality, biogeochemistry, productivity, aquatic biology
Pennsylvania	Impact of forest road crossings on riparian wetlands on riparian wetlands	Stream habitat quality, channel stability, water quality
South Carolina	Response of a blackwater bottomland to timber harvesting	Biogeochemistry, water quality, productivity, herpetofauna
Texas	Effects of timber harvesting on wetland functions of bottomland hardwoods of southeastern Texas	Hydrology, water quality, biogeochemistry, productivity, soil herpetofauna, small mammals
Virginia	Evaluating the effectiveness of BMPs on streamwater quality in riparian wetlands	Biogeochemistry, water quality, hydrology
Virginia	Effects of site preparation, drainage, and fertilization in a loblolly pine flatwood	Hydrology, productivity, soil properties, plant diversity

Environmental Life-cycle Analysis: Wood and Non-wood Building Materials

Jamie Meil, Senior Economist, Forintek Canada Corp., Ottawa, Ontario, Canada

Abstract

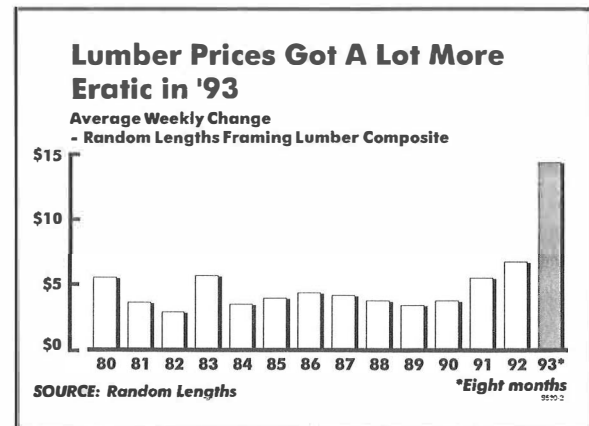
Historically, technical utility and price have been the primary criteria in the decision to use wood or non-wood building materials. Renewed environmental awareness, pressures from environmental activists, and direct government regulation will increasingly combine to affect building material choices in the future. Hence, competition between alternative products will evolve to include environmental as well as traditional price and product utility criteria.

All building materials offer certain environmental benefits while entailing environmental costs. Unfortunately our present environmental knowledge and piecemeal measures leave us ill-equipped to make sound environmental choices.

This paper marries the concept of sustainable development with the practice of life-cycle analysis in a broader, holistic framework to afford a more objective assessment of the environmental consequences of using various alternative materials in specific applications. The paper also presents some preliminary results comparing wood and steel in a building application.

As we have already heard both today and yesterday, the wood products industry is facing some tremendous challenges on the environmental front. Some of you may well think that this is a fad that will eventually consume itself and go away. I think we all now realize that this is not about to happen, and if we choose to ignore the environmental movement we do so at our own peril. Today's environmental movement is without boundaries as it stretches around the globe and intervenes not only on public lands, but is now encroaching on private property as well. Essentially, the environmental movement has changed the public's perception about how we manage forest resources and subsequently,

how they view wood products. At the same time they have created a lot of uncertainty. (Figure 1)



This uncertainty manifest itself in higher wood product prices and more volatile price swings, which in turn, has opened the door to unprecedented possibilities for substituting alternative materials for wood.

This paper address the complex issue of the environment and substitution. It introduces some concepts we need to understand so we can look at environmentally motivated substitution in an objective and constructive light. It also ties these concepts together by describing a research program we have underway at Forintek to address this and other environmental issues related to building materials and then, the paper concludes with some preliminary results of our work.

Traditional substitution, the price system, and environmental claims

Historically, product performance and price have been the primary drivers behind substitution of wood and non-wood products. Many analysts

contend that government regulation, motivated by the environmental movement, will increasingly affect building material substitution in the future. One result is likely to be the use of a wider mix of building in any given structure as we begin to distinguish between each products environmental benefits and cost. Or in other words, competition between alternative building materials will be redefined to include environmental as well as traditional price and product performance criteria.

Unfortunately, the prevailing price system is incapable of accounting for the environment and may actually send perverse signals about the relative environmental benefits and costs associated with competing products, especially when they are made of different materials. Although in time we can expect to see more environmental factors embodied in the price system (such as carbon or Btu type taxes) and therefore in the cost of building materials, the use of market forces to achieve environmental objectives is not likely to occur quickly or on a broad front. I will return to this price system a little later in the presentation.

The environmental cloud hanging over the wood products industry coupled with the recent price volatility of wood products and the stagnation of non-residential construction markets, has the steel and concrete industries doubling their efforts to capture a share of the residential construction market.

Subsequently, each industry has begun to position themselves against the other as the obvious "green" choice with glossy brochures and marketing campaigns. Now the goal of the steel industry is to have a 25% share of the residential framing market before the turn of the century. While this is probably optimistic, just setting the target gives a pretty clear indication as to the direction they are heading.

So what we have here is a lot of environmental information being put out by all three material groups, each with their environmental claim to fame, which only tells a small part of the whole story. For

instance, steel major environmental claim is that it is North America's most recycled material, wood chooses to underscore its renewability trait and concrete counters with the claim of being produced locally from common and abundant natural resources.

And then we have the environmentalists who I think are rightfully concerned, but seem to me to be rather shortsighted. They have not yet considered that if timber is not to be a product of the forest than what do we replace timber with, and are these alternatives more or less environmentally benign.

Building materials in the context of sustainable development

The combination of a maturing environmental movement, the inefficiencies built into the market price system and the piecemeal measures we presently use to gauge product environmental impacts all provided the impetus for a project we initiated two years ago entitled "*Building Materials in the Context of Sustainable Development*".

The concept of sustainable development links the common themes of maintaining, sustaining and preserving environmental processes and of dealing with environmental constraints when meeting present and future needs. Perhaps the number one problem that plagues the concept is that it is not a one time goal that can be precisely defined and then achieved in a certain period of time. Rather it is more like a moving target, because as our global population continues to grow, it puts additional pressures on our planets resources.

The concept's primary value is its broad scope and implied shift away from shortsighted and economically expedient decisions in favor of something of a more thoughtful and balanced orientation in the long-term.

The concept of sustainable development has captured the imagination of society as a whole. The business community, governments and the general

public continue to be very interested in having a means to holistically examine and reduce the environmental impacts of products, processes and our daily activities.

As a society, we have well developed methods and criteria to measure productivity and profits to help us improve performance. That is, ways of thinking about, comparing and selecting from alternatives. The challenge is to develop a similar tool to incorporate sustainable development into our decision process. One tool is emerging on the international scene which seems to offer us a method for comparing environmental trade-offs in something more than in a piecemeal way. It has more than one name, but it is most commonly referred to as *life-cycle analysis*.

It is a process whereby the environmental burdens associated with a product, process or activity is evaluated by quantifying energy, material usage and environmental releases throughout the life-cycle. Because all products, processes and activities impose some toll on the environment, we have to assess these environmental impacts on a comparative or relative scale while at the same time striving to improve their individual environmental performance.

Life cycle analysis, while originally developed in the 1970's, is still undergoing refinement and has slowly filtered down to the business unit level as a tool for allocating scarce resources among competing pollution abatement goals so industries can get the best bang for their pollution abatement buck.

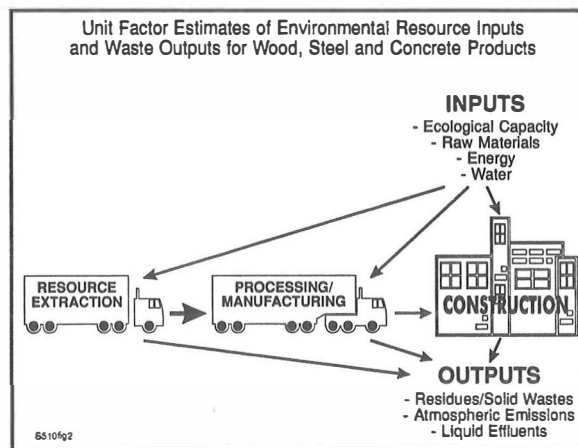
The International Standards Organization (ISO) has also established a technical committee (TC207), headed by Canada, to harmonize life-cycle analysis around the world. It is believed that this methodology will form the cornerstone for environmental claims and environmental choice programs in the future.

The important thing to remember is that life-cycle analysis is a benchmark methodology for

equivalence evaluation, improvement and comparison across products, process and activities.

While our project has a number of secondary objectives, the ultimate goal is to make available a simple model which will enable the building community to assess the relative environmental implications of using various building materials in defined applications: again within this holistic framework of sustainable development. **The goal here is not to mount an all out offensive in favor of wood, but rather, to encourage the wider use of all materials in any particular building design such that together they minimize the building's environmental impact.**

The sustainable development doctrine demands that we look at the environmental consequences of an area of activity such as building construction from a broad perspective (Figure 2). We think that our life-cycle approach is up to the task. It starts with the idea that five main activity stages define the life-cycle of a building. These include resource extraction, product manufacturing, on-site construction, building occupancy and maintenance and lastly, demolition and disposal of the building. Transportation services within and between these activity stages are also included.



What we are concerned with is how various building materials interact with and affect the environment during these five activity stages. And to this end we

have defined the sustainable development objective to be the minimization of physical environmental inputs and outputs required over the life of the building.

These inputs and outputs must also be considered in the context of various sustainable development criteria such as resource availability and renewability, product durability and recyclability as well as substance toxicity and pollution abatement levels.

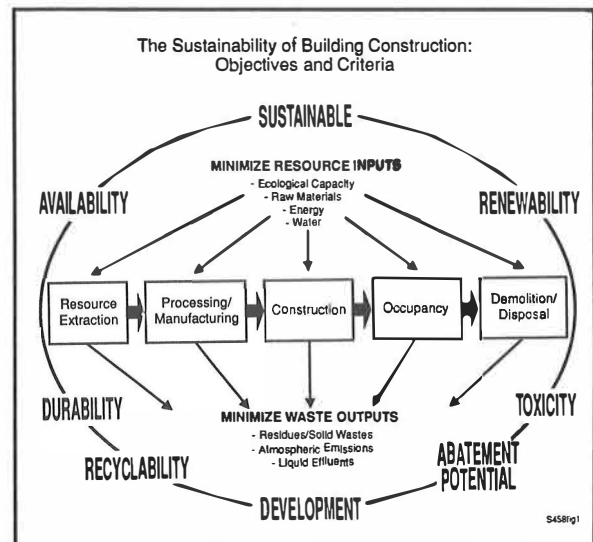
The physical environmental inputs and outputs themselves are relatively straightforward, with perhaps the exception of the term "ecological capacity". Ecological capacity denotes the numerous other effects caused by human interaction with the physical environment during the extraction phase of the life-cycle. A major task of the project is to assess some of these key effects which we then hope to incorporate into our model. So far the ongoing research on ecological capacity suggests that the raw materials for wood, steel and concrete are physically sustainable; the question we are wrestling with is at what **relative** environmental cost?

A project of this scope of course demands numerous skill-sets. So over a period of six months we established a multi-disciplinary research alliance of eight organizations comprised of three university programs, two private consulting firms, a government agency and another private research firm similar to Forintek to undertake this multi-faceted project.

Great lengths have been taken to structure the alliance such that the objectivity and integrity of the study is not compromised. Over the last 18 months the research alliance has completed the major analytical task. The focus of this work has been on vertical and horizontal structural assemblies using a number of wood, steel and concrete products in light commercial and residential buildings.

So far we have developed what we call unit factor estimates (Figure 3) for a number of products in

terms of their raw material requirements, embodied energy, the demand they place on the water supply, solid wastes produced and a select number of atmospheric emissions and liquid effluent; from the resource extraction stage to completion of a structural assembly on a construction site. An example of a unit factor estimate would be GJ of energy used per ton of steel or KG of CO₂ emitted per MBM of lumber.



In essence, the alliance's research to-date has advanced our environmental understanding on three fronts:

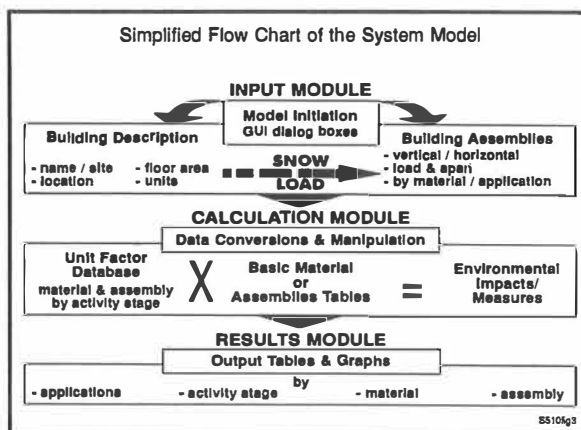
First, we have provided a new standardized benchmark for environmental assessment of building materials. So, no longer do we need to use dated information from a number of different sources employing different research methodologies;

Second, we have expanded the number of environmental variables considered beyond energy use and atmospheric emissions; and,

Lastly, we've moved the analysis forward by explicitly considering the construction activity stage.

Needles to say, however, we still have a lot of work to do.

We have also begun to construct our environmental design computer model (Figure 4). It contains a menu of typical floor, roof and wall assemblies for the three materials from which the user specifies the building's geographical location, the actual space to be modeled and the working loads and spans. The model proceeds to determine and then breakdown the required assemblies into their respective materials and applies our unit factor estimates to the materials used and in turn, compiles the total environmental inputs and outputs for that particular design. The real value of the model is that it allows the building designer to focus in on what aspects of the design are particularly environmentally costly and then try alternative materials and assemblies and materials to reduce the buildings environmental load or cost.



The model focuses on comparative building assembly designs rather than on comparing materials directly. This focus is necessary because unit measures such as a pound of wood versus a pound of steel or concrete is for all practical purposes meaningless as such measures do not consider the functional capability of each of the materials in use.

I now want to run through an actual assembly comparison using our model and data for two materials in a simple application. The application I

have chosen for comparison is a typical exterior infill wall assembly used in light commercial structures. Usually a building this type of assembly would be built using steel as the post and beam supporting structure. The exterior opening can then be infilled using a number of different products.

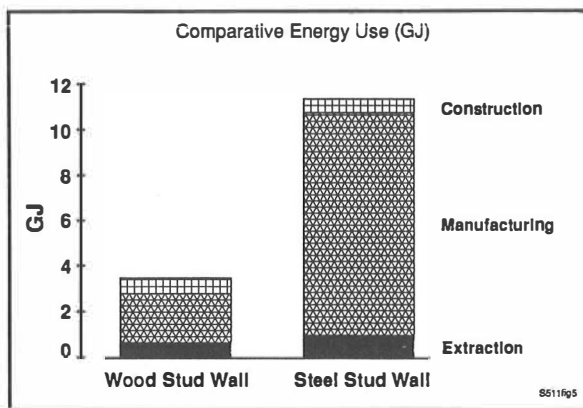
For the purpose of material comparison, we used 20 ga. steel studs produced in an integrated or virgin steel plant as one example, and 2x4 wood studs as the second alternative. The infill space to be modeled was arbitrarily set at 3 meters high by 30 meters long or approximately 10' by 100'.

This first chart (Figure 5) summarizes the resource demands for the two alternative wall infill methods. It took over 600 kg of raw materials to produce the softwood lumber and nails used to in the wood wall assembly. So on a mass basis, the wood design is only 75% as resources intensive as the steel design.

Comparative Resource Requirements (Kg) (Wood & Steel Wall Assemblies)		
Raw Material Required	Wood	Steel
Roundwood	597	
Limestone	2	77
Iron ore	12	509
Coal	6	252
Zinc		2
	617	840

851254

In terms of embodied energy (Figure 6), the steel wall is three times more energy intensive than the comparable wood wall. The steel wall is more energy intensive in terms of resource extraction and manufacturing, but is slightly less energy intensive than wood during the actual process of construction.



Now minimizing energy use is a key sustainable development objective as energy, especially energy from fossil fuels, represents a major environmental impact. Moreover, (Figure 7) as builders and architects strive to make their buildings more energy efficient, the embodied energy of the building materials used becomes more significant. Here we see that energy efficient residential designs relative conventional designs are twice as energy efficient and subsequently, the embodied energy of the materials expressed as years of operating energy has grown two-fold in importance as well. We think this energy efficiency trend is going to continue unabated and may even accelerate in the near future. Hence, the wise choice of materials from the outset should be a major concern.

House Type, Location	Operating Energy GJ/yr	Embodied Energy GJ	Embodied Energy Expressed as years of Operating Energy
Conventional, Van.	107	1,000	9.4
Energy-Efficient, Van.	60	1,075	17.9
Conventional, Tor.	143	1,000	7.0
Energy-Efficient, Tor.	82	1,075	13.1

SOURCE: Cole, R. (1983)

All human endeavor results in a host of atmospheric emissions, some of which are more serious than

others. One emission that is especially topical and perhaps even critical is carbon dioxide, because of its role in global warming. Carbon dioxide emissions for the steel wall are three times that of the wood wall (Figure 8). The relative energy intensiveness of the two products explains a large portion of the carbon dioxide emission difference.

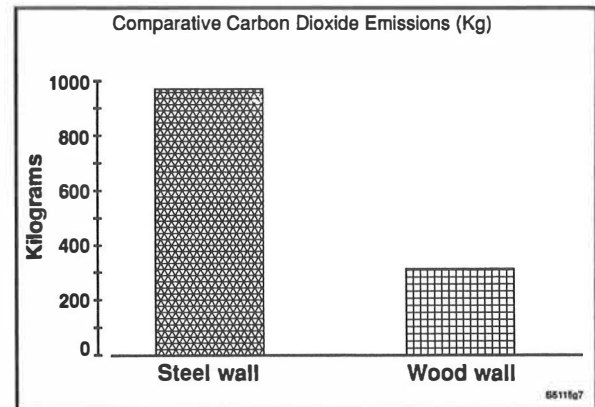
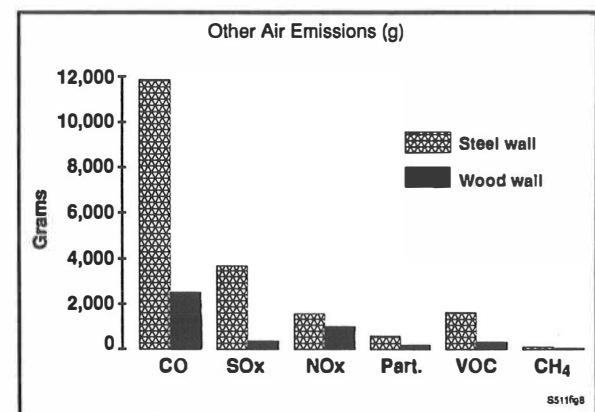
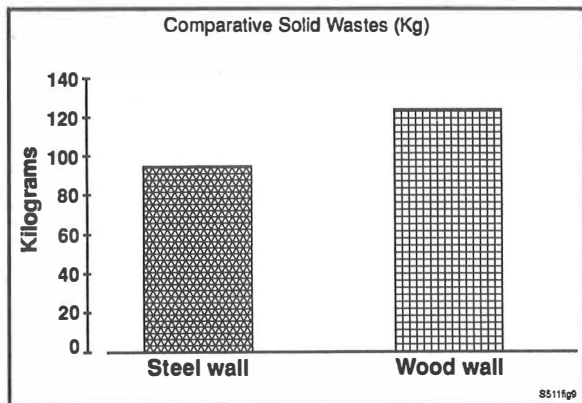


Figure 9 provides further comparison for some other important emissions. Here again, the wood assembly proves advantageous when we compare carbon monoxide, sulphur dioxide, nitrous oxides, methane, particulates and volatile organic compound emissions; all of which pose a hazard either to human health or the environment.

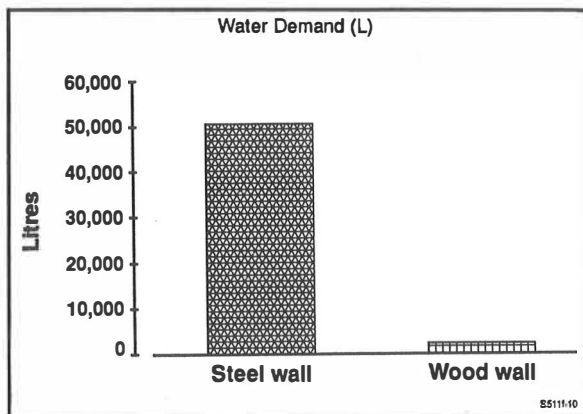


Another consideration is solid waste (Figure 10). The solid waste generated during manufacture and construction was about 30kg higher for the wood wall. This outcome is primarily due to the more efficient use of steel on the construction site as well

as the growing market for the slag by-product produced during the manufacture of steel.



The largest difference between the two material wall designs (Figure 11) was found in their comparative water use during product manufacturing, with the steel assembly demanding over 25 times more water input relative to the wood design.



Water use of course results in effluent. Figure 12 summarizes the results for similar effluent for the two wall assemblies. Again we see that for the same effluent, the wood assembly results in far less effluent than does its steel counterpart.

Comparative Manufacturing Effluents		
Effluents	Wood Wall	Steel Wall
Suspended Solids (g)	12,180	495,640
Non-Ferrous Metals (mg)	62	2,532
Cyanide (mg)	99	4,051
Phenols (mg)	17,715	725,994
Ammonia and Ammonium (mg)	1,310	53,665
Halogenated organics (mg)	507	20,758
Oil & Grease (mg)	1,421	58,222
Sulphides (mg)	13	507
Iron (mg)	507	20,758

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Well that's the extent of our preliminary results to-date. As I mentioned, we still have a lot of work to do to complete the total picture. What you should take away from these preliminary results is that choosing between materials is by no means a simple task or in other words there is no SANTA - Simple Alternatives are Not The Answer.

Environmental externality costs

I now want to provide an interpretation of these findings in terms of our present price system and relate it back to the issue of substitution. In doing so, we have to understand the concept of environmental externality costs. These are the additional costs to society in terms of human health and environmental damage that are not already incorporated into a product's price. Essentially determining environmental externality costs provides a method for estimating the full cost of environmental impacts to society. To ignore these external costs in planning, pricing and product selection values them and society, for that matter, at zero.

Perhaps more importantly, by putting a dollar value on environmental damage we begin to provide building designers and policy-makers with a measure they inherently understand and which should encourage all concerned to invest in and use,

less polluting resources and materials. Politically, these externalities amount to pollution fees or taxes.

The Pace University Centre for Environmental Legal Studies in New York State completed a lengthy study of externality costs for electricity generation, and arrived at the following dollar values for four important air pollutants as well as three non-fossil fuel electricity generation methods (Figure 13). Their work on the external cost of effluent proved inconclusive due to wide range of values reported in the literature. They indicated, however, that effluent pollution is generally less damaging than air pollution and so I have incorporated an estimate of effluent discharge costs which is pegged at one-third the value of the least costly air pollutant -- carbon dioxide. This is a very conservative estimate in light of the ranges in values reported in the literature.

Environmental Externality Cost Estimates	
Pollutant	Cost (Cdn \$/Kg)
Carbon Dioxide	0.15
Sulphur Dioxide	1.80
Nitrogen Dioxide	4.47
Particulates	2.62
Nuclear	8.08
Hydro	0.33
Renewable	1.11
Effluents ¹	0.05

Source: Pace University (1990) 85121-12
¹ Estimated by Forintek from Pace Study

So, with the total quantity of pollutants known, plus the quantity of non-fossil fuel electricity used, we can begin to calculate and compare the environmental externality cost of the two alternative wall assemblies. Figure 14 summarizes both the direct material costs as well as the externality costs of the two wall assemblies constructed in Toronto. As is indicated the wood wall is not directly cost competitive with the steel alternative.

Direct Material & Indirect Externality Costs (Wood & Steel Stud Infill Walls - 3 m x 30 m)		
	Wood Wall	Steel Wall
Cost of Material (Cdn \$)	\$ 410.00	\$ 350.00
Externality Costs (Cdn \$) (inclusive of fasteners)		
Electricity (non-fossil fuel)	\$ 1.46	\$ 4.67
CO ₂	47.00	145.65
SO ₂	0.66	6.65
NO _x	4.52	7.04
Particulates	0.49	1.55
Effluents	0.61	24.80
Sub-Total	\$ 54.74	\$ 190.57
Grand-Total	\$ 464.74	\$ 540.57

From an environmental cost accounting perspective, however, the wood wall assembly is only a quarter of the cost of the steel wall or is some four times more environmentally benign. Much of the gain for the wood wall assembly can be ascribed to its lower carbon dioxide emission level.

Taken together, the direct material and externality costs sum to a significant cost advantage for wood and given the price sensitivity of builders, I would hazard a guess that any builder confronted with these truer costs would choose the wood stud over the steel alternative.

Our price system has long been the primary determinant for choosing amongst competing alternatives. As is evident here, the problem is that it is not a very good environmental indicator on its own. And while life-cycle analysis offers us a method to better understand environmental trade-off and to compare competing alternatives on an equivalent basis, it is by no means a simple concept to grasp or implement. Or in other words it does not lend itself to the 20 second sound bite.

It is up to us as professionals to better understand the broader burden we exert on the environment and work towards minimizing this burden. Similarly, we must take-up the challenge of communicating this broader understanding to the public, so we can move away from the narrow and often myopic viewpoints about environmental impacts which seem to dominate our present understanding. Until then, we

run the risk of making some perverse decisions regarding the efficient use of our natural resources and hence, building materials.

Environmental Issues for Forest Products: What is the USDA Forest Service Doing?

Thomas A. Snellgrove, Acting Director, Forest Products and Harvesting Research)

I was asked to give you a government perspective on what is being done and can be done to minimize adverse environmental impacts from harvesting and manufacturing activities. There are a number of other speakers representing "government views", including our new Chief, Jack Ward Thomas, and I want to make sure that you understand that my perspective is that of the Forest Products and Harvesting Research (FPHR) staff of the Forest Service in Washington, D. C. Much of what I will say is also applicable to university and industrial research groups, but I am speaking specifically from an FPHR view.

A little more perspective. A few years ago our staff published a "vision document" articulating the FPHR vision for the future. After all was said and done, we developed a motto that we thought captured the essence of what FPHR is about, "Meeting Needs for Wood Products and Enhancing the Environment." In hindsight, we still believe that motto expresses the philosophy of our program--to be sure, our thinking has evolved somewhat over the last three years, but the values embodied in that motto remain the same.

What I will do today is provide you with a summary of our FPHR program placed in the context of issues that we see today and project into the future. I will briefly build a case for what we think is the overarching issue in natural resources, then provide a summary of how we are addressing this issue, and close with some tangential thoughts related to moving forward with an environmental agenda.

The case for sustainable development

Other speakers have made a strong case, either directly or indirectly, that the foremost natural resource issue facing society is sustainability. I don't need to replot that ground. I would, however,

like to emphasize the critical importance of the issue with two compelling pieces of information. The first is shown as the per capita consumption of wood products in the United States (Figure 1).

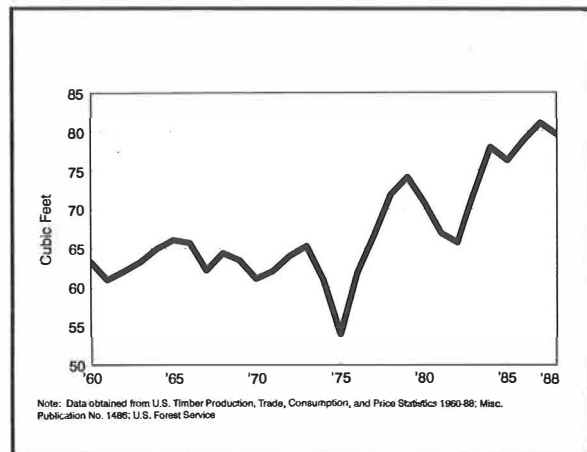


Figure 1. Per capita consumption of wood products in the U.S. from 1960 to 1988.

It is clear that even in "developed" countries consumption has not been diminished by our paperless society. It's not unreasonable to assume that per capita consumption may increase at an even faster rate in "developing" nations.

The second piece of information was taken from an Associated Press article on August 12, 1994. Paul Ehrlich of Stanford University and Gretchen Daily of the University of California said, "The world population of 5.5 billion is more than twice what the earth can support over the long term.....the Earth's maximum "carrying capacity" is about 1.5 to 2 billion people.....we're unstable now!"

Whether or not one agrees with these assumptions, or with the exact numbers, it is hard to conclude that sustainability is not a key issue facing the entire global community.

There are prefacing points that I think are important in discussing sustainability, and both involve clarification of the concept. First, we need at least a working definition, and the one set forth by the Bruntland Commission is satisfactory as a starting point. "Meeting the needs of the present without compromising the ability of future generations to meet their needs....." This definition addresses two critical dimensions of sustainability, i.e., the time dimension of current and future generations, and economic as well environmental factors.

In a similar vein, Donella Meadows, adjunct professor of environmental studies at Dartmouth College when writing in the Bennington Banner (1/10/94) addressed the importance of being clear on the difference between growth and development. She says, "....it's a step toward precision and sustainability to say **growth** when you mean physical size, and **development** when you mean, as the dictionary says, to realize the potentialities of, to bring to a fuller, greater, or better state. Development means to get better, growth means to get bigger."

Components of sustainability

For our purposes then the key driver of our FPHR programs is sustainability, meaning sustainability of resources and of people. We see three general components to attaining sustainability:

1. **Begin with conservation.** Saving as much as we can through conservation is a cornerstone of our strategic framework for FPHR programs. If this were being written 100 or maybe even 50 years ago we might not be starting here (although Gifford Pinchot, Aldo Leopold and other visionaries were explicitly addressing the issue in that time period). But, there appears to be ample evidence that we have to save and extend as many of our resources as we can. Clearly, this is not a call for preservation, that is a separate issue; this is about the most effective utilization of those resources that we choose to harvest.
2. **Help ensure ecosystem health, vitality, and productivity.** In other words we need to protect our environmental capital. If we are to look to providing the full array of values that society expects from our forests now and into the future we have to ensure the integrity of those forests--it's as simple as that!
3. **Foster economic vitality.** The importance of healthy and vital economies manifests itself clearly in developing countries. One only has to look at what often happens to natural resources in countries that do not have healthy economies to understand the consequences. Clearly, a healthy economy does not preclude abuse of natural resources, but it does remove an excuse for short term detrimental actions.

Program responses to sustainability

Conservation of Resources

Our research programs to improve conservation fall in three broad areas: improved utilization, recycling, and improved durability. Not everything

can be captured here, but these three areas frame our efforts in conservation.

Utilization research--Conducting research aimed at saving and extending forest resources is not a new concept for those of us involved in the forest products and harvesting arena. It is good, however, to revisit that history and think about where we should be going in the future. In the Forest Service we have been involved in improving utilization since the establishment of the Forest Products Laboratory (FPL) in Madison, Wisconsin, in 1910. Then, as now, forest conservation involved not only the protection, management, and cultivation of forests, but also more effective use of products from those forests. Over time a network of units was established in the regionally located Experiment Stations to help complement the efforts of the Forest Products Laboratory as a national center for forest products research.

Research initially focused on how to reduce the amount of waste and then moved to looking at opportunities for making use of previously unused material. Tremendous gains have been realized by improved saws and sawing practices, thereby, reducing the amount of "wasted" material in the form of sawdust and chips. The same holds true for manufacture of other products such as plywood. Attention was then focused on unused portions of logs: slabs, edgings, sawdust, material being burned in wig-wam burners, and related material that could be used to make products such as particleboard, oriented-strand board, and finger-jointed lumber. There were more advances in this area than can be enumerated here.

Forest Products Research units in the "field locations" also made tremendous progress in improving utilization. As an example, they worked with FPL and university researchers to demonstrate how "dead timber" could be used. They then worked with resource managers to assess fair-market-value. That research resulted in billions of board feet of timber that was killed by insects, disease, fire, and even volcanoes being used over the last couple of decades instead of going to waste. This "historical role" continues.

As we look into the future, statistical process control, benchmarking, and process simulation modeling are strategies that can foster significant improvements in forest products utilization and conservation (Figure 2). For example, statistical process control can be used in a furniture rough mill to minimize width deviation in the lumber ripping operation, resulting in substantial wood raw material savings. Benchmarking, to determine industry-best practices, gives the wood industry a set of standards for conversion efficiency that they can use to both measure and focus their improvement efforts. Computer-based process simulation modeling allows us to revisit many of the most critical utilization questions and provide integrated answers that address both resource utilization and industrial productivity. These areas provide more than ample opportunity for FPHR to continue making gains in conservation of resources.

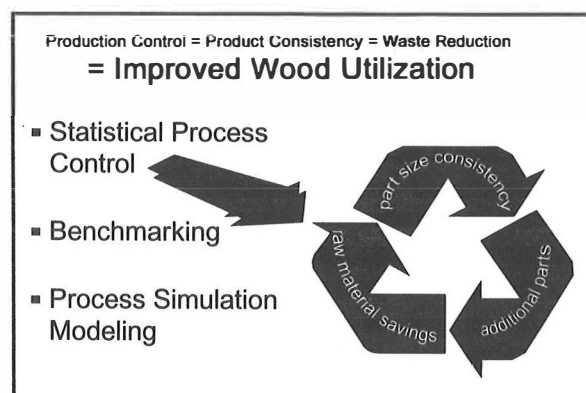


Figure 2. Schematic diagram of model for process control to improve wood utilization.

Recycling--Our most visible conservation program currently focuses on recycling, or conceptually, using the same fiber more than once. The recycling program originally began in response to a need to reduce landfill space. Subsequently, there has been substantial discussion of the benefits of recycling to help reduce carbon emissions. Both of these issues remain important, but the most rational and probably enduring reason for increased recycling relates to the opportunity to more effectively use our fiber resource thereby fostering conservation of our forest.

The research program initially focused on waste paper to paper opportunities. It has since expanded significantly to include paper plus wood plus a host of other materials, some renewable and some not, to develop a new generation of recycled composite products.

One of the difficulties we see in the future is to find enough suitable uses for recycled products to make major inroads into the accumulation of waste materials. We have initiated a research program aimed at developing the technologies needed to create housing components from recycled materials. The goal is to provide technologies that will allow the use of recycled products to replace 20 percent of virgin wood material currently used in housing by the year 2000. Figure 3 pictorially depicts some of

the opportunities that exist. Roof systems, exterior walls and siding, interior wall floor systems, foundations, interior and exterior components all provide opportunities to use recycled material. Research on processing technologies, performance evaluation, and economic feasibility will all be required to move the program to fruition.

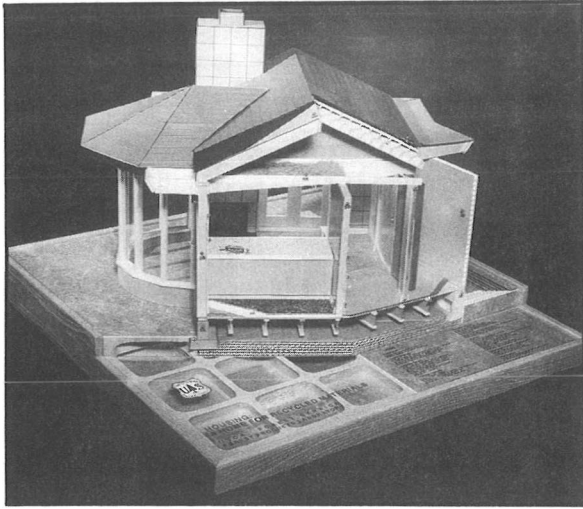


Figure 3. Cut away model of house showing potential components that could be made from recycled material.

Durability Research--Using the same fiber for a longer period of time provides another way to more effectively use our resources to foster conservation. We see this research as a potential growth area in the future. The historical role in durability research focused more on development of chemical treatments and on the efficacy of those treatments. Future research will concentrate on "natural" treatments and inhibitors.

We feel that there are opportunities to improve durability other than through preservative treatments. Enhanced design technologies could improve durability without using preservatives. New practices and technologies for inspection, repair, renovation, restoration, and maintenance of

wood structures could contribute to improved durability.

Health and productivity of ecosystems

Our new Chief has sent a loud and clear message to Forest Service employees: "We will do nothing that puts our ecosystems at risk." FPHR began making a shift that supports that premise a few years ago, and his message affirms the importance of that shift. For us it meant changing our thinking from one of efficiency of harvesting timber to one that focuses on implementation of ecosystem-based management activities in support of the multiple-use mission of the Forest Service. Examples of direct contributions that FPHR makes to help implement ecosystem-based management include technologies for vegetation management, visualization technologies, developing options for use of material generated in the course of ecosystem related activities, and understanding the impacts of different management practices on tree morphology.

New technologies will be required to carry out the different types of management practices that will be used. Flexibility and maneuverability will be critical. Ability to handle small material and non-uniform material may become more important. Cut-to-length technology is one example of this type of technology. Efficiency of equipment may not be the driver, but it will continue to be important, because implementation of ecosystem-based activities is not likely to be inexpensive.

Visualization technology that allows us to look at the consequences of management activities over time will be an important tool to help ameliorate conflict among disparate groups. Those same techniques, when coupled with Geographic Information System technologies, will allow us to visualize historical patterns of management activities and natural disturbances. It will also be useful in developing and displaying "Access Models" on a landscape scale.

Ecosystem-based activities will generate an array of new types of materials. What to do with smaller, non-uniform, and lower quality material will present challenges to resource managers. The need to remove woody material is becoming increasingly apparent through the occurrence and severity of wildfire in the Western U. S. And likewise, the importance of helping defray costs of ecosystem-based activities for non-timber objectives will heighten the importance of finding uses for this new material.

New management practices may have a profound effect on the morphology of trees. This varied morphology may be consistent with management objectives, and it may not. Managers need to understand the consequences of their practices, whether their objective is to produce habitat for the red-cockaded woodpecker, the marbled-murrelet, or to produce high-value wood products.

None of this "new emphasis" diminishes the importance of harvesting timber where that is the management objective. Harvesting timber continues to be important and will remain one of the multiple-use objectives on National Forests. Much of the research in support of harvesting, however, has been completed and we need a different emphasis to support the new approach to management.

Economic vitality

Whether economic vitality is viewed from the perspective of rural economies, gross domestic product, or international competitiveness, the contribution of wood-based forest products is critical. FPHR has historically provided science and technology that has fostered local and national economic vitality. Examples of areas where strong contributions have been made, or will be made, include engineered products and design, performance standards for wood and fiber based products, and the new area of "green" or environmental technologies.

Engineered products—Research and development by a host of researchers from universities, industry, and FPHR have contributed to the development of highly visible and successful products such as laminated beams, wooden I-beams, laminated veneer lumber, oriented strand board, and wooden trusses (Figure 4).



Figure 4. Engineered products that have been developed throughout forest products and harvesting research.

These engineered products have not only conserved resources, but have made a direct and substantial contribution to the U. S. domestic economy and to international competitiveness.

A new high-strength, light-weight fiber product (space board) developed at the Forest Products Laboratory, can be used in a wide range of applications from veneer-coated furniture to non-load bearing walls and dividers. Spaceboard (Figure 5) is an example of a new generation of products that can be made from a variety of feedstocks, including recycled materials, and then used in valuable residential and commercial applications.

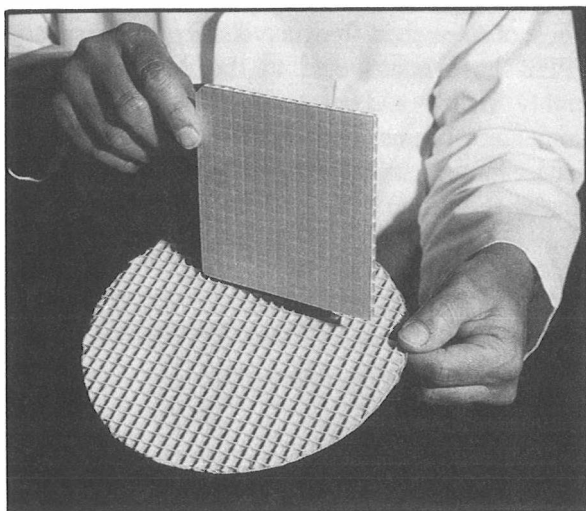


Figure 5. Spaceboard is a good example of the new generation products developed at the Forest Products Laboratory.

Environmental technologies--Also referred to as "green technologies", these products and processes have the potential to ameliorate environmental degradation and to generate revenue. Processes such as non-chlorine bleaching are being developed in response to the need to protect water quality, but they will also be valuable technologies that are exportable to developing countries. Biopulping is currently being used in limited applications and shows tremendous potential to reduce costs and pollution. Bio-based adhesives and preservatives have similar potential.

Performance standards--Performance standards are often an unsung component of research. Yet in a critical-path analysis context, few products can be commercialized without that component. Products standards are applied directly in the development of "codes" that are used by architects and builders that translate into safety to consumers. Whereas the development of performance standards is a somewhat oblique contributor to domestic trade, the lack of standards can be a direct deterrent to global trade and international competitiveness.

Some concluding thoughts

I would like to conclude with a few somewhat tangential thoughts that might help us move toward sustainability. They are based simply on perceptions drawn from a couple decades of experience in FPHR related activities.

Society's change in values--We often talk about society's change in values--what society expects from our forests. The implication is that people are now placing value on things that were not valued before. We feel this is a misstatement. Society's values have not changed, people have always valued all of the resources that are derived from forests. What has changed are the relative proportions of the different forest resources that they want, particularly from National Forests. There is a clear message that society wants a more balanced emphasis in objectives for management of these forests. We need to recognize this, but also recognize that society continues to expect the full complement of benefits from the forests without associated tradeoffs.

Environmentalists versus industry--By using these terms we inadvertently foster polarization of groups that will ultimately have to work together to help move toward sustainability. I strongly suspect that there are many individuals working for profit-oriented corporations that would meet all expectations of someone who cares about the environment. Conversely, I suspect that many "environmentalists" see the importance of using forests for an array of benefits, including profits from wood-based products. This is not a plea for a Pollyanna-solution to genuine differences of opinions about natural resource policy. But it is a plea to recognize that there is an abundance of commonality between people categorized by those terms.

Energy cost of polarization--Building on the last point, a tremendous amount of potentially constructive energy is wasted on defending polarized viewpoints. Disparate views are a valuable part of our decision-making process.

Without robust and sometimes acrimonious debates we may settle for mediocrity in our policy decisions. But when the vast majority of energy is expended on developing and defending the extremes in policy debates, we all lose.

THE LOWER ROANOKE RIVER BIORESERVE PROJECT— A MODEL FOR PRIVATE-PUBLIC PARTNERSHIPS, NORTH CAROLINA

J. Merrill Lynch, Assistant Director for Protection, The Nature Conservancy - North Carolina Chapter

The Lower Roanoke River Bioserve Project had its beginnings as a high-priority land protection project of The Nature Conservancy. In the 16 years since its inception, the project has expanded to include partnerships with a diversity of public agencies (both state and federal), other private conservation groups, and landowners and local communities. This paper discusses the process of how the partnerships developed, the roles each partner has played, and the results in terms of the protection, conservation, and management of the natural and economic resources of the lower Roanoke River floodplain, North Carolina.

Project background

The Roanoke River is the northernmost of the five major brownwater rivers draining the Atlantic slope of the southern Appalachian Mountains. Its headwaters are located in the Ridge and Valley Province west of Roanoke, Virginia, and its mouth is almost 400 miles to the southeast, at Bachelor's Bay in the western end of North Carolina's Albemarle Sound. The drainage basin covers 9,666 square miles. The project area consists of the drainage basin of the lower Roanoke River between the dam at Roanoke Rapids Lake (River mile 137) and the river's mouth at Albemarle Sound. This portion lies totally within the Atlantic Coastal Plain Province. The project area includes the 100-year floodplain, tributary streams, and adjacent uplands encompassing an area of roughly 800 square miles.

The lower Roanoke River floodplain is recognized as one of the most ecologically significant bottomland hardwood ecosystems in the southeastern United States (Lynch 1981, USFWS 1988). The floodplain forest corridor along the river supports old-growth examples of natural

community types and many plant and animal species including many rare, threatened, and endangered species. The river supports one of the most important striped bass fisheries on the Atlantic seaboard. The drainage basin was designated a Nationally Significant Estuary by the Environmental Protection Agency under the Clean Water Act Amendments of 1979.

Basic facts

- * At the beginning of the project all land in the floodplain was in private, non-conservation ownership; ownership was mainly by industrial forestry corporations and large family farms.
- * The counties in the lower Roanoke River region are very poor economically; they have some of the lowest per capita income rates in the state and are one of the few areas with a declining population.
- * The local economy is agriculture and forestry based; there is little industrial development
- * The river is the lifeblood of the ecosystem; the plants and animals are adapted to a flooding regime. The quantity and quality of the water are of notable concern.
- * There are many diverse riparian owners and users including state-owned gamelands, national fish and wildlife refuge, Nature Conservancy preserves, timber companies, farmers, municipalities, etc.
- * The "tap" is controlled by the U.S. Army Corps of Engineers (they own and manage an upstream reservoir that regulates the

downstream water regime that affects the project area).

- * Threats include altered flow and sediment transport regimes resulting from upstream dams, water pollution, water withdrawal, forest conversion, and exotic species.

Process - the evolution of the project

Phase 1 -- Inventory

The Nature Conservancy and the N.C. Natural Heritage Program co-sponsored a biological inventory of the project area in 1978. The three-year field reconnaissance and inventory, using Heritage methodology, identified twenty natural areas in the project area with high ecological significance. The natural areas represented the full spectrum of biological diversity along the lower floodplain including locations of rare and endangered species, exemplary examples of natural community types, old-growth forest stands, colonial nesting bird sites, and other elements of natural diversity. A report issued in 1981 described each natural area site, its biological significance, and priority ranking. Detailed maps accompanying the report identified ecological and ownership boundaries, and rare species locations.

This document, the Roanoke River Preserve Design Plan, became the blueprint for science-driven land protection activities on the lower Roanoke River. The plan attempted to address conservation needs based on an ecosystem, landscape-level approach. The plan focused on the natural forested corridor along the river and identified discrete areas within the corridor that needed acquisition.

Phase 2 -- Land acquisition/building a conservation constituency

Using the preserve design plan both as a scientific justification document and as a marketing tool, TNC began building a conservation constituency for land protection along the lower river. The first partner

with TNC was the N.C. Wildlife Resources Commission (NCWRC), the state agency charged with managing the state's game and non-game wildlife. In this partnership, TNC was the real estate broker and the NCWRC was the owner and land manager. The State also was the funding source for the first acquisitions. Using the preserve design report as a guide, TNC began contacting landowners and negotiating acquisition of ecologically important tracts based always on a willing seller premise.

Many protection tools were used to acquire land including the establishment of a mitigation bank with the N.C. Department of Transportation, tax-free land exchanges, bargain sales, land gifts, conservation easements, and informal, non-binding registry agreements. The objective was to always find a means of protecting land that benefitted both buyer and seller.

In 1989, the U.S. Fish and Wildlife Service formally established the Roanoke River National Wildlife Refuge, identifying 33,000 acres of bottomland forest habitat for federal acquisition. TNC and USFWS began a partnership involving the purchase of lands for the new refuge, again using the willing seller-willing buyer concept. In an agreement worked out between the USFWS, NCWRC, and TNC, lands on one side of the river (Bertie County) would be acquired and consolidated in federal refuge ownership while lands on the opposite side of the river (Martin and Halifax Counties) would become part of the State-owned gamelands managed by the Wildlife Resources Commission. Using the river to divide the federal and state lands made a lot of sense for management and administrative reasons.

The Wildlife Resources Commission and the Fish and Wildlife Service also worked out a cooperative management plan for the state gamelands and federal refuge: each agency will retain primary jurisdiction over the administration of their individual properties but hunting permits for both lands will be issued by the Wildlife Commission.

Under the state's Nature Preserves Act, ecologically sensitive parts of the gamelands will be dedicated as state nature preserves and preserved in perpetuity in the natural condition.

Land Protection History (Progress to Date)

Pre-1981-- Roanoke River is recognized as one of the most important areas for wildlife/fisheries in North Carolina by state and federal agencies but not a single acre in conservation ownership; ownership pattern is either large acreage industrial forestry corporations or large acreage private farms.

1978-1981-- Natural Heritage Program and The Nature Conservancy (TNC) sponsor a biological inventory of the lower Roanoke River floodplain. Inventory identifies 20 natural areas with significance as habitats for wildlife, natural communities, and rare species. Total acreage: 60,000 acres out of roughly 300,000 acres in 100-year floodplain (20%).

1982-- TNC receives a gift from Union-Camp Corporation which establishes first Conservancy preserve--Camassia Slopes.

1983-1987-- TNC teams up with the N.C. Wildlife Resources Commission (WRC) to acquire nearly 14,000 acres in six tracts in Martin, Bertie, and Halifax Counties, using various state funds such as the Endangered Wildlife Fund, the Waterfowl Fund, the Recreation and Natural Heritage Trust Fund, and the N.C. Wildlife Endowment Fund. [Funds for purchase total \$5.94 million]. These lands represented some of the best wildlife habitats along the river and all had been originally identified in the Heritage-sponsored biological inventory.

1986-- TNC/WRC/Fish and Wildlife Service meet to outline priorities for land purchases; WRC asks that FWS wait until State acquisitions are complete before announcing an intent to create a new national wildlife refuge.

1988-- FWS announces creation of proposed Roanoke River National Wildlife Refuge. Up to

now there has been little controversy regarding land purchases; all purchases have either been retained by TNC or transferred to the State. Public hearings indicate major opposition to federal acquisition, mainly from local hunters and Martin County officials.

1989-- Roanoke River NWR approved by Governor under a compromise plan. To satisfy Martin County, the Service excludes from its proposed acquisition all Martin County lands except for one tract. Lands in Bertie County owned by the State will be traded for replacement lands of equal ecological (and monetary) value in Martin and Halifax Counties.

1990-- TNC acquires almost 11,000 acres from Georgia-Pacific Corporation for \$6.4 million. Some of this acreage is added to the State Gamelands program and the rest becomes national wildlife refuge property.

The Wildlife Commission and the Fish and Wildlife Service agree to cooperatively manage both the Service's refuge lands and the Commission's game lands. Each agency retains primary jurisdiction over the administration of their individual properties. A single hunting permit for both state and federal lands are issued by the Wildlife Commission.

1990-1993-- TNC acquires almost 1,000 additional acres for the Wildlife Commission and purchases two additional private preserves bringing the total protected acreage on the Roanoke to 28,700 acres (FWS= 12,500 acres, WRC= 14,900 acres, TNC= 1,300 acres).

1991-- TNC begins its planning process for its Lower Roanoke River Bioreserve Project, a Last Great Places site. While the Conservancy and others have had tremendous success in protecting land-based resources on the lower Roanoke River (see above: from zero acres protected to over 28,000 in about ten years), a much broader conservation effort is required if all of the natural resources of the basin are to be protected.

The Conservancy can serve as the catalyst for scientific analysis of the ecological processes which sustain and regenerate the Roanoke's biological communities.

The bioserve planning process enumerates the threats to the ecosystem and develops a set of goals and strategies designed to restore and perpetuate the ecosystem processes which sustain the biological resources along the floodplain. The plan also outlines a scientific agenda that proposes the development of an ecosystem model in order to better understand the interplay of ecological processes and patterns along the lower Roanoke. It is hoped that this scientific approach to conservation will provide an important institutional example for interagency cooperation and problem solving that seeks to find workable solutions to environmental problems and avoids the "train wreck" scenario.

Phase 3 -- Stewardship

The lower Roanoke River from the Kerr Reservoir to the mouth at Albemarle Sound is a complex mosaic of riverine, palustrine, and terrestrial natural communities. This diversity of natural communities is the expression of a complex interplay of edaphic, abiotic and biotic factors and processes. In order to gain a better understanding of how these processes and patterns are interrelated on the Roanoke, TNC is developing a set of linked quantitative models representing reservoir operations, floodplain hydrology, geomorphology, and community ecology. The intention is to use these models to direct our conservation agenda on the Roanoke. These models will provide tools for preserve selection design, for setting monitoring and research priorities, for negotiating a reservoir operations strategy with the U.S. Army Corps of Engineers, and for long-term management of the lower Roanoke.

Partnerships -- the future

The Nature Conservancy will continue to work with our partners, the U.S. Fish and Wildlife Service and

the N.C. Wildlife Resources Commission, to protect key floodplain and riverine natural communities by acquiring priority tracts; and, to continue the partnership of joint conservation management of these lands.

The Nature Conservancy intends to design and implement a river management plan to restore and perpetuate the ecosystem processes which sustain the floodplain and riverine natural communities. This will involve forging a new relationship with the U.S. Army Corps of Engineers, managers of a key upstream reservoir, that will lead to the development of a cooperative river management plan for the Roanoke which addresses the needs of the many riparian landowners, ranging from state and federal conservation agencies to lumber mills and bottomland farmers. This management plan must be sensitive to potential impacts to the region's economy while at the same time not compromising the essential biological requirements needed to restore and maintain a healthy environment. If successful, the plan could provide the foundation for long-term ecosystem protection for not only the Roanoke River, but also for other similar southeastern bottomland hardwood ecosystems.

The Nature Conservancy will continue to forge partnerships with a variety of interested parties in order to succeed in long-term protection of the river and its resources. This effort will require considerable public and private funding for acquisition, management, scientific research, and analysis. Broad public support will be essential.

Bibliography

1. Lynch, J.M., 1981. Roanoke River Preserve Design Project. Unpublished report to The Nature Conservancy and the N.C. Natural Heritage Program.
2. U.S. Fish and Wildlife Service, 1988. Final Environmental Assessment - Roanoke River National Wildlife Refuge. U.S. Department of the Interior, Fish and Wildlife Service, Southeast Region, Atlanta, Georgia.

CONSERVATION PARTNERSHIPS HOW TO GET TO A WIN - WIN!

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Abstract

Successful partnerships don't just happen, they require planning, hard work and individuals committed to making it happen. Finding common ground is a key challenge for any partnership. The welfare of the resource - plant, animal or ecosystem - is usually a theme that groups can rally around. Partnerships are successful or fail for a number of reasons. This paper discusses those reasons and ways to structure partnerships to assure that they become a win - win proposition. Five successful partnerships are also discussed.

Introduction

Webster's dictionary defines partnership as "a relationship resembling a legal partnership and usually involving close cooperation between parties having specified and joint rights and responsibilities." "Partnership" has become a buzz word of the nineties. Countries, states, municipalities, government agencies, conservation groups, and private industries are all forming partnerships. Government agencies are partnering with each other, with conservation groups, and with industry. Conservation groups and private industry are beginning to realize the synergy created by healthy partnerships. The whole partnership idea, especially conservation partnerships, is gaining momentum.

Partnerships have been around a long time. During the last three decades, partnerships have focused on different things. The 1970s were characterized by personal partnerships as the baby boomers came of age. The 1980s saw an explosion of business partnerships - some friendly, others not so friendly. Now the 1990s find us forming partnerships to make the world a better place to live.

R. S. Whaley (1993), in his article "Working Partnerships: Elements for Success", gives three reasons why collaborative arrangements (partnerships) in the renewable resources field are more important today than in the past.

First, are the conflicting social goals created by the strain between economic growth and environmental health. While these two goals seem to conflict, they are not mutually exclusive. It is very difficult to have environmental quality without economic stability. Continued pressure on the world's natural resource base will increase this strain.

Mr. Whaley's second trend centers around the increasing democratization of decisions. Citizens are organizing themselves into activist groups, and getting their voices heard. Oftentimes these views do not agree with us or our employers.

The third trend focuses on information. We are drowning in information. Information is easily transportable, it's sharable, it's difficult to keep secret, and it's expandable.

Mr. Whaley makes the argument that "the latter two trends - the empowerment of citizens in the policy process and the ubiquity of information - cry out for coalitions and partnerships not just for political reasons but so that the professional community can most effectively bring its particular expertise to decisions."

Partnership benefits

Unique resource protection. Managing and protecting unique resources is usually the landowner's responsibility. Landowners normally have neither the expertise nor the revenue to protect their unique resources. Protection could be as

simple as protecting a small waterfall from degradation or as complicated as managing a fire sub-climax community dependent on periodic burning. Partnering with the right organization helps assure that the necessary practices are implemented.

Third party validation. The forest industry's management practices are often criticized. Some criticism is justified, most is not. Forming partnerships with the "other side," getting their input into management strategies, allows them to become more familiar with what's going on and more importantly, feel they have a stake in the outcome. This can turn critics into supporters.

Public relations. Publicity generated by successful partnerships is definitely a plus. Leveraging the positive publicity generated by strong partnerships is a way to capture economic value from these efforts.

Partnership risks

Requires getting along with our adversaries. This might be a scary thought, but usually, once you start working with a group, you find more common ground than you thought possible. The fact you might be perceived as being to the left of center on an issue and actually trying to get along with these people is a perceived risk by some. We would not want to be perceived as breaking away from the flock - would we?

Outside review of management practices. External review of long-held management strategies is risky. What if the strategies are found to be no longer valid or are in direct conflict with certain environmental goals? The struggle associated with changing entrenched practices can sometimes shake a corporation to its core.

Legal questions. When entering long-term partnerships, whether for business or conservation goals, legal details must be addressed. Partner liabilities create concern. A cancellation clause of

some type is usually necessary. Anti-trust concerns arise when entering a partnership with a competitor. Anti-trust questions can make partnerships extremely difficult if it becomes necessary to discuss long-range management strategies.

Public relations. Just as PR can be a benefit, it has associated risks. PR campaigns centered around ill-conceived projects with no real substance usually expose the project for what it is - something developed just for publicity with no real benefits for the resource. This type publicity is very difficult to overcome.

Ingredients for a successful partnership

Focused. Successful partnerships must be focused. Mission, goals, and objectives must be clearly understood by all involved parties. Unfocused projects quickly become too broad, partners lose interest, and the efforts die a slow, miserable death.

Designed to do what's right. Partnerships focusing on natural resource issues require that the resource, and ultimately society, benefit. Understanding this makes it much easier for partners with diverse backgrounds to focus on the issue, and to do what's right for the resource. Partnerships that only take on the appearance of doing what's right and never deliver real results are sure to fail.

Committed partners. All the players in a partnership must be committed to success. Partners have to be willing to work, and work hard, to reach a win/win scenario.

Trust. Trust between partners is a key element of any successful partnership. Trust does not happen overnight. It must be built, much the same way grapes ferment into a fine wine. Trust cannot be built if all the partners show up with "hidden agendas." Each needs to know what the other is bringing to the table.

Project champion. The most critical ingredient in any successful partnership is the project champion.

This person needs to be committed to doing whatever it takes to make the process work. This must be an individual and not the organization he or she works for. This person must have organizational skills, be able to keep the process moving, work to reach consensus, and produce a product that meets expectations.

Why partnerships fail

Partnerships fail because they don't include any of the successful ingredients just mentioned. But, there are other reasons.

Too many partners. Efforts to include all affected groups can result in alliances becoming too large to be effective. By trying to reach a win for everyone, you are driven to the lowest common denominator and often lose any real substance the project may have had. The delicate balance between including the right partners and getting the group too large is critical to a partnership's success.

Fear of the unknown. Many potential partnerships fail because the partners fear they will discover something that they cannot live with. This might be valid in a few cases. It is usually paranoia that disappears once the process begins and commonalities among the different parties begin to surface. Successful partnerships take time - time to build trust and to remove that fear of the unknown.

Successful partnerships

Partnerships come in many different shapes and styles. Following is a discussion of five partnerships, each for a different reason, but all having the essential elements for a successful alliance.

- *Addressing a single issue.*

The Black Bear Conservation Committee (BBCC) demonstrates how effective an alliance of many different partners can be when it focuses on a

specific problem: the restoration of the Louisiana Black Bear. The BBCC represents a broad-based effort by landowners and representatives from state and federal agencies, private conservation groups, forest industry, agricultural organizations, and the academic community to work together for management and recovery of a wildlife species. The proposal by the U.S. Fish and Wildlife Service to list the Louisiana Black Bear as threatened under the Endangered Species Act brought to the forefront the need to actively address management and recovery of the bear. However, formation of the BBCC is a positive action to benefit the resource, rather than a reaction to this proposal.

Jimmy Bullock, BBCC chairman, described the committee's success very well when he said "...all that has been accomplished thus far has been the result of a group effort, a group in which individual agendas and egos have been set aside, and the focus directed toward the benefit of the resource."

- *Learning more about a sensitive ecosystem.*

International Paper and the National Biological Survey recently announced a partnership to learn more about a sensitive ecosystem, the pitcher plant bogs of southern Alabama. Specifically, two rare plants and a rare bird will be studied on International Paper timberlands in Baldwin County, Alabama. Both the plants and the bird are candidates for the Endangered Species lists, but are not yet listed. The hope of this partnership is that more scientific information about these species will result in better conservation practices that will increase their numbers and keep them from endangered species status.

- *Benefitting from a group's expertise.*

Ducks Unlimited (DU), a nationally known conservation group whose primary goal is to increase North American waterfowl populations, has formed numerous partnerships with many different organizations, both federal and private. DU personnel have extensive knowledge of waterfowl habitat and management. What they do not have is

extensive landholdings. Forest industry companies own millions of acres but generally have limited expertise with waterfowl management.

A partnership between these two groups allows DU to leverage its expertise to achieve their goals, while the landowners benefit from the increased recreational opportunities afforded by increased waterfowl populations. A win/win for both groups.

- *Validating management activities.*

The National Wild Turkey Federation (NWTf) and a dozen forest industry companies have formed a unique partnership that will benefit wild turkeys and their habitats on about 40 million acres of industrial forestlands across the United States. Through a series of memorandums of understanding, the companies have agreed to include certain management strategies into their land management objectives. These strategies are designed to integrate forest management with maintenance and improvement of wild turkey habitat.

The NWTf has endorsed industrial forest management as a viable option to produce wild turkey habitat. The NWTf also has valuable expertise within its organization to assist in designing these strategies, much the way DU does for waterfowl. This partnership represents a synergistic relationship between two organizations, who at one time thought their differences were too great to work together. However, once the efforts were under way, significant common ground existed that resulted in an alliance that will have long-term benefits for a prized gamebird - the wild turkey.

- *Pooling resources to benefit a unique natural resource.*

The Copenhagen Hill Environmental Preserve became a reality in 1991 when The Nature Conservancy and International Paper signed a cooperative agreement to protect 440 acres owned by International Paper in the Copenhagen Hills near the town of Columbia, La. This site contains 16

rare plants and the only cedar woodland in Louisiana.

The Nature Conservancy originally approached International Paper with a request to donate or sell the land to them. The site had been designated the top candidate for protection in Louisiana by the Louisiana Natural Heritage Program. Because of its location, surrounded on all sides by company land, it was not feasible for International Paper to donate or sell the property. After lengthy discussions with TNC, it was determined that the best way to protect the site was through a cooperative agreement.

The Nature Conservancy will conduct biological research to protect and enhance the habitat and assist with management of this unique area. International Paper has agreed not to disturb the area and to prevent damage from free-ranging livestock. The company will also provide labor and equipment to carry out management activities.

The true winner in this project is the Copenhagen Hills Environmental Preserve. This unique ecological area has been protected through the collaborative efforts of two partners committed to doing what's right for the resource.

Summary

Demand for natural resources will continue to increase and come from more user groups. Not only will more people have a stake in what happens but they will also exert tremendous influence on how natural resources are managed. We can no longer just "take our marbles and go home!"

Who has the biggest stake in these debates? Some would argue that the landowner will have to sacrifice most. Their management strategies would have to be altered to accommodate the needed environmental provisions. They might not be able to meet all their economic objectives.

What stake do environmental organizations have when they enter into a strong partnership? Many of

these groups survive on conflict and controversy. James Watt's tenure as Interior Secretary and the Exxon Valdease oil spill generated tremendous revenues for certain environmental groups. Some of the more radical groups view compromise as defeat.

So who loses? Hopefully, no one. Successful partnerships must not have losers, only winners. Get yourself a project champion, check your agendas and egos at the door, be willing to work hard, and a successful partnership will result. The true winners of any successful environmental partnership are the natural resources that we all work so hard to maintain. Keeping this focus enables all the partners to work for the ultimate goal - a win/win for everyone.

Literature cited

1. Whaley, R. A. 1993. Working partnerships: elements for success. *Journal of Forestry*, March, 1993:10-11.

Policy Tools to Influence the Management of The Forest Resource of the Eastern United States

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Abstract

Many policy tools currently are being used and others can be brought to bear to influence the direction of forest management in the Eastern United States. Most of the forest resource in the East is not directly controlled by government but owned by private individuals and corporations. When governments adopt policies changes which apply broadly to all forested lands (such as the Endangered Species Act, wetland-protection regulations and cancellation of the registration of forest pest control chemicals) they affect not just how the forest resource itself will be managed (as on National Forests) but also the freedom of private property owners to manage as they wish and the value of their property. Changing policy (e.g., restricting imports) or restricting the availability of timber (e.g., wilderness classification, designation of endangered species critical habitat) does not reduce the demand for forest products but moves the environmental impact to another region or country. Landscape-level ecosystem management may be a means of assigning private forests the lead role in the East in producing fiber while the public forests take the lead in providing amenities.

Tools are aids for performing work. Foresters' tools typically include calipers, diameter tape, Biltmore stick, Abney level, increment borer, planting bar, grub hoe, axe, saw, wedge, and peavey.

Forest resource policy-makers' tools are quite different. Forestry schools in the past typically have not devoted much time to teaching forestry students how to use them, but they--not the yield tables in the Forestry Handbook--often determine how much wood will be harvested from a particular tract in the United States.

Policy-making tools in general

Policy-makers' tools include:

- Statutory law, or legislation. It's the end product of election campaigns, lobbying by interest groups, and Congressional or state general assembly debate.
- Administrative law, mainly rules and regulations. It is produced by public agency career employees, usually through a public involvement process.
- Case law, or court opinions. Written by judges, it is the result of lawsuits--litigation initiated by plaintiffs who may be individuals or may be interest groups representing a class of individuals.
- Public relations. "PR" includes both broad public education and sharp-focused media campaigns designed to influence public opinion. Public opinion helps determine who is elected to legislative bodies, which laws are passed, the policy "spin" in new regulations, who is appointed to the bench, and therefore how court decisions come out.

Statutory law

Statutory laws authorize program and appropriate funds. Government programs require both an authorizing statute and appropriated funds to be viable.

Three well-known examples of forest resource policy-making statutes are the Wilderness Act of 1964, the National Environmental Policy Act of 1970, and the National Forest Management Act of

1976. These are seen by their advocates as tools to protect the beauty, diversity and productivity of the forest environment. They set aside undeveloped "old growth" forest areas, require environmental impact assessments before timber sales or other development proceeds, and require the preparation of national forest land use plans that conserve biological diversity. Opponents have described them as authorizing counterproductive lock-ups of productive land and as "paralysis by analysis", but the majority of the members of Congress, representing the will of the American people, voted for them, and they are the law of the land.

Money to put such policy tools to work on the ground is doled out annually in separate legislation called appropriations bills. Appropriations bills are written by House and Senate appropriations subcommittees, including the Subcommittees on Interior and Related Agencies which decide how much money the USDA Forest Service and all Department of the Interior agencies will receive each fiscal year.

Authors of appropriation bills begin with the President's Budget, which is prepared by the Office of Management and Budget (OMB) based on agency requests and the President's priorities. But the final result--the Act of Congress--often differs markedly from the agency's or President's request because interest or pressure groups cause appropriations committee members to make changes. Additions to the President's Budget are called "Congressional add-ons". For many years the Forest Service's State and Private Forestry budget has been the result of a Congressional add-on; the OMB, year in and year out, eliminates the Forest Service's State and Private Forestry budget request and Congress restores it.

Authorized programs can be killed through "defunding"--denying them any money. Appropriations committees often go beyond the simple financing of agencies to provide specific program-management (policy) direction in their money bills. As a result, agencies may receive conflicting policy direction, from differing instructions from their authorizing

committees, from their appropriations committees, and from the White House.

Anyone who would like to change forest resource policy--not just government agency legislative affairs specialists and the big private industrial trade and environmental-protection associations' lobbyists, but any citizen with the ear of his or her congressperson--can easily obtain access to the rough and tumble U. S. federal legislative process. Any citizen with an idea for a new law--anyone in this room, for example--can have his or her idea converted to draft legislation. Members of Congress, with the assistance of the Congressional Research Service, can convert any concept into a bill and introduce it. It is referred to a committee, which may or may not choose to hold hearings on it and move it along. New forestry legislation constantly is being drafted and peddled on Capitol Hill, to put new forest policy tools into the hands of forest resource managers . . . and lawyers.

To show you how easy it can be to change forest policy, here's an example from the time 20 years ago when I was on the resource development faculty of Michigan State University. To fulfill a legislative drafting class requirement, a law student at the University of Michigan drafted a state wilderness bill. He sent a copy to the member of the Michigan House of Representatives from his district just "for his information." That legislator liked the student's bill so much that, although no one had asked him to do so, he put it in the hopper for formal introduction. It was printed and assigned to a committee for hearings. Only after hearings were scheduled did the Sierra Club and the Natural Areas Council learn of its existence. They were so upset that they hadn't been asked for input during the bill's drafting that they almost killed it. I was asked by the sponsor to smooth ruffled feathers and organize support. The bill was passed promptly and is the basis of the State's popular wilderness and natural areas system. Like the federal system, Michigan's wildernesses and natural areas are set-asides within existing state parks and forests.

Statutory law--found, at the federal level, in the U.S. Code--is as dynamic and ever-changing as a natural forest. In place of logging, fire, insects and windstorm, the agents of change on Capitol Hill include media attention, grassroots letter-writing blitzes, re-election campaign contributions, and direct lobbying by interest groups. Intense pressure on individual legislators--in effect, the threat to defeat them in the next election if they don't cooperate--results in the constant passage of legislative amendments. Each legislative session produces new laws requiring new regulations and creating new "causes of action" for lawyers to litigate.

Administrative law

Rules and regulations are written and adopted by government agencies to tell the world how they--responding to the philosophy of the political party in power -- interpret the often-purposely-vague language of an authorizing statute. The same statute may be interpreted differently by different Administrations. The Carter Administration interpreted all the constraints of the Endangered Species Act as applying to the actions of U.S. government employees and the use of U.S. funds in other countries, as well as within the U.S. The Reagan and Bush Administrations did not.

Skillful forest resource policy-makers find ways to influence the content of the agency's draft and final regulations. Federal regulations are advertised as being under consideration in the Federal Register and published in final form in the Code of Federal Regulations. The Environmental Protection Agency's pesticide-registration decisions--such as its decision to prohibit the use of the herbicide 2,4,5-T to kill broad-leaved brush in reforestation projects--and the Army Corps of Engineers' Clean Water Act-based regulations defining wetlands are examples of administrative law-making.

The Forest Service's original national forest planning regulations, adopted under my supervision during the Carter Administration to interpret the

complexities of the National Forest Management Act (NFMA), were drafted by an apolitical Committee of Scientists and fine-tuned in response to constructive criticism from all sides. The NFMA regs were critically reviewed during the Bush Administration's regulation-reduction campaign led by Vice President Quayle but survived relatively intact because of the broad consensus achieved on their contents the first time around.

An inclusive definition of administrative law also includes:

- decisions on program staffing levels (some programs have died from lack of interest within the agencies to which they were assigned);
- micromanagement of field offices (see the Forest Service Manual and all agencies' environmental impact statement-preparation guidelines for examples of programmed decision making); and
- administrative-appeal decisions made by agency higher-ups. Appeals are the administrative remedy judges say must be exhausted prior to suing the Forest Service in federal court. The chief of the Forest Service can reverse a forest supervisor's or regional forester's decision through the appeal process.

Case law

Case law is the collective body of published court opinions--the essays judges write to conclude trial, appellate and supreme court-level lawsuits. They determine the outcome of the case at hand and influence outcomes of future similar cases in the same and other jurisdictions.

A key case law ruling was the Scenic Hudson decision made in 1965 by the Second Circuit Court of Appeals in which the court held "that the public interest in environmental resources . . . is a legally protected interest affording these plaintiffs . . . standing to obtain judicial review of agency action".

This and subsequent case law such as the Supreme Court's 1972 ruling in Sierra Club v. Morton--the Mineral King ski resort case--have opened the court system's doors to private environmental group plaintiffs and have put the litigation policy tool in their eager hands.

Public relations

All forest products corporations would like to be known as "tree-growing people" and qualify for "green" certification. Good public relations, important to a government agency's funding level, also is essential to the success of an industrial trade association's legislative and administrative lobbying campaigns and to the parallel and often contrary lobbying efforts of any private environmental-protection group.

Included in every forest policy-maker's tool box is something often called "public education". Examples: Industry- and agency-subsidized teacher-training programs such as Project Learning Tree, industry support for television news-analysis shows and documentaries with politically conservative hosts, and corporate or institutional advertising. The Society of American Foresters' annual "Walk in the Woods" day--walks are led by Blue Ridge Chapter volunteers at Virginia's Explore Park, for example--brings professional foresters and the lay public together in a constructive way.

Environmental groups sponsor television action specials on "the last of" the great bears, great whales, or great forests. Every interest group uses magazines, newsletters, direct mail, telemarketing, field trips, nonviolent protests, media events and similar efforts to win the attention and support of a larger public for their policy-change agenda.

The "forest resource" defined

Agreement among forest policy players on the meaning of the term "the forest resource" isn't automatic. The famous Bill Barton-Ross Whaley

debate at the 1992 national convention of the Society of American Foresters (SAF) proved this. The debate between these two recent ex-presidents of the SAF was reproduced in the January 1993 Journal of Forestry (Difley 1993). Barton objected to "the erroneous concept of managing huge acreages of forested land for myriad reasons other than for timber, [a concept which] poses many threats to the profession and to a needed, vibrant industry." Whaley noted that "society is asking for help in looking at forests as an international resource; as a filter for excess climate-influencing gases; as an indicator that things are okay with our natural world; and as a legacy that will be available for our grandchildren to enjoy." There's a bit of a difference there.

How did the Nation's first chief forester, Gifford Pinchot, describe a forest? In prose pretty close to poetry, I found. In the first chapter of his Primer of Forestry, Pinchot wrote:

"Although it is composed of trees, the forest is far more than a collection of trees standing in one place. It has a population of animals and plants peculiar to itself, a soil largely of its own making, and a climate different in many ways from that of the open country. . . . The forest is as beautiful as it is useful." (Pinchot 1900)

That's about as holistic a view as Aldo Leopold's, in Sand County Almanac--"Every farm woodland, in addition to yielding lumber, fuel, and posts, should provide its owner with a liberal education" (Leopold 1949)--or Chris Maser's, in The Redesigned Forest:

"Our dream--a sustainable forest--must be bold enough to allow change not only in the forest but also in our thinking because the land is not to be conquered but is to be nurtured. We must also understand, accept, and remember that the world is always in a state of becoming, in a state of change, so that nothing is ever 'finished.' Thus, if we try to hold things constant, like yesterday's timber values projected into tomorrow's forests, then it is like driving through life looking in the rearview mirror.

Today's decisions will design and sustain or destroy the forests of tomorrow." (Maser 1988)

Forest resources are assets

The dictionary says resources are available capital or assets. The forest resource includes many assets. They include wildlife habitat and attractive settings for homes and for outdoor recreation, and they produce clean air and water as well as timber.

The forestry community's task is to convince voters in the political center, not committed to either the anti-all-clearcuts environmental camp or to an extreme industry position, that America can have beautiful forests and use them, too. The public relations tools I've described can be used to gain popular support for these four propositions:

1. Continued production of forest products such as paper and lumber is essential for the well-being of human society.
2. The manufacture of substitutes for wood, such as steel, aluminum and concrete, consumes far more fossil fuel, produces far more greenhouse gases, causes more mining and therefore punishes the natural environment far more than using wood.
3. Forcing commercial wood harvest offshore by increasing the acreage of domestic forestlands closed to logging worsens global environmental problems. It encourages the logging of rare tropical hardwoods and the destruction of the habitats of endangered wildlife species in other countries with weaker environmental protection law enforcement than we have.
4. Therefore, society at large, environmentalists included, should work to provide incentives that encourage an economically robust domestic forest products industry that meets sensible biodiversity-conservation and environmental-protection standards in its own enlightened self-interest.

Global consequences of U.S. policy changes

Roger Sedjo, a senior fellow at Resources for the Future, described the "Global Consequences of U.S. Environmental Policies" in the April 1993 number of the Journal of Forestry (Sedjo 1993). Then, together with Clark Wiseman, David Brooks, and Ken Lyons, he produced an RfF Discussion Paper in February of this year entitled "Global Forest Products Trade: The Consequences of Domestic Forest Land-Use Policy" (Sedjo 1994). On the issue of relocating environmental impacts, Sedjo et al. concluded:

"In a world where wood products are heavily traded internationally, prohibiting logging in some areas will almost surely result in the relocation of the timber activities to other regions and reallocate environmental damages to other forested regions. In a global economy, logging will continue regardless of U.S. policy since logging restrictions in some regions will simply be offset by logging increases elsewhere."

On the matter of wood substitutes, Sedjo observed:

"Reduced timber availability might be expected to result in higher wood prices, both locally and globally, and therefore promote materials substitution. Although materials substitution may appear to be environmentally desirable, a careful examination of alternative materials suggests that substitution is not an unmixed blessing. Most materials are probably more environmentally destructive than wood."

Paper can be produced from substitutes for wood which are less environmentally destructive than wood. The Spring 1994 number of the Forest Voice, the periodical of the Native Forest Council, includes an article entitled "Solutions to the Global Forest Crisis" which notes:

"Long before there were chain saws, pulp mills, and dioxin-poisoned rivers, there was paper produced from hemp, straw and other common plants. Kenaf and hemp are both annually renewable and have low

water requirements. Combining hemp and straw produces chlorine-free, acid-free, and ink-free paper." (Native Forest Council 1994)

Not all wood substitutes harm the environment more than wood.

Exporting the environmental impact

Sedjo predicts that expansion of the U. S. National Wilderness Preservation System and the creation of more set-asides for endangered species critical habitat in the U.S. may cause significant increases in forest harvest and associated environmental harm elsewhere, such as in the Russian Far East. I toured the Russian Far East in 1992 and can imagine the extensive damage to watersheds and to the habitats of rare species such as the Amur tiger that could be caused by the unconstrained sale to multinational conglomerate corporations of long-term logging rights there. There are no grassroots "watchdog" environmental groups, no NEPA, and no Endangered Species Act in Russia. Russia today is a struggling third world state, not a place where concern for the future of other species is likely to be given high-priority attention.

The same conditions exist in other forested countries that could serve as alternative sources of U.S. timber supplies. I agree that we should think twice before driving more forest harvest offshore by creating more U.S. wilderness and wildlife habitat set-asides. There are other ways to skin this cat, however, than through a moratorium on forest set-asides for recreational and endangered species-protection purposes in the U.S. If all the forests now set aside in the U.S. were thrown open to logging tomorrow (including 96 million acres of designated wilderness in 564 separate units), soon the very last of the old growth would be converted to redwood decks, rayon shirts, and chop sticks. After this logging blitz we'd find ourselves once again short of domestic timber supplies, but without any old growth or old growth-dependent fish and wildlife species.

Policy tools to reduce demand

The focus of forest products conferences usually is on ways to increase the supply to satisfy a growing demand. But there are some ways to address the timber-supply crunch by working on the demand side of the issue. Government policy tools can be used to reduce demand for virgin wood fiber.

The main cause of the increasing demand for product is the growth of the global human population. Hal Salwasser's essay on "Ecosystem Management" in the current (August 1994) Journal of Forestry begins by noting:

"During the past 300 years the global human population has grown elevenfold, from an estimated 500 million to more than 5.5 billion. [It has] doubled in the last 40 years [during which time] industrial wood production has doubled and is now matched in volume by the use of wood for fuel."

Salwasser quotes these Worldwatch Institute projections: Between 1990 and 2010 the human population will grow by another 33 percent and forests will decline by 7 percent for a per capita decline of 30 percent (Salwasser 1994). Newsweek's August 1, 1994 number included a feature article entitled "No Room, No Rest", with a subhead reading: "Crowds and conflicts. Backpackers vs. mountain bikers. Lines, lists and limitations. All across the country, our recreational areas are being overrun with vacationers and clogged with restrictions" (Adler 1994).

Many foresters visibly blanch when told they should limit the size of their own families and support local, national and international family planning efforts. In an official policy position the Society of American Foresters "encourages efforts to place before the public scientific information on the dangers of unlimited population expansion" (SAF 1993). I am a population control activist and believe we should eliminate all government subsidies for large families and require strict enforcement of our immigration laws to protect the quality of our lives and those of our grandchildren.

The population of the U.S. is growing faster than that of any other developed country. American society and North American natural resources are showing the strain (McCarty 1994).

Policy tools to increase supply

I was the assistant secretary of agriculture for natural resources in the Carter Administration. President Carter is a forest conservationist, so I had firm support in the White House for USDA programs to assist private forest landowners and mill owners. We made important strides, including passage of the Renewable Resources Extension Act to create a separate natural resources staff in the Federal Extension Service to encourage state universities to provide more technical assistance to forest landowners and mill owners and other forest products industries.

In speeches I made during that time (1977-80), I advocated adoption of a variety of forest resource policy tools to increase the timber supply. They still make good sense:

- I advocated tax reform to eliminate oppressive and "highest use" taxation of forests and provide tax credits, write-offs for reforestation, and stabilization of taxes over the lifetime of the timber crop. I applaud the Internal Revenue Service's decision allowing companies that pollute land and water in the course of operations to deduct the cost of cleanup as a business expense (Conservation Fund 1994).
- I supported forestry incentives. These included direct economic incentives to assist the small woodlot owner with site preparation, reforestation, and timber stand improvement, using Virginia's cost-share program as the model.
- I proposed providing more market information and marketing assistance for forest landowners.

And I also put the government on record in favor of actions to increase the industry's efficiency and to reduce the rate of increase in the demand for timber (Cutler 1979a). At a Conference on Resource Conservation at the Brookings Institution in January of 1979 (Cutler 1979b) I noted:

"The amount of timber available for use can be dramatically affected by improvements in processing technology for both use of wood now considered residue and for increasing efficiency in converting raw material into finished products. There is tremendous potential for getting more product from the trees now being harvested. Better designs or engineering and systems to protect wood products from decay in use can save a great deal of timber."

I laid these opportunities out again in a speech to the Timber Supply Issue and Options Conference sponsored by the Forest Products Research Society in San Francisco in October of 1979 (Cutler 1979c):

"We must deliberately seek to hold down the rise in demand for raw timber by meeting consumer demand more efficiently. We can do this by increasing the recovery of wood fiber in high-value products, by improving the efficiency in using wood products for construction and other purposes, and by developing wood fiber recycling systems to reduce our reliance on new wood fiber."

"We have the technology to do these things," I concluded. Today, 15 years later, as the result of more public- and private-sector research and development, we have an even better chance to achieve such desirable wood-conservation objectives.

A tool to save biodiversity, not reduce timber supply

I'm always looking for policy tools to protect wild ecosystems that don't threaten the economies of nearby human communities. I described a way to do this in a February 1993 Journal of Forestry article

entitled "A Land Exchange Program to Protect Biodiversity" (Cutler 1993). Here's my proposal:

Use the National Wilderness Preservation System to protect native biological communities that require insulation from man's activities afforded by wilderness-classification to survive. This can be done with minimum impact on the economy through the following no-net-gain-of-public-land approach. Each addition to the Wilderness System justified for biodiversity-conservation purposes would be matched by the deletion of land from the public domain of comparable market value containing plant and animal species well protected elsewhere. The result: a more ecologically diverse public domain of the same size with former public lands of commercial interest traded to industry in exchange for unusual habitats.

If this idea were implemented, both those interested in biodiversity conservation and those interested in jobs derived from the commercial use of natural resources would win. The overall tax base would not be affected. An example of how this idea can work is given in a sidebar article in the February 1993 Journal of Forestry: In 1990, the U.S. Bureau of Land Management traded a potato farmer 4,000 acres of good farmland it owned near Glenns Ferry, Idaho for the farmer's 3,800 acres of prime sharp-tailed grouse habitat--clearly a win-win outcome that could be replicated many times over.

A tool to coordinate plans of forest neighbors

I would like to encourage neighboring forest landowners to share their forest resource management objectives and, by pooling that information, create multi-million-acre de facto forest plans for the forested regions which surround Eastern cities. The land use mosaic created simply by mapping and aggregating landowners' current, varying objectives might very well show that almost every needed use is in fact being provided. It could document the fact that society has a shot at receiving almost every kind of forest-based service it wants

under the present land ownership pattern, with a little fine-tuning.

Public land managers with long planning horizons can be expected (or can be encouraged) to provide "core reserves" containing wilderness, rare species, trout streams and long-rotation hardwoods (Morton 1994). Some private owners will want to manage their stands intensively to produce the softwood needed for lumber and paper, while acknowledging their responsibility to protect roadside aesthetics and streamside zones. Others will want to manage for high populations of fish and game for their own families' recreational enjoyment or as a source of income through leasing the access to their lands to sportsmen.

When a private owner discovers his lands contain unique public values, such as endangered species habitat and spectacular scenery easily seen from the highway, the public can step in and reimburse the private landowner to keep him financially whole. Land exchanges can be arranged. Private land trusts can offer economic incentives including development easements with tax benefits. Cost-sharing programs can be used. Society at large should reimburse the private landowner for any major loss of freedom to derive income from his land associated with protecting a unique public value.

If forest planning in the East were to take place at the city-centered region level, with full participation of the private sector and local governments as well as the administrators of national and state forests, and with full coverage by the news media, the public might come to recognize and applaud the essential role of private forest landowners and industries. With increased public awareness and appreciation of the role private forests play in the local economy, private forest managers might come to be regarded as local heroes for providing jobs, the way Norfolk Southern and General Electric are regarded in the Roanoke Valley.

Specific forest resource policy recommendations

The ideas just expressed are in synch with those recommended in a book published in March of this year by the World Resources Institute called Breaking the Logjam: Obstacles to Forest Policy Reform in Indonesia and the United States. Written by Charles Barber, Nels Johnson, and Emmy Hafild, it offers an extremely useful list of forest resource policy-tool ideas (Barber 1994). I will conclude my presentation by summarizing the suggestions of Barber, *et al.* They represent enough grist for our policy-tool-making mill to keep us all busy in Washington, in our state capitals, and in our home communities for years. Barber's recommendations:

"In the United States, overcoming structural problems in forest policy-making will require the following steps: Develop a new alliance of all who stand to benefit from forest policy reform. Improve participation in forest planning and policy development so the public gets more involved in defining what Americans want from their forests. Give scientists and professional natural resource managers more say in determining what resource-use levels are sustainable. Initiate pilot efforts to manage forests regionally, integrating the needs of deferent sectors and landowners.

"A transition to more sustainable forest economies will require the following steps: Use natural resource accounting methods to determine the true status of the resource base, the trends affecting it, and the full values of alternative uses. Eliminate below-cost timber sales and other policies that invite waste or subsidize special interests at the expense of the public. Invest the savings from the elimination of public subsidies to private timber interests in the restoration of degraded forest lands and the economic diversification of communities that have grown dependent on federal timber resources. Replace federal programs for sharing revenues from timber sales with fair and consistent compensation to counties that have tax-exempt federal forest lands in their jurisdiction. Encourage the development of markets for sustainably priced forest products,

including timber, recreation, wildlife and fisheries, watershed protection, and such other non-timber resources as biodiversity. Establish incentives to encourage private investment in sustainable timber management on commercial timber lands and small tract of non-commercial lands.

"Steps to improve the balance between rights to use forest resources and responsibilities to maintain them include: Strictly enforce existing responsibilities to maintain forest resources on public and private lands. Identify the forest areas most important for biodiversity and other non-timber 'forest values' and protect the areas where logging and non-timber values are found to be incompatible. Develop forest ecosystem management plans that anticipate conflicts between commodity-extraction and the conservation of endangered species and other non-commodity values.

"Possible actions should be developed by task forces composed of individuals representing diverse interests with a stake in area forests. This should include representatives of government agencies (local, state, and federal), private landowners and businesses with a stake in the area's forest resources as well as representatives of local communities, non-governmental organizations, and interested members of the public. Such task forces might call for voluntary actions by private and public interests, or for policy changes accomplished through tax and fiscal incentives, reform of existing laws and institutions, or new regulations."

I haven't given you any policy-change panaceas. We can agree that many of the answers to our forest resource management difficulties will be found, not in Washington, D.C., but in regional and local resource management forums.

One barrier hard to overcome may be the traditional reluctance of the private sector to play the forest planning game in public view. I can only offer you all my conclusion, from 40 years' experience with the media, that the more the public understands your business, the more they will support it. The news

media and the general public are potentially strongly supportive of people who work hard for a living and provide jobs and needed products for society.

As President Clinton is discovering, this is an age of skepticism regarding the efficacy of big government and a time when private enterprise is being given the benefit of the doubt. Take advantage of that window of opportunity! Go public with your goals and your plans. As long as you're not harming the environment, you may be surprised at the support you'll generate and possibly at the incentives the public will be willing to provide to make your forest resource management efforts more profitable.

Thank you.

Literature cited

1. Difley, Jane, 1993. Forestry: what path to the future? *Journal of Forestry* 91(1): 25-29.
2. Pinchot, Gifford, 1900. A primer of forestry, Part 1--The forest. Washington: U.S. Department of Agriculture Division of Forestry Bulletin No. 24, pp. 7-8.
3. Leopold, Aldo, 1949. A sand county almanac. New York: Oxford University Press, p. 73.
4. Maser, Chris, 1988. The redesigned forest. San Pedro: R. & E. Miles, pp. 189-190.
5. Sedjo, Roger A., 1993. Global consequences of US environmental policies. *Journal of Forestry* 91(4): 19-21.
6. Sedjo, Roger A., Clark Wiseman, David Brooks, Kenneth Lyons, 1994. Global forest products trade: The consequences of domestic forest land-use policy. Resources for the Future discussion paper 94-13.
7. Native Forest Council, 1994. Solutions to the global forest crisis--hemp, straw, kenaf. *Forest Voice* 7(2): 12-13.
8. Salwasser, Hal, 1994. Ecosystem management: Can it sustain diversity and productivity? *Journal of Forestry* 92(8): 6-10.
9. Adler, Jerry and Daniel Glick, 1994. No room, no rest. *Newsweek*, Aug. 1, 1994, pp. 46-52.
10. Council of the Society of American Foresters, 1993. The management of natural resources in the face of an increasing human population. 2 pp.
11. McCarty, Laura, 1994. Are we loving our parks to death? *The ZPG Reporter* 26(4): 3.
12. The Conservation Fund, 1994. Small tracts. *Common Ground* 5(5): 5.
13. Cutler, M. Rupert, 1979. Future directions for private nonindustrial forests. Speech to National Conference on Private Nonindustrial Forests, Washington, DC, Nov. 27, 1979.
14. Cutler, M. Rupert, 1979. Timber's future--conservation through use. Speech to Conference on Resource Conservation at Brookings Institution, Washington, DC, Jan. 16, 1979.
15. Cutler, M. Rupert, 1979. Options for tomorrow. Speech to Timber Supply Issues and Options Conference of Forest Products Research Society, San Francisco, CA, Oct. 3, 1979.
16. Cutler, M. Rupert, 1993. Proposal: A land exchange program to protect biodiversity. *Journal of Forestry* 91(2): 25-29.
17. Morton, Peter A., 1994. Charting a new course: National forests in the Southern Appalachians. Washington: The Wilderness Society, p. 67.
18. Barber, Charles V., Nels Johnson and Emmy Hafild, 1994. Breaking the logjam: Obstacles to forest policy reform in Indonesia and the United States. Washington: World Resources Institute, pp. 99-107.

A Successful Failure: The Old Modern Conference (Conference Summary Part I)

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Abstract

A reaction to the total conference, this paper suggests the conference is no longer an appropriate format for discussing very complex, multi-factor problems with strong value dimensions. The grounds for frustration with the conference are not with its conduct but with its topics, a growing urban class, new attitudes and demands. Fourteen suggestions are made for what an awakening and to what future "discussions" may mean. Many of the difficulties presented during the conference have been repeated at least for 40 years. Perhaps there are alternatives.

Introduction

You have heard what was said. Ms. Manning will help analyze and compare these things. Let me share with you a reaction, not a summary, and what I believe is an important result of this conference. It is a singular perception, a whole brand new concept that I did not have when I walked into the hotel. It is my perception that we have witnessed an extraordinary event. We have been a part of it and viewing it at the same time. A hundred men and women in "tight times" decided consciously and deliberately to come together to discuss "environmental issues affecting forestry and forest products industries in the Eastern U.S." We have met for 2.5 days ... and "discuss" we did! But now we feel frustrated. In the most modern of settings with the most modern of equipment with assistance from extremely well-informed people, we feel ill-at-ease. We did not succeed.

- we did not see emerge a concept of more scientific observations
- we saw no new pattern of rational thinking

- we heard about magic, emotion and relations to "the whole", not just parts
- we praised forestry as practiced well and taught in superior schools for over 50 years
- we have no new concept or definition of an "environmentally sound forestry operation"
- we have no new plan for recognition of superior practices
- a new research cooperative has not emerged
- I noticed no new incentives proposals to counteract disincentives

I suggest the need for an awakening. I am not at all sure I know the consequences of my observation. I struggle toward the light and I request your help. I do not make this observation to be evil, or impolite, or just to create editorial attraction. It is a call to awareness; a call to seek new strategies for achieving the important objectives stated for us all by the steering committee and Dr. Dolan. It is an expression of a need to awake together. Our conference itself is educational. Old conferences were good; appropriate for their day. They no longer work for the modern problems (Suwyn) with which we all grapple.

I am like the mule hit with a 2x4. (Perhaps it was laminated.) This conference finally got my undivided attention. I have known there were changes but the reality has finally engulfed me:

- we cannot agree on anything in the university; within the society; between societies; between the public, bureaucrats, environmentalists, or industrialists -- except in the most general and vague concepts.
- we have very diverse education; many people do not graduate from high school.
- there is diverse commitment to and skepticism about our political system .
- there is extreme difference in socio-economic groups; abject poverty to striking richness.

- strange patterns of knowledge among the public about nature, forests, and animals gained from piecemeal TV.
- irreconcilable differences in public as well as corporate policy and actions.

The points: we are frustrated. Frustration is reasonable. Things have changed. Old solutions, once excellent, no longer work. We have been engaged in a good old process, the conference, one that no longer works. We have to find another way in the future to express what we mean when we say we have a desire "to discuss issues." We does that really mean? The conferences for discussing complex issues is now, I believe, *passee*.

I am making this observation in parallel with another one about U.S. citizens. We have heard it several times. There are mostly city folks out there; 70%. In Texas, 8 out of 10 university enrollees come from 5 major cities. No one in our voting, Congress-calling, letter-writing, injunction-filing, sign-carrying, marching public has ever seen a chicken killed, chopped wood, gotten a jeep stuck, or tied down things in a night storm. The point: things have changed; people have changed. They just don't understand (and its not our fault.) We assume they know too much. Dr. Les Pengelly of Montana State University used to say of the public: never underestimate their intelligence; always underestimate their information (1964).

We have together witnessed a phenomenon of our times, a step-function change: Old tried and proven solutions, the conference itself as an example, do not work in the new situation. We have a brand new social, international, physical, biological, even religious situation. You certainly see the new situation as well or better than I do:

- phone calls are not to people
- phone calls are not returned
- complaints are net with counter complaints or shared sympathy
- a public meeting to educate is often an embittering event

- publications on any research topic now exceed our ability to read the abstracts
- publication lists, are too long to scan for relevance
- software is now excessive, taking more time to learn it than the time it will save once learned.
- the USFS is said to be "broke" (Thomas)
- the Berlin wall is down; our Enemy is divided
- wars break out like lighting fires in a dry forest

We are all like slow readers who can master speed reading but cannot afford the time off to go to the class. To emphasize my point: We are in a brand new situation.

My wife thinks I'll never kill myself. She claims I'll never finish the suicide note. My list of environmental concerns and factors is very long. I cannot explain anything about the complex environment in a "paragraph or two." To be brief about something as large, complex, and complicated as the environment with its combinations and permutations is to be wrong. To act as if we could be brief is to be silly: to show that we do not know what we do not know. The public sees through silliness and arrogance. The dimensions of any environmental situation are so great that the average, well-educated forestry graduate cannot possibly discuss it well. That person cannot even list all of the relevant factors.

I hasten to add that I have met many below-standard graduates of our forestry and wildlife schools and as a taxpayer I am incensed by them and as a professor I am embarrassed. The university has gotten by without scathing comment in this conference. It is now rare for us to be treated so kindly. We admit, as others around us, to some real problems. There is guilt enough on all sides to share. Grade inflation has occurred; curricula have diversified; and (I speak from experience) synthetic courses are presented to advanced students who have little in their heads to synthesize. We do not do comprehensive wildland management half as well as we know how.

It may be that the "old ways" of doing business will not work and that nothing else will either. Other civilizations have destroyed themselves. This is an un-American thought and more pessimistic than I usually allow but I think the evidence is squarely on the side of rational hopelessness. I struggle on with a little hope. I do wish you will ponder with me alternatives. We can "fix it", achieve objectives outlined by Dolan at the start of the conference, but the work ahead is enormous, available, but far from operational. The conference, based on my one-person observation, failed. We had a wonderful conference that through no fault of its planning or conduct or facility, failed. It did so because the problem was insurmountable. We have asked too much of it. Perhaps we have asked too much from our current way of doing business. The problems, however, are real and there are possibilities for skillful, strategic action that can turn things around. No one will be sufficient; the list here is suggestive of the types of work I think are needed. (You have heard supportive comments during the conference.)

I do not know the full meaning of the needed awareness that I perceive, but it probably includes actions such as:

1. Talk "total systems". Perfect knowledge about 2 parts of a 10-point problem with no knowledge of 8 parts will usually result in decision failure. Reasonable effort on all parts is needed.
2. Build and use large computer simulations. Let a particularly obnoxious person with a proposal enter that idea and see what will be an index to all of the consequences -- to him or her and others.
3. Deny the equality of every opinion. One-person; one-vote is silly. Jefferson himself insisted on education as fundamental for democracy. I love Thomas' work but his emphasis on the hump in the curve is probably wrong. Castro was in the tail of the curve and look at Cuba. You cannot talk center-of-the-

population and also leadership. A leader is in the tail of the curve about which Thomas spoke.

4. Work for the new modular manager -- a person (1) better educated in a specialty (2) with a connector or linking thought patten, and with (3) planned, long-term education. Efforts to educate generalists have failed (there are exceptions that do not deny this observation). They are rare and cannot be produced. They emerge over time. Producing generalists is like teaching a pig to sing: It wastes your time and annoys the pig.
5. Several speakers (Petrick, Legg) suggested the need for more information brought to each decision. Holtje argued for multi-group, inter-agency coalitions to improve management. Given the vast needs (tens of thousands of units, diversity of areas and situations, dynamics, costs, and layoffs) alternative ways (other than teams) are needed to use the knowledge now available (e.g., expert systems, models (Meil), and dynamic planning systems).
6. Return to the oldest phrase in education: To believe the message is to believe the messenger. Mr. Ticknor made the point as he emphasized the lack of trust by society of its resource institutions. We all have to work at this national illness that creeps into society from gambling, sports frauds, political failures, and crime on the street or in the office. We are all infected by this evil pathogen.
7. We need to do serious financial analyses. Many forester do not "like economics." Many wildlififers do not even have one course in economics or finance. When only 16% of the regional land base is in federal lands (Aplet) we must think of the other 84% as productive and not just units of "reserved productive forests", not just wood (for that may bankrupt you) but all uses together in a managed, financial, entrepreneurial unit. Only a little over half of all tree-covered land in the U.S. is classed as "timberland". Perhaps it will be wise to work

on sustained profits, not just wood produced, from all of the many (yet unexploited uses) of such tree-covered land.

8. As agencies cut back while needs increase, there will be new roles for action groups, new enterprises, and groups (Heissenbuttel) to meet these needs. There will be less need "to discuss" because these NGO's can move out of many political and regulatory loops and traps.
9. We're trying to get one phrase, "ecosystem management", to do too much work; carry too great a load. Our topics are too numerous, too mixed for it to work. We need 10-20 work groups to (as Giltman said) "carry these concepts across the city limits into urban America." We need to work with out words in a more scholarly way. We cannot plead for more science one day with its increased precision and rigor and wonder why college-educated citizens are amused by "biodiversity", "sustainability", "land ethic", and "forest health" and otherwise meaningless (or at worst confounding) words. Why should "financial analysis" be assumed to be part of "ecosystem management". Why do ecologists spend so much time deriving a precise definition for "ecosystem"? Does it really meaningless to do so? Convinced that people are a factor in primitive ecosystems (Buckner), is it therefore logical that modern vacation homes and logging camps should be included? Viewscapes? Why should the public follow us down such an ambiguous pathway? Stop the emphasis on the ecosystem. Asking scientists to do more science and arguing for a more scientific approach and then using words unscientifically and irrationally will not serve us well. Not just ecology but interactively the 4-E's -- ecology, economics, esthetics, and energetics are needed. A regional strategy (Aplet) will include these. The total system, not forest system, not natural system (Legg), not eco-system but total system is needed. We can now do it. We have new tools.

10. We need to present the limits to the human system. Often called a "scare tactic", the alternative is a positive "score" that can be followed and presented as a synthetic index to every person's question of "how are we doing?"
11. The field demonstration may work well in small local areas (Cutler) but we're talking about work over 80% of the land. And it costs energy and time to get people to demonstrations. Many do not know once they have experienced it what to do with the observations. They have only urban experience. The demonstration has to be taken by TV to the public. We're not talking about educating 2000 kids - merely 300 million children and adults in a parade passing at 3 per second (Rains).
12. We need a new "Rules of Order" (as in "Roberts Rules") for discussion and public involvement. Perhaps incorporating assistance from the courts that allow well-meaning action from trustworthy people to proceed in achieving long term social objectives.
13. We have to separate better the managed land, the owners, and the citizen's role. We badly need to segment our publics. We have many small owners; many not interested in harvests; many having acreage with trees but not ruled as timberland (20 cubic ft/acre/yr)

I was 34 yesterday and now I am 61. I've seen plenty of changes but:

in 1954 I heard the same appeals for more education. 50 years and 50 million dollars later I heard the same yesterday, and today.

in 1964 I heard the need for better understanding of the ecosystem and for cooperative efforts ("partnership") (Foreman, Lynch, McGlincy).

in 1974 I gave 35 public lectures on the population crisis.

in 1984 I heard the appeal for baseline studies and ecological inventories.

in 1984 I heard we have 50 years of oil left.

in 1984 Odum published Systems Ecology (and concern for energy-based modeling of ecosystem wanes).

I've heard it all. The Conference repeats the past but perhaps that is necessary because we are slow learners and we still see no alternative solutions. We've got to do better; not more but new and better. For the sake of the gods, all of them, all of us, and my grandchildren and yours, don't do it all over again.

- Target your work in the decision makers -- don't do general stuff
- Strike at the sensitive points; don't wrestle fat problems.
- Lay aside classical science. Science is great but it is a process; seek knowledge by however you can get it. There is no more money, no more time. Too many species. We must be more like the medical doctor -- single patient, unique, adaptive decide today -- check and revise tomorrow. We've been led astray by the scientific paradigm after Sputnik.
- Use the power of the computer, particularly expert systems and hypermedia.
- Look for and use analogies: the life cycle of yesterday evening (Meil) is isomorphic with ecologic succession of yesterday morning (Buckner).
- Form diverse companies and when demands increase and state and federal servers decrease (as we were told by Thomas), the time may be right for the new varied organization to exploit the gold-horde of knowledge of past research.
- Learn energy budgeting - whole system energy

budgeting and lead society into the fossil-energy short world coming within the life-time of people here.

I have enjoyed being with you. I have learned. I have been stimulated. Now it is time for me - I hope all of you - to go to work, into the woods, lab, mill, and office. We can really do the really important things if we select them carefully, then do them better than in the past. No more discussion -- it is time for thought, decision, and action.

Conference Summary Part II

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Summary

Environmental Issues Affecting the Forestry and Forest Products Industries of the Eastern United States . . ." Where should one start in summarizing a week's conference dedicated to that topic? Well can you imagine Willie Nelson in the background dressed in his normal attire singing "This Land is My Land, This Land is your Land from California to the New York Harbor . . . From the Iowa Farm to the Texas Border . . . This Land belongs to You and Me. From the highway corridors to the cottonwood flowers . . . I love this land . . . this land belongs to YOU and ME . . . There in lies the problem. This week we have heard most aspects of the issue. We have heard the passion in the voices of the speakers as they addressed their environmental concerns. We have heard the audience plea for consideration and fairness . . . It is a matter of choices . . . no-one ever said that the matter of choice was easy . . . Which choice should we make for this land that belongs to you and me? A more basic question might really be . . . does this land really belong to you and me.

One of the objectives of this conference was to provide some answers . . . including a balanced review of the methods and policies used to direct the use of the eastern forest resources over the past fifty years; direction to policy makers in government, industry, and environmental organization for future use of the resource; and strategies we as individuals should undertake to provide management for these lands.

As we develop this strategy, we are to clarify what:

- (1) an environmentally sound forestry operation really is
- (2) identify examples of good cooperation among the many entities
- (3) identify steps needed for improvement

- (4) promote multi-disciplinary research
- (5) promote multi-disciplinary approaches
- (6) provide motivation for organizations to meet and work on compromises
- (7) create more incentives for good practices rather than disincentives

If you stop and think for a moment, you could say this conference was a "success." I'd venture to guess that each one of us will leave having heard something that made us feel good about the way the forest resources were being managed and the cooperative spirit of the different groups and individuals. I'd also venture to guess that each one of us heard something that caused us to raise an eyebrow or even to think "with that attitude" we will never agree on how the resources should be managed.

We did, however, agree on the generalities . . . but the specifics? Well that's another matter. Let's access the situation: We agreed: that environmental issues are here to stay and we have to deal with them. Sustainable development is a good goal; ecosystem management is a good process by which decisions should be made; the only constant is change.

We all want an environmentally sound forestry operation . . . we agreed that there is a need to view the southeastern forest resources in a systematic way . . . ecosystem management . . . an ecological approach . . . natural systems sustainability.

Generally, we agreed that the public needs and desires should be considered; all resources should be valued and private properties rights should be respected.

A happy group right. . . now we can all go home assured that we have reached a consensus and the

forest resources in the eastern United States are managed as we all wished.

Not exactly. There are questions still needing answers. If we are to manage using an ecological approach we need a historical baseline . . . Now history WAS . . . so there is no problem in recreating what WAS . . . is there? Again, we were presented with differing viewpoints about the condition in which we inherited this land and the role of humans as they impacted this land. We saw evidence of having received lands nobody wanted and turning them into old growth ecosystems. We saw evidence of natural phenomena changing dramatically the biological make-up of an ecosystem. The question then becomes who gets to determine the management vision for that ecological unit? What role will the public needs and desires play in that vision?

Often the trust level of the public is low resulting, sometimes, from misinformation . . . sometimes from errors made by the land steward and sometimes just because of the culture of that particular public (only trusting that in which they are familiar). How do we reconcile this disagreement is an issue needing much more work.

Sustainability of the resources was a goal embraced by all. We all echoed the message that there is a need to manage these lands in a manner that will guarantee the existence of these "forest resources" for the next generation. The specifics on the management strategies that will accomplish this and the needed resource balance are, however, still open for debate.

Private property and its role in this whole question of ecosystem management is an area of wide spread concern. Much of the environmental issues are predicated upon concessions of private land owners in achieving strategic management of the forest resources. Private land owners while supporting the stewardship of the land fear the impact upon their landowner rights. Do we provide incentives to compensate landowners for benefits foregone as they provide resources for the "public benefit?" Is

it necessary to utilize regulations to protect the forest resources for the public benefit? Or a more basic question might be is the proposed strategy really for the public benefit or is there an ulterior motive by the environmentalist . . . is it really just an attempt to prevent management of the forest resources . . . or are we really endangering the future of the planet with the manner in which we manage these resources?

Does it sound as if the issues are so complex that there is no solution and the Conference was just another gathering lamenting the impact of environmental issues upon the forest industry? An astounding NO.

This week, we witnessed several examples of strides the timber industry had made in addressing environmental issues and concerns. We saw formal partnerships outlining goals and objectives needed. Included are things such as:

- (1) Maintenance of biological potential of the forest in the East to provide all values.
- (2) Maintaining forest health through natural processes and management practices.
- (3) Collaborative planning among federal, local, and private entities.
- (4) Management based on science while acknowledging emotions (spiritual values).

You have heard that we, all the people, need to be committed to the resources, have a knowledge of the resource, be flexible, and accept change . . . at least some degree of change. There was a strong message of the need to educate the masses and even a stronger message for respecting private property rights.

What can you take away from this conference and commit to helping to achieve the goals or reaching agreements in the areas of dissention?

There is a movement to draft the Farm Bill for 1995. You have indicated a need to have incentives for land-owners to help pay the extra cost of

implementing some of the needed actions. This is an opportunity.

You expressed concerns about the Endangered Species Act . . . not in its intent but its' methods ... it too is being considered for reauthorization.

The Clean Water Act is also up for reauthorization. Another of your interest area.

You indicated you'd like to see good regulations. . . You are the tax payers, you are the voters . . . Both Federal and State agencies listen when you speak.

You stated a concern about the lack of understanding about the forest resources in the Eastern United States as the general public . . . a group of citizens in Florida started a tour allowing tourists to visit the forest and see for themselves what actually happens in a clear-cut operation and why clearcutting is necessary for the long-leaf pine ecosystem.

We have seen evidence of people with different ideologies sitting down over lunch and solving some of the worlds most pressing problems. Could you possibly pick up the phone and start with some-one in your community? Or are you going to leave this conference simply stating these problems, concerns, actions, goals and objectives? can we realize "we are in this together" and commit ourselves to action:

No-one makes a greater mistake than one who does nothing because if would only be a little or as Margaret Meade said it so eloquently "Never doubt that a small committed group can change the world." Before you leave we are asking you to make a commitment. It doesn't have to be earth shattering, it can be as simple as inviting one of the persons you have met here this week to lunch and talk over some of the areas in which you disagree . . . visiting a school and talking to a class about the importance of managing forest resources. Or it can be as time consuming as commitment to work on the reauthorization of the Endangered Species Act. . . Write this commitment on the not page in your program and sign it. Give this along with your

address to Dan Dolan. Dan will check with you to find out how you fared with your pledge. This is what it will take to accomplish the goals of this program and this is what is needed to sustain the forest resources of the Eastern United States for both the environmentalist and the forest products industry.

PROCEEDINGS

TECHNICAL SESSIONS

Eastern Hemlock and the Hemlock Woolly Adelgid in Connecticut: A Challenge to Forest Managers

Christopher Donnelly, Old Post Consulting, Northford, Connecticut

Eastern hemlock (*Tsuga canadensis*) is an important tree species in Connecticut - as a functional component of the forest, as a source of wood and fiber, and as a valued part of the forested landscape. According to the 1985 US Forest statistics, better than 8% of the growing stock volume on the state's timberlands is hemlock (Dickson and McAfee 1988).

Hemlock is threatened in Connecticut's forest, due to the invasion of an exotic insect pest, the hemlock woolly adelgid (*Adelges tsugae*). This small, aphid-like insect, which feeds by sucking the sap of young twigs, was first noticed in Connecticut in 1985 (McClure 1987). The hemlock woolly adelgid kills the trees upon which it lives, usually within 4-5 years after infestation. Although initially the insect was found only near to the coast of central and western Connecticut, it has steadily spread up the river valleys and out across the state. It is predicted that eventually every town in the state will have the adelgid present in it.

Challenges to forest managers

The spread of the woolly adelgid presents challenges to the forest managers of Connecticut. Examples of how the adelgid may affect forest harvesting can be seen in two recent operations in the lower Connecticut River Valley. Each operation occurred during the late fall of 1993 through the spring of 1994, under the supervision of the Madison, Ct. forest consultant team of Ferrucci and Walicki. Each had been infested by the adelgid for about the last 4-6 years.

The first site is located in Haddam, Ct. The owner is a private landowner, whose primary interests are aesthetics and recreation. Most of the harvesting of hemlock has occurred on a 26 acre parcel. Prior to

the infestation, 90% of the volume of this parcel was in hemlock, and the rest in mixed hardwoods. Trees were large, with many of over 30 inches dbh. The pre-harvest volume averaged between 12,000-15,000 board feet per acre.

The foresters and landowner jointly made the decision to remove as many of the hemlocks as feasible in one operation. The choice of a buyer for the sale was guided partly by concerns about the appearance of the site following harvest. A harvest of this degree would be expected to present problems due to slash accumulation, rough logs, small trees and snags. The operator chosen has demonstrated a history of making thorough use of the wood fiber present. On this site he removed both pulpwood and sawlogs. The sale of the latter in Connecticut is somewhat unusual, as pulpwood harvests tend not to be profitable. The main buyer of these pulp logs is in upstate New York; the main buyers of the sawlogs are Canadian. Some 360,000 bd. ft. of hemlock was removed from the 26 acres, with 10-15% of that being pulpwood.

The second site is in Middletown, and is owned by a public utility. Before harvest, it was comparable to the first site in terms of acreage and degree of infestation by adelgid, although the ratio of hemlock to hardwoods and size of the hemlocks were somewhat less. The owner of this property had previously entered into an agreement with the state of Connecticut's Wildlife Division, which permitted hunting on the property under state supervision.

The state wildlife biologists became interested in this site, due in part to their concern that stands dominated by hemlock and infested by the adelgid will convert to hardwoods. According to the 1985 Forest Statistics (Dickson and McAfee 1988), forest types in which conifers dominate make up less than 14% of the timberland in the state. Hemlock is a

major contributor to those forest types. These biologists are concerned that the loss of hemlock will have a deleterious impact on wildlife, including such known hemlock users as songbirds, owls, white-tailed deer (*Odocoileus virginianus*), red squirrel (*Tamiasciurus hudsonicus*), turkey (*Meleagris gallopavo*), and ruffed grouse (*Bonasa umbellus*).

Peter Picone of the state Wildlife Division has designed an experiment on this second site that involves leaving various degrees of the existing overstory, and planting conifers seeds and seedlings. The seedlings planted are Norway spruce (*Picea abies*), red spruce (*P. rubens*), and eastern white pine (*Pinus strobus*); the seeds are of the same species, plus western hemlock (*Tsuga occidentalis*). The survivorship of these planted conifers will be monitored, as will their use by various kinds of wildlife.

Analysis of pollen records in central Massachusetts performed at the Harvard Forest lends justification to the expectation that hardwoods will replace hemlock in many of the current hemlock stands (Foster and Zebryk 1993). In recent centuries, American chestnut (*Castanea dentata*) has responded most aggressively to hemlock disturbance; a pattern that is highly unlikely today. On these two sites, observations during the summer of 1994 suggest that the excellent acorn crop of the previous fall may help the various oak species (*Quercus* spp.) gain early control of these sites.

Challenges to hemlock buyers

The bulk of the sawlogs off of the first site were shipped to Canada, for processing into dimension lumber, while the all of the hemlock off of the second site was shipped to Rhode Island, for conversion into industrial and construction lumber. Movement of raw hemlock materials out of the forest does raise some concerns. One of McClure's findings is that the movement of eggs and first instar crawlers can lead to dispersion of the adelgid (McClure 1990). It is possible that the transport of

forest materials could accelerate the spread of the insect.

Since 1988, the northern New England states of Vermont, New Hampshire and Maine have sought to limit the spread of the hemlock woolly adelgid across their borders by imposing quarantines on the shipment of hemlock from states with active adelgid populations. Interestingly, these quarantines do not restrict the movement of loaded log trucks passing through these states to Canadian hemlock markets, providing the trucks do not stop en route.

More recently, the Connecticut State Entomologist has been working on Memoranda of Understanding with his counterparts in the northern New England states. These MOU's seek to take into account the biology of the insect and legitimate efforts at its control in a way that balances forest health concerns and economic considerations. The State Entomologist proposes to issue phytosanitary certificates, permitting free movement of hemlock logs, if one of the following conditions are met: the logs are from an area of the state free of infestation; the logs are harvested and shipped between August 1 and February 28, when crawlers are unlikely to be present; logs are debarked prior to shipment; or the logs are properly treated with an approved pesticide prior to shipment.

The issuance of a certificate would be contingent on an inspection. The implementation of these MOU's is currently being negotiated.

The future

Most people hope that natural controls for the hemlock woolly adelgid will arise. The record cold of this past winter may have caused a reduction in the adelgid population in Connecticut - good news if true for the forests of northern New England. Dr. McClure has been investigating several potential biological controls, including an oribatid mite he collected during a field trip to the native range of the adelgid in Japan. The results appear to be positive.

Discussion points

Handling the effects of the hemlock woolly adelgid raises several questions for forest managers in the state. Among these questions are:

How should forest landowners deal with the effects of the adelgid, and with the widespread mortality associated with the insect? Is this a profound shock to the ecosystem that warrants an intensive response? Is this a unique opportunity that can allow unexpected income from salvage harvests to be used to increase and improve the level of forest management?

If the hemlock woolly adelgid is going to cause hemlock stands to convert to hardwood stands, are silvicultural efforts to counter that trend, by creating stands dominated by conifers, practical, and are they worthwhile? Are there benefits to wildlife?

Is the introduction of non-native coniferous species (eg, Norway spruce, red spruce, western hemlock) desirable? Does the introduction of a non-native pest warrant the search for a non-native answer? In the past, outlets for Connecticut softwood have been fairly limited. In fact, hemlock was often called a dog in the woods - hard to sell and hard to be rid of. Whether it is the increased availability of hemlock or events affecting sources of softwood supply worldwide, there is an increased interest in Connecticut hemlock. How should Connecticut forest landowners and foresters deal with this new-found interest in their wood? Can this be used to re-evaluate the practice of forestry in the state?

The shipment of hemlock logs raises the risk of accelerating the spread of the hemlock woolly adelgid. How great is this risk, and how effective are the efforts that seek to minimize it, including quarantines and the agreements covered in the individual Memoranda of Understanding?

References cited

- Dickson, D. R. & C. L. McAfee. 1988. Forest Statistics for Connecticut - 1972 and 1985. Resource Bulletin NE-105, USDA Forest Service, Broomall, Pennsylvania
- Foster, D. R. & T. M. Zebryk. 1993. Long-Term Vegetation Dynamics and Disturbance History of a Tsuga-Dominated Forest in New England. *Ecology* 74(4), 982-998
- McClure, M. S. 1987. Biology and Control of Hemlock Woolly Adelgid. Bulletin of the Connecticut Agricultural Experiment Station 851, New Haven, Connecticut (out of print)
- McClure, M. S. 1990. Role of Wind, Birds, Deer, and Humans in the Dispersal of Hemlock Woolly Adelgid. *Environ. Entomol.* 19(1): 36-43.

Public-Private Partnerships for Ecosystem Management of Longleaf Pine Forests: A Research Agenda

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Abstract

Longleaf pine forests once occupied vast areas of the southeastern coastal plain of the United States. Today, only small fractions of this once-extensive forest type remain. Recent mandates for ecosystem management present a unique series of opportunities and challenges for people interested in stewardship of longleaf pine forests. We know relatively little about how ecosystem processes have shaped longleaf pine throughout history. The scope of these challenges and opportunities is far greater than what can be accomplished by any single agency or non-governmental organization. Therefore, we designed a series of collaborative and cooperative research initiatives to address what we believe are key concepts that pertain to informed, ecosystem management and restoration of longleaf pine forests.

Introduction

The Problem

Longleaf pine (*Pinus palustris*) forest once covered nearly 70 million acres of the southeastern coastal plain of the United States. Today, less than 5 million acres of this important southern pine forest type remain. The vast majority of remnant longleaf stands are second-growth. Examples of old-growth longleaf pine stands are extremely rare; a total of

about 2,000 acres of these ancient stands remain; most are scattered as small fragments throughout the landscape. Despite recent concerns expressed over the recent declines of temperate and tropical rain forests, a far greater proportion (99.9+%) of original longleaf forest has been lost.

The widespread loss of original longleaf forest is especially problematic because we need examples of such ancient stands to understand how this forest originally functioned. Such information is crucial if principles of ecosystem management are to be applied in an informed manner. Certain aspects of longleaf pine forest ecology can, however, be pieced together from the early natural history and forestry literature, records from early settlers, and observations from remnant old-growth stands. For example, we know that longleaf pine forests are among the most fire dependent forest types in the world; naturally-recurring fire regimes regularly burned most original longleaf forests on a frequency of 2-7 years. The natural structure of longleaf stands resembles a classic, open canopy park-like forest maintained by fire. Scores of vertebrates and hundreds of plants have co-evolved with longleaf pine and the frequent fires that burned the understories of these forests through the millennia.

The widespread suppression of wildland fires in longleaf has seriously compromised the integrity and health of this system. For example, of the

remnant stands of longleaf suffer from midstory hardwood encroachment. Additionally, endemic vertebrates such as the red-cockaded woodpecker, gopher tortoise, indigo snake, and Bachmann's sparrow have suffered widespread declines as a function of fire suppression and type conversion in longleaf pine.

The strategy

Given the scope of the problems described above, it is clear that no single organization or agency can conduct a comprehensive program of applied, land management research for longleaf pine. Such a program is, however, needed to produce the body of reliable knowledge required by people who want to apply ecosystem management concepts to longleaf pine. Clearly, cooperative research partnerships between and among public agencies and private organizations are necessary to meet contemporary longleaf pine research objectives at both local and landscape scales. To this end, we have undertaken a series of cooperative research partnerships to conduct research projects on key aspects of longleaf ecology. The purpose of this paper is to describe these projects. Perhaps they may serve as models for similar research partnerships for research on environmental issues and forest management elsewhere in the eastern United States.

The projects

Season-of-burn effects

Historically, the natural fire regime that shaped the ecology of the original longleaf stands most frequently occurred between April and September. Since the turn of the century, however, most applications of prescribed fire in longleaf have occurred during February and March. One of the truly unique features of longleaf pine forests is that fire can be applied to the landscape during virtually all months of the year. Dormant-season fires, while easy to prescribe and manage, do not typically have sufficient intensity to kill the encroaching

hardwoods that will eventually invade the longleaf midstory. During the past half-century, most forest managers have been reluctant to apply lightning-season fires in longleaf and other southern pine forests because of fears that such a burning regime will harm ground-nesting birds, and native legumes that provide key food resources for upland game birds.

Three of us (Brennan, Engstrom and Hermann) have initiated a study to examine how dormant and lightning-season burning regimes influence the distribution and abundance of terrestrial vertebrates in stands of longleaf pine of the Apalachicola National Forest in the Florida panhandle. This work is funded by the National Fish and Wildlife Foundation in cooperation with the National Forests in Florida. We hope to secure additional funding for replicate sites in the Red Hills physiographic province along the border of Georgia and Florida, and in the Sand Hills of eastern North Carolina.

Restoration of longleaf stands by removal of midstory hardwoods

Lack of regular lightning-season fire has resulted in hundreds of thousands of acres of mature, second-growth longleaf that have extensive hardwoods throughout the midstory of the tree canopy. Numerous opinions exist about the "best" ways to remove midstory hardwoods and thus restore these stands to a structure that is more characteristic of natural longleaf stands. Three of the most commonly applied methods to achieve this management goal are 1) application of herbicide, such as velpar, 2) mechanical removal with on-site chipping for pulp wood, and 3) application of lightning-season fire.

Three of us (Hardesty, Provencier and Brennan) are cooperating with other Nature Conservancy and Eglin Air Force Base personnel on a manipulative field experiment to test how the three restoration strategies described above influence plants, arthropods and birds in experimental stands.

Red-cockaded woodpeckers and uneven-aged forest management

The endangered Red-cockaded Woodpecker (RCW) exists in relatively large numbers on private lands managed for bobwhite hunting in the Red Hills of southern Georgia and northern Florida. The Red Hills RCW population represents the sixth largest population of this bird anywhere, and the largest population now remaining on private land. Most of the longleaf pine forests that support RCWs in the Red Hills are managed with uneven-aged silviculture and single-tree selection. These lands have produced a constant stream of timber and other forest products over the past 60 years, while at the same time have maintained apparently healthy populations of RCWs.

Curiously, many areas of public lands in the southern U.S. that contain RCWs are not available for logging because large-block clear-cuttings are detrimental to the RCW. We believe that the type of uneven-aged management practiced in the Red Hills may be applicable to certain areas of public land in Florida, and perhaps elsewhere.

We (Brennan, Engstrom and Hermann) have therefore designed a manipulative field experiment to test what happens to the annual productivity of RCWs when their the structure of their resident stands are shifted from an even to an uneven-aged silvicultural regime. Like the initial phase of the season-of-burn project, this project is being conducted on the Apalachicola National Forest, and is being supported by the National Forests in Florida and the National Fish and Wildlife Foundation.

Enhancement of communication

For management to be effective, research results must be effectively communicated from the researcher to the practitioner. Since the early 1960s, Tall Timbers Research Station has published a series of 17 conference proceedings on fire ecology. These proceedings have played a key role in

communicating the importance of fire as an ecosystem process. Originally, the Tall Timbers Fire Conference Proceedings were the exclusive domain of the Research Station. The two current proceedings, both of which are in press, will be the product of a cooperative arrangement between Tall Timbers, The Nature Conservancy Fire Management and Research Program (Directed by Ron Myers) and the southeastern region of the U.S. Fish and Wildlife Service (Regional Fire Ecologist Frank Cole). Both Myers' and Coles' programs are based at Tall Timbers Research Station.

Other related initiatives

Restoration of pyrogenic native grasses

Florida Gas Transmission Pipeline Co. and the Florida State Division of Forestry have administered a project with Hermann to perform a series of experiments to determine the most effective and economical ways to restore native, pyrogenic grasses to gas transmission pipeline corridors.

Northern bobwhite habitat ecology

Plantation owners in the Red Hills of southern Georgia and northern Florida are passionate about hunting northern bobwhites. They are currently supporting a major research initiative to address a series of questions that pertain to factors that regulate bobwhite numbers. Brennan is principal investigator of this project.

Monitoring prescribed fire effects

A standard, comprehensive method for assessing the effects of prescribed fires has been developed for western regions of North America, and may be applicable to fire-maintained systems of the southeast. Hermann and Cole are collaborating on this project, which is being supported by the U.S. Fish and Wildlife Service.

Synthesis: The advantages of cooperation

Cooperative, interdisciplinary studies are clearly needed to provide the reliable knowledge needed for the informed management of forest resources. Longleafpine forests are no exception to this axiom. In fact, the numerous management problems faced by people interested in longleaf stewardship present classic opportunities for integrated, interdisciplinary studies.

The collaborators for the projects described here bring expertise in fire ecology, ornithology, plant ecology, entomology, forest policy, and wildlife management to each of these investigations. Clearly, these partnerships represent a collaborative arrangements where the whole has a greater potential to produce useful research products than the sum of the individual parts.

Suitability of Softwood Boiler Ash for Inclusion in a Rubbish Landfill

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Abstract

To reduce power cost and solid waste volume, forest products industries rely heavily on wood-fueled boilers. The residue from this process, ash, has recently drawn increased attention from state and federal environmental agencies. Frequently, these governmental entities conclude that wood ash is too toxic for current disposal methods or company owned landfills, and recommend more stringent disposal criteria. The purpose of this study was to ascertain if any environmentally pernicious results could be expected if the ash were to be applied to a rubbish landfill or, alternatively, land-farmed.

The data used in the study were from TCLP tests performed on softwood ash obtained from a southeastern forest products company. Results of this study indicate the toxic leachate potential for either solid, semi-solid or liquid samples to be negligible. Therefore, the inference can be made that no harm would be posed to the environment if this ash were applied to the top soil. This further suggests that either rubbish landfilling or land-farming should be acceptable means of ash disposal.

Introduction

Softwood ash disposal has recently become an important issue within the forest products industry. Currently, many southern wood products industries use a softwood-fueled boiler to reduce power costs and solid waste volume. Recently, environmental agencies in Mississippi have specifically stated that the resulting ash should not be included in a rubbish site. The basis for this decision was that this material is too toxic for inclusion in such a low-risk

facility. This will result in higher operating expenses due to the cost associated with ash disposal in a more stringently-regulated landfill. The purpose of this study was to determine if any environmentally harmful results could be expected if softwood ash were applied to a rubbish landfill or, alternatively, land-farmed.

Background

Landfill types and operating expenses

Several types of landfills exist under the guidelines promulgated by regulatory agencies. Each type of landfill has regulations that govern the type of waste that can be accepted, necessary geological conditions, maintenance and groundwater monitoring, etc. There are four recognized landfill classifications: hazardous, sanitary, special/industrial, and rubbish landfills.

Hazardous waste landfills are operated under strict guidelines that allow little flexibility. Hazardous facilities can accept one or several of the following: carcinogenic, infective, mutagenic, toxic and radioactive wastes. The regulations governing these facilities will not permit the natural geology to suffice for the landfill liner, and a synthetic liner has to be used. Equipment must be in place to capture (and in some cases to treat) storm-water runoff and leachate. A groundwater monitoring system must also be installed to ensure that contamination does not occur.

Sanitary landfills, which accept household wastes, are also highly regulated. A synthetic liner must be installed and the geologic conditions of the site have to meet certain criteria to be acceptable. Additionally, equipment must be in place to collect,

and in some cases treat, the leachate formed by rainfall percolating through the landfill. Regulations also require the waste to be covered daily and a monitoring system to be installed to continually observe groundwater quality. Upon closure of the facility, a network of piping must be installed to vent the gases formed from waste degradation.

Special/industrial landfills can vary in regulatory complexity depending on the waste produced by the industrial entity. In some cases, a liner and a leachate collection system will be required. Operators may propose the use of an alternate liner system (e.g., in situ clays, recompacted clays, etc.). If an alternate liner will be used, it must be demonstrated that the liner system will offer adequate protection to regional groundwaters and surface waters. Groundwater monitoring systems may be required of these facilities, again, depending on the waste to be disposed of. Regulations additionally require the waste to be covered daily in most cases.

Rubbish sites are classified as Class one or Class two. Class two landfills can accept natural vegetation, mortar, brick, concrete, stone and asphalt for disposal. Class one sites can accommodate all the waste allowed in class two sites plus wood, sawdust, wood shavings, wood chips, furniture, plastic, glass, metal, cardboard and appliances (other than refrigerators and air conditioners) which have had the motor removed. Regulations require the liner to consist of adequate naturally-occurring geologic materials and to be present immediately below the disposal area and on all sidewalls. Such materials shall generally consist of clay, silty clays, or other soils which have an average hydraulic conductivity of 1×10^{-6} cm/sec or less. Also, the rubbish shall be managed so that it shall not become windblown, and an earthen cover shall be applied to the waste approximately every two weeks.

Land farming

Land farming is the process by which the waste (ash in this case) is incorporated into the top soil.

Regulations require that land application sites be located in a hydrologic section where the historic high water table is at a safe depth below the zone of incorporation. Additionally, waste must be applied uniformly and incorporated into the soil during or immediately following its application. Incorporation should normally be accomplished by disking or plowing until the waste is adequately turned under the soil or thoroughly mixed. An additional requirement is that the soil pH shall be maintained at or above 6.5. Currently no loading rates exist that specifically pertain to ash. Therefore, state officials have suggested the use of regulations that apply to sewage sludge such as; the maximum plant available nitrogen levels listed in Table 1 and the maximum cumulative heavy metal loading rates listed in Table 2 which hinge on the cation exchange capacity of the soil.

Experimental procedure

A representative softwood ash samples was collected with the cooperation of a mill site in the southeastern U.S. and sent to an independent laboratory for analysis. Toxicity characteristic leaching procedure (TCLP) tests were performed to assess the mobility of organic and inorganic constituents in the waste. The abbreviated TCLP test procedure is as follows:

- 1) If the waste contains 0.5 % or greater solids, the liquid is filtered and retained. The solid phase is reduced in size if necessary and extracted with 20 times its weight using an extraction fluid (the extraction fluid used is a function of the alkalinity of the waste). Following extraction, the waste is filtered through a 0.6–0.8 micron filter.
- 2) If the retained liquid and the filtered extract fluid are compatible, (i.e. miscible), they are combined and analyzed as one. If not, they are analyzed separately and the results are combined to yield a volume-weighted average concentration.

Results and discussion

TCLP test results report the metal concentrations in our leachate samples (that could result under adverse conditions) in milligrams per liter. As can be seen from Table 3, the metal concentrations were very low. Comparatively, the metal concentrations in this softwood ash are less than one-tenth of the hazardous waste regulatory levels (see Table 4.) Additionally, the metal concentrations reported by TCLP analysis are in the same range as the metal concentrations allowed by drinking water standards (also in Table 4.) The only elevated characteristic reported by the analysis was the pH, which is inherent to all ash.

As noted above TCLP test results indicate metal concentrations to be below one-tenth of hazardous levels. A Mississippi state environmental administrator stated that, as a rule of thumb, his agency considers material to be environmentally safe if toxic concentrations are below the one-tenth level. If soil borings prove the site to be geologically acceptable, the relative toxic concentrations, coupled with the close relationship between drinking water standards and the TCLP results indicate that this material should be allowed to enter the company's rubbish site. The only issue that needs to be addressed is the elevated pH of this material.

An elemental analysis should be performed on the ash to determine land farming applicability. As noted earlier, loading rates for this material depend on the cation exchange capacity of the soil and the concentrations of metals in the waste.

Conclusions

If the softwood ash analyzed for this study is typical of that resulting from softwood-fired boilers throughout the south, there should be no significant technical challenges involved in the disposal of this material in a rubbish landfill. It would be prudent, however, to verify the TCLP for each mill site before assuming that the all ash properties are similar to those found in this investigation (which is,

admittedly, limited in scope). If land farming is contemplated, additional analyses must be conducted to verify the metals content so as not to exceed the loading rates stipulated by regulatory agencies.

Table 1. MAXIMUM PLANT AVAILABLE NITROGEN LEVELS TO BE APPLIED TO CROPLANDS

<u>CROP</u>	<u>MAXIMUM P.A.N. (LBS/AC/YR)</u>
Bahia grass	160
Bermuda grass	300
Fescue	120
Grain sorghum	180
Silage sorghum	300
Millett	150
Rye grass	220
Alfalfa, clover, vetch	450
Cotton	180
Corn	240
Soybeans	300
Wheat	135

Table 2. MAXIMUM CUMULATIVE HEAVY METAL LOADING RATE TO BE APPLIED AT LAND APPLICATION SITES

	CEC* <5		CEC* 5-15		CEC* >15	
	kg/ha	(lb/ac)	kg/ha	(lb/ac)	kg/ha	(lb/ac)
Lead (Pb)	500	(455)	1000	(890)	2000	(1780)
Zinc (Zn)	250	(222)	500	(445)	1000	(890)
Copper (Cu)	125	(111)	250	(222)	500	(445)
Nickel (Ni)	125	(111)	250	(222)	500	(445)
Cadmium (Cd)	5	(4.4)	10	(8.9)	20	(17.8)

*CEC - Cation Exchange Capacity, meq/100

Table 3. SOFTWOOD ASH TCLP RESULTS

COMPONENT
CONCENTRATION (mg/l)

Arsenic	<0.20
Barium	1.6
Cadmium	0.021
Chromium	<0.050
Lead	<0.20
Selenium	<0.50
Silver	<0.010
Mercury	<0.020
Phenol	<0.050
pH	11.45

Table 4. TCLP TEST RESULTS AND COMPARISONS

COMPONENT	TCLP ASH <u>mg/l</u>	ONE-TENTH DRINKING HAZ. LEVEL <u>mg/l</u>	WATER <u>mg/l</u>
Lead	<0.20	0.5	0.05
Mercury	<0.020	0.02	0.002
Cadmium	0.021	0.1	0.01
Arsenic	<0.20	0.50	0.050
Barium	1.6	10	1.0
Chromium	<0.050	0.50	0.05
Selenium	<0.50	0.10	0.01
Silver	<0.010	0.50	0.05

Factors Influencing Material Substitution in the United States Pallet Industry

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Abstract

The grocery industry is one of the major markets for wood pallets. This industry uses approximately 20 percent of the wood pallets produced in the United States. However, current trends suggest that this reliance on wood pallets could be changing in response to unacceptably high materials handling costs. For some grocery distributors, the use of substitute material pallets (plastic, corrugated, and wood composite pallets) is one approach for reducing these costs. The objectives of this study were to quantify substitute material pallet use for shipping goods downstream from grocery distributors to customers, to investigate the reasons for use of substitute material pallets, and to predict trends in substitute material pallet use by the industry. One hundred percent of the responding companies were using solid wood pallets in 1994. Responding companies indicated that they plan to increase their use of alternative material pallets by 1997. Plastic was the dominant substitute pallet material. In terms of overall performance, respondents perceived plastic pallets to be superior to solid wood, wood composite, and corrugated pallets. Respondents considered cost per use, durability, employee handling safety, and quality to be the four most important factors when choosing a pallet to be sent downstream. On all four of these factors, respondents rated plastic pallets to be superior to solid wood pallets.

Introduction

The solid wood pallet is used by many industries including the grocery industry. The grocery industry

is a major market for solid wood pallets because of the quantity of pallets used. In 1985, the grocery and related products industry purchased 42 million standard 48 by 40-inch GMA (Grocery Manufacturers of America) solid wood reusable pallets (Anderson 1987).

However, current trends suggest that the grocery industry's reliance on wood pallets could be changing in response to high product handling costs (Anonymous 1989). These unacceptably high costs (whether real or not) are a signal that the traditional solid wood pallet is falling short of meeting the grocery industry's needs. To satisfy these unmet needs, some grocery distributors are investigating and even turning to alternative product handling devices (e.g., plastic, corrugated paperboard, and wood composite pallets). The United States Department of Commerce, International Trade Administration (1992) also reported that alternative shipping materials (including slipsheets, plastic, and metal pallets) have been pressuring sales of traditional wood pallets.

Unfortunately, very little information is available on pallet material substitution in the grocery distribution industry. If the hardwood pallet is to remain the dominant force in the increasingly competitive grocery pallet market, producers must be aware of the factors influencing material substitution and be prepared to meet the changing needs of pallet consumers.

Methods

The study focused on the downstream shipment of goods, from distribution center to the retail store.

Grocery distributors involved in company pallet decisions were surveyed through mail questionnaires and interviews. Of the 444 questionnaires mailed nationwide, 245 were usable resulting in a response rate of 55 percent.

Results and conclusions

Respondents were asked to indicate the types of pallets (solid wood, plastic, corrugated paperboard, and wood composite) they were currently using in 1994 and projected use in 1997 (Figure 1). One hundred percent of the surveyed grocery distribution companies used solid wood pallets to send groceries downstream to their customers in 1994. Plastic was the dominant substitute pallet material used by 22 percent of the respondents in 1994.

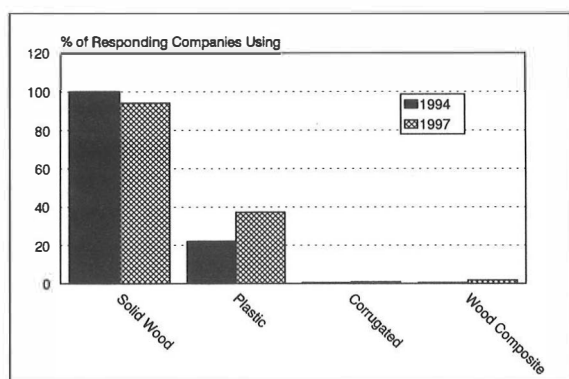


Figure 1. Reported 1994 and estimated 1997 rates of use for selected pallet types by grocery distributors.

Figure 1. Reported 1994 and estimated 1997 rates of use for selected pallet types by grocery distributors.

In the next 3 years, the percent of surveyed companies planning to use solid wood pallets to ship goods downstream is predicted to decrease slightly to 94 percent. Over the same period, responding companies indicated that they plan to increase their overall use of alternative material pallets (Figure 1). Plastic also is predicted to be the dominant substitute pallet material. By 1997, 37 percent of the responding companies indicated that they would use plastic pallets.

Respondents assessed the relative importance of specific factors when choosing a pallet to ship goods downstream to their customers by rating them on a scale from 1 (low importance) to 7 (high importance). The four most critical factors reported by respondents included cost per use, durability, employee handling safety, and quality; however, the four least critical factors noted by respondents included ability to nest, ability to sanitize, weather resistance, and fire resistance. On all four of the most critical factors, respondents rated plastic pallets to be superior to solid wood pallets.

Respondents were asked to rate the overall performance of various pallet types on a scale from 1 (very poor performance) to 7 (excellent performance). Mean scores were collected for each pallet type by averaging performance scores across respondents. Plastic pallets were perceived to have the best overall performance while corrugated paperboard pallets were perceived to have the worst overall performance (Figure 2). Advantages of solid wood pallets as reported by respondents include "availability," "multipurpose," and "repairability," while disadvantages include "easily damaged," "short life," and "high repair and replacement costs." The advantages of plastic pallets as reported by grocery distributors include "overall savings," "cut costs in repair, sorting, and labor," and "safe for the selector."

Respondents rated various pallet types on nine factors (initial cost, durability, recyclability, ability to sanitize, environmental friendliness, cost per use, disposal cost, quality, and employee handling safety). Differences in agreement scores for each pallet type (solid wood, plastic, corrugated paperboard, and wood composite pallets) were examined on the nine factors. Respondents perceived plastic pallets to be superior to solid wood pallets on all factors except low initial cost.

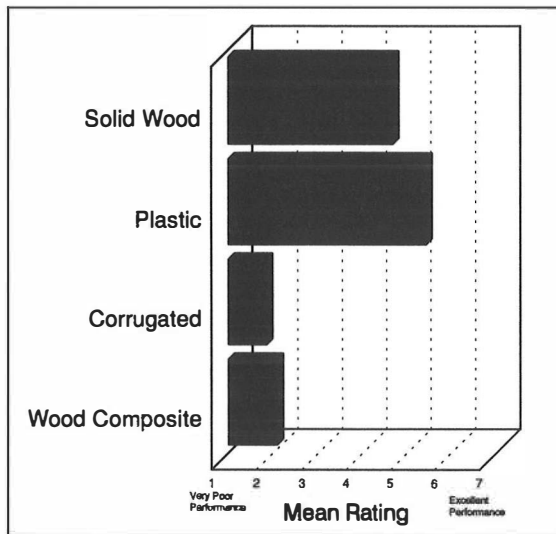


Figure 2. Perceptions of selected pallet types on overall performance for downstream shipments of groceries.

Literature cited

1. Anderson, B. R. 1987. Pallet use in the grocery industry. *Pallet Enterprise* 6(6):20-23.
2. Anonymous. 1989. Review of costs to operate the grocery industry
3. USDC International Trade Administration. 1992. U.S. industrial outlook '92, International Trade Admin., Washington, D.C.

Interpreting Forestry to the Public: Master Planning the Forest Stewardship Center at Conway Robinson Memorial State Forest

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Abstract

Interpretive programs at public or private forests present a special opportunity to inform the general public about forest stewardship and the sustainable use of forest resources. To enhance visitor enjoyment and recall, program elements must be organized into a clear and well defined storyline. An interpretive paradigm focusing on the general themes of forest history, forest ecology and forest management can utilize a forest's natural and cultural attributes and management activities to present a message of forest stewardship. The Master Plan for a Forest Stewardship Center at the Conway Robinson Memorial State Forest, Prince William County, Virginia, uses this approach to organize interpretive stations with diverse, but linked content, into a system of trails for guided or self directed visitor use. A short introductory loop provides an overview of the three knowledge areas and connects the visitor center building to the three main trails. The forest history loop covers the topics of subsistence, indigenous site inhabitants, colonial settlement and farming, the civil war, reversion to forest, and growing urban and suburbanization.

The forest ecology loop focuses on diversity, inter-relatedness, cycles, stress and systems. Sustainability, silviculture and multiple use make up the forest management trail message. Interpretive stations emphasize one of these three areas, but each station contains related secondary messages.

Forest setting and history

The 440 acre Conway Robinson Memorial State Forest (CRMSF) contains mature and immature hardwoods, pine-hardwoods, pine plantations,

prehistoric and historic sites, rare plants and attractive wildflowers, streams and rolling topography. The CRMSF is located 1500 feet east of the intersection of Route 29 and Interstate Route 66 in Prince William County, Virginia. The Forest is slightly more than one mile west of the Manassas National Battlefield Park, and 30 miles west of Washington, D. C. While currently surrounded by undeveloped land, the local area is experiencing significant development. Over 1,400 housing units are approved for construction immediately west of the Forest. Land across Route 29 from the Forest is designated on the County Comprehensive Plan for regional retail and commercial development.

On February 14, 1938, CRMSF was conveyed to a precursor of the Virginia Department of Forestry. The donor organization gave the land in tribute to its namesake, the founder of the Virginia Historical Society. A covenant signed at the same time stipulates that the land be administered as a State Forest and Wild Flower and Wild Life Preserve and states that land then in forest should remain so except "as it may be desirable to cut for the purpose of eliminating fire hazards, improving the growth and development of other nearby trees or vegetation, or eliminating dead, decayed, or unsightly growth." (Dean 1956).

Forest resources

Approximately 431 of the CRMSF's 440 acres are now forested, including areas recently harvested and replanted or naturally regenerated. The forests can be divided into two general types, those which were extant prior to the gift of the site to the Commonwealth, and those which were unused or abandoned farm fields and which were planted by the state beginning in 1939. The former, consisting largely of upland hardwoods and mixed pine-

hardwoods are found in the western two-thirds of the site. Individual mature oak trees range in age up to 250 years old, dating back to the site's earliest settlement and cultivation in small farms. The latter pine plantations are to the east. Plantings of loblolly and white pines were accomplished with Civilian Conservation Corps help in the 1930s. The balance, approximately 9 acres, is an open "savannah" at the picnic area directly off Route 29, and the open field of a gas transmission right-of-way easement.

Detailed timber stand information has been collected periodically to support development of forest management plans. The most recent survey occurred prior to the preparation of the 1984 Management Plan. In general, timberlands were mature to over-mature, exhibited poor growth rates, overstocking, and high levels of mortality (Warner 1984). Table 1 was developed from this data and updated to reflect more recent harvests, planting and regeneration. Commercial harvests have been limited due to forest size, deed restrictions, and small local market.

The Forest contains a great variety of other natural and historic features. Three rare plant species have been identified on site, and the forests have entertained visitors with masses of flowering trillium, Virginia bluebells and other wildflowers. A rock outcrop overlooking the Little Bull Run floodplain on the north boundary may have provided shelter to the site's earliest inhabitants. More recently this area has served as a nesting site for black vultures. Historic road traces, and the Manassas Gap Railroad roadbed, abandoned before the civil war, describe the regions initial transportation system and commercial growth. Old homestead foundations, remains of rock walls and a standing chimney testify to the Forest's gradual reversion to fallow land and forest. Historic markers celebrate early stewardship efforts of the Virginia Garden Club and the Daughters of the American Revolution. Another marker notes the site of an historic civil war meeting between Confederate generals Lee, "Stonewall" Jackson and Longstreet at the Battle of Manassas.

The market for an educational program

Over 1.6 million people live within a one hour drive of the CRMSF. The number of school age children within this area is expected to increase from 257,000 in 1993 to over 331,000 public school students by the year 2,000 (Center for Public Service 1992). Results of a survey conducted as part of the planning effort indicate that students within the market area now travel up to 60 miles for a natural history oriented field trip. Local county park systems, the Northern Virginia Regional Park Authority, the Virginia Department of Conservation and Recreation, Division of State Parks and the National Park Service all operate nature centers or visitor centers with interpretive natural programs within the greater market area. None focus specifically on forest resources. While adjacent states provide a number of facilities devoted to explaining forest history and forest ecology to the public, Virginia offers no similar opportunity (Fahl 1983). The ability of the Conway Robinson Memorial State Forest to offer a specialized and identifiable program will make it a strong candidate to attract visitation by school groups, particularly in the grades K through 8.

Table 1:

Age Class	Short-leaf Pine	Loblolly Pine	Virginia Pine	White Pine	Mixed Pine	Pine Hard-wood	Upland Hard-wood	Bottom-land Hard-wood	Bald-cypress	Total
1-19	1.3	8.3		2.4		0.8	5.2		2.1	20.1
20-39		10.6		3.5						14.1
40-59		58.0	5.4	13.2	8.5	30.5		20.2		105.3
60-79			6.1					11.6		48.2
80+			16.8				221.7	5.0		243.5
Total Acres	1.3	76.9	28.3	19.1	8.5	31.3	226.9	36.8	2.1	431.2

Interpretive program

Creating an informative, enjoyable program which encourages repeat visitation requires that it focus on a specific and well defined message. The recommended interpretive mission for the CRMSF is based upon forest stewardship, and designed to inform visitors of all ages about forest stewardship and the sustainable use of forest resources. Stewardship requires knowledge of forest ecology, forest history, and forest management. These three interrelated themes reflect the important characteristics of the CRMSF and provide an opportunity to utilize the Forest's unique resources as interpretive settings.

Natural and cultural features deliver ecological and historical messages. Extent forest stands illustrate different stages of forest succession and the implications of forest management. Interpretive stations emphasize history, ecology, or management, but always contain related secondary/tertiary messages. In some cases landscape and forest management techniques will be used to communicate important ideas regarding stewardship.

Like many Piedmont forests, the CRMSF provides ample evidence of sustained human influence. Interpretive messages on forest history will highlight the effects of subsistence, indigenous people, colorists, homesteading, plantations, Civil War, reversion, donation to the Department of Forestry and urbanization.

The ecology of the CRMSF reflects different forms of continuing human influence such as clearing,

harvesting, changes to soils and hydrology. The message of forest ecology will illustrate that forests have basic biophysical requirements and that forest organisms are interrelated. Cyclical forest processes such as succession, evapotranspiration, and nutrient transfer will be illustrated through interpretive signage and programs. The message will stress that the diversity at the CRMSF forest depends upon both biophysical and human factors.

The management message of the CRMSF will stress that forests provide useful products and services, and that humans have used forest resources for a long time. Forestry is the scientific practice of managing these forest resources. The CRMSF and all forests can be managed for various objectives and multiple uses with sustainability as an important goal of stewardship.

Interpretive facilities

The Visitor Center serves as the starting point and terminus for a system of paths linking interpretive stations located throughout the forest. Thirteen interpretive stations will be linked by existing and proposed forest roads and trails. A one-third mile loop near the Visitor Center, the Growing Forest Trail, provides an easily understandable introductory presentation of forest stewardship, touching upon history, ecology and management (including forestry and forest product) themes, expressed through three interpretive stations. This path, which will be paved and fully accessible, is particularly suited to school groups of younger children and to those with limited mobility, or

limited time to spend in the Forest. Figure 1, the Visitor Center Site Plan, illustrates these facilities.

From the Visitor Center and introductory trail, visitors will select from three additional self guiding trails focusing on forest history, forest ecology or forest management. A series of outdoor interpretive stations linked together by paths provide the key interpretive messages. Interpretive messages target visitors of diverse age and education levels, but primary school age children will be a major audience. Interpretive settings are designed for compatibility with existing environmental education curricula such as Project Learning Tree, Project Wet, and Project Wild.

An interpretive station is a natural or cultural setting within the forest possessing interesting physical characteristics. It may be an existing stand of timber of a particular age and type, or a habitat, such as a wetland, or a cultural site, such as a former homestead. In some cases, it may be a manipulated area, such as a field, or plantation site, used to describe aspects of forest ecology, history, or management. The three major trail loops group stations with the similar major themes of forest history, forest ecology and forest management. Table 2 describes each of the interpretive stations on site.

Conclusion

The creation of a Forest Stewardship Center on the Conway Robinson site will be accomplished specifically to preserve the site's important physical, historic and cultural resources because they constitute its interpretive program. Development of the center and integral on-site management provides an opportunity to protect and monitor the Forest's resources. The creation of the Forest Stewardship Center provides a structured and scientific response to potential impacts to the site's forest and other resources caused by encroaching off-site development. All education center facilities will be located to minimize impacts to known rare plants, important wildflower groups, very old trees, wetlands, and other special features while providing

for their interpretation under appropriate management or oversight, including limiting access. Similarly, old homesites, the historic Manassas Gap Railroad roadbed, and prehistoric encampment sites will be protected from disturbance. The program of self-guided walks through historic sites, wildflower stands, and all types and ages of forest stands will appeal to a growing interest in nature appreciation and nostalgia for attributes of Prince William County since passed.

Bibliography

Center for Public Service, University of Virginia. 1992. *Virginia Statistical Series, Projections of Educational Statistics*.

Dean, George W., State Forester, Department of Conservation and Development, Virginia Forest Service. May 18, 1956. Letter to Mr. F. B. Filley.

Fahl, Kathryn A. 1983. *Forest History Museums of the World*. Forest History Society, Santa Cruz, California.

Warner, Stanley F. 1984. *Management Plan for Conway Robinson Memorial State Forest*. Charlottesville, Virginia: Virginia Division of Forestry.

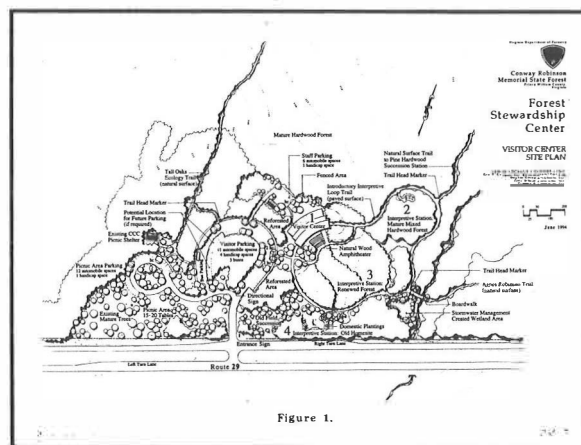


Figure 1.

Table 2:

Station Number and Name	History Theme and Content	Ecology Theme and Content	Management Theme and Content	Landscape Management Required
1. Visitor Center	history introduction hands-on learning	ecology introduction hands-on learning	forestry introduction hands-on learning	optimize viewing opportunity of diverse habitats
2. Mature Mixed Hardwood Forest	presettlement norm	succession natural history of forest gypsy moths and chestnut blight	timber value wildlife value non-consumptive use	little management necessary-locate in reserve area
3. Renewed Forest	pine plantations in modern era naturally regenerated pine stands in past	single species ecology ecological benefits	modern forestry fast rotations sustainability	intensive silviculture keep 1, 2, 5, 10 year and older plots
4. Old Homestead	homestead life in Piedmont reversion to forest urbanization trends	diverse, introduced domestic plants wildlife early succession short lived plants	historic management by homesteaders incidental cedars, Virginia pines	manage historic site - plant domestic species keep small plot in arrested succession
5. Fernstrom Forest	acquisition of CRMSF Civil War history	horticultural use of native plants exotic plants	cooperative agreements for forest management	restore ornamental plantings
6. Exposed Bedrock	Native American shelter	geology, soils species adaptation	none	archaeological study - protect from damage
7. Abandoned Manassas Gap Railroad	pre Civil War life Battles of Manassas Reconstruction	barriers and corridors for wildlife, drainage	reuse of railroad corridors	maintain as trail
8. Forest Clearing	Native American and early settler cultivation	clearing formation and regeneration	early native management	create clearing native food plants
9. Pine-Hardwood Succession	history of succession from farm field to pine forest to hardwoods	seed transport successional species	natural and artificial pine regeneration releasing hardwoods by harvesting pines	planting pines release and thinning
10. Forested Wetland	role of railroad in creation of wetland	characteristic plants and wildlife	management for wildlife habitat aesthetics water quality	boardwalk
11. Little Bull Run	old mill across stream	stream ecology Chesapeake Bay watershed	beavers as managers Chesapeake Bay preservation	boardwalk
12. Loblolly Pine Plantation	history of forestry in Virginia	maturation change in species diversity	superior tree seed improvement modern forestry	continuing silviculture
13. White Pine Plantation	pine's historical usefulness	site characteristics favoring species	modern forestry aesthetics forest products	thinning as necessary
14. Hardwood Management	history of hardwood lumbering and wood uses	habitat and mast species diversity	hardwood improvement cuts disease/pest control	continuing silviculture

THE MARYLAND FOREST CONSERVATION ACT

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Abstract

The Maryland Forest Conservation Act, enacted 1991, requires that forest resource issues be addressed as an integral part of the land development process. The Act emphasizes retention of existing forests, mandates ratios for replacement of forests cleared during land development, and requires certain minimum percentages for afforestation on land that has little or no forest cover. Forests retained or planted under the Act must be protected by long term covenants.

This Act has resulted in a demand for professionals with the technical expertise to delineate and evaluate forests, to develop forest conservation plans, and to review plans submitted for approval to state and local authorities. In addition there is an increasing demand for industries that will grow, install and monitor required forest plantings.

The technical presentation is an overview of the Act and the regulatory requirements of the program. The graphic exhibits are based on figures prepared for the second edition of the Forest Conservation Manual, Guidance for the Conservation of Maryland Forests During Land Use Changes, Under the 1991 Forest Conservation Act.

The act and the manual

To reduce the loss of forest resources during the increasing urbanization of the state, the Maryland

legislature enacted the Forest Conservation Act on July 1, 1991, the first such statewide program in the national. The Forest Conservation Act provides for local jurisdictions to establish forest conservation programs to enforce controls on the disturbance of forests as part of the overall development review process. The Forest Service, Department of Natural Resources administers the state program.

Forest conservation issues now must be considered under any public or private application for a grading or sediment control permit on areas 40,000 square feet or greater. Most development that occurred prior to July 1, 1991 is exempt; provisions also are made for numerous other exemptions.

The primary objective of the Act is to ensure that as much forest as possible is retained during the land development process. If forest clearing is unavoidable, the Act requires reforestation at mandated ratios. On sites with limited or no forest resources, new forest stands (afforestation) must be established at minimum levels.

Although the Act provides for conservation of certain specimen trees, it is not a tree preservation act. Similarly, although the Act may require new plantings to replace forests lost to clearing and development, it is not a landscaping ordinance. The emphasis is on conserving forests as ecological communities. A forest is defined as an area 10,000 square feet or greater with a minimum of 100 trees per acre.

The Act requires publication of a companion document, *Forest Conservation Manual: Guidance for the Conservation of Maryland's Forests During Land Use Changes*, Under the 1991 Forest Conservation Act. The first edition was published December 31, 1991. A Forest Conservation Manual Task Force was convened by the Department of Natural Resources in 1993 to recommend changes to the Manual. The expected publication date for the second edition is December, 1994.

Forest conservation documents

The Manual outlines standards and recommends procedures for the preparation of required plans using a case study approach. Two major submissions in the process are the Forest Stand Delineation and the Forest Conservation Plan.

The Forest Stand Delineation (FSD) inventories existing forest resources and sensitive environmental areas on the site. Field reconnaissance and forest sampling procedures are required. Worksheets are provided in the Manual for recording forest structure and conditions. FSD information is summarized on maps and in a narrative describing each stand and evaluating its potential for retention, management, or development. The FSD provides guidance for decision making during the development of site plans and forest conservation plans.

A Forest Conservation Plan (FCP) is a compendium of documents that may include maps, specifications, implementation details, worksheets for computing forest conservation obligations, construction timetables, legal instruments, post-construction maintenance agreements and long-term protective agreements. Maps in the FCP package may include plans showing forest retention areas, forest protection plans (with protective devices), and planting plans for reforestation and afforestation areas (if required).

Forest Stand Delineations and Forest Conservation Plans must be prepared by a state licensed Forester,

a state licensed Landscape Architect, or other qualified professionals as defined in the Act. The state offers courses through local colleges to train professionals and to assist them in obtaining the qualifications that are needed to prepare FSD and FCP documents.

Calculating obligations

A series of formulas (thresholds), based on land use type, have been established to calculate reforestation and afforestation requirements when forest clearing is unavoidable. Conservation thresholds range from 15% in commercial, industrial, mixed use, and planned unit development areas to 50% in low density residential and resource areas. Afforestation thresholds are in the 15% to 20% range. Thus, high density residential development and high intensity commercial land use areas have lower requirements, with low density residential development or resource protection areas having higher expectations for forest conservation.

Clearing below the threshold levels is not prohibited; however, it results in significant reforestation penalties. Forest cleared down to the level of the conservation threshold must be reforested at a ratio of 1/4 acre planted for every acre removed. Clearing below the conservation or afforestation threshold must be reforested at a ratio of 2 acres for every acre removed. As an incentive for forest retention, forests saved above the threshold can be credited to reforestation requirements at a ratio of 1 acre credit for every acre saved above the threshold. There exists a break-even point for every site: for every 5 acres of forest above the threshold, 1 acre may be cleared without incurring a reforestation obligation. A worksheet is provided in the Manual for computing forest conservation obligations.

Site planning guidelines for forest conservation

The Manual provides extensive site planning guidance so that forests, particularly those in high

priority environmentally sensitive areas, may be retained. Site planning practices that limit clearing and grading of forest areas are encouraged. The Manual promotes the use of creative site planning techniques such as clustering to protect sensitive areas. Innovative approaches to issues such as stormwater management are encouraged when they reduce forest clearing. Forest conservation planning also requires that the relationship of on-site forests to nearby adjacent forest resources be taken into account.

Forest retention, reforestation, and afforestation

Retention of forests in high priority areas is promoted in the Manual. Typical high priority areas include critical habitats of rare, threatened, or endangered species; streams and their buffers, steep slopes with easily erodible soils; 100-year flood plains; forests with high diversity and large contiguous forest corridors. Individual trees that are part of an historic site or that have a diameter of 30" or greater are high retention priorities. Priority forest retention areas often coincide with sensitive environmental areas required to be protected under the Maryland Economic Growth, Resource Protection, and Planning Act of 1992. A goal of reforestation and afforestation is to provide new forest planting to enhance sensitive areas, establish forest corridors, and create buffers to adjacent properties. In general, priority areas for reforestation and afforestation are similar to high priority retention areas.

Reforestation and afforestation requirements can be satisfied in various ways, such as (in order of preference) selective clearing and supplemental planting, installation of transplanted or nursery stock, use of whip and seedling stock, landscaping, and natural regeneration. Reforestation and afforestation plantings should be located on-site. If off-site planting is permitted, preferred locations are within the same watershed or local jurisdiction.

The Manual encourages planting patterns that

replicate natural groupings with mixes of species and sizes for both aesthetic and ecological reasons. Specifications for plant size, quantity, and survival rates are included in the Manual.

Opportunities and needs

The Act has resulted in new opportunities for forestry professionals with the technical expertise to delineate and evaluate forests, to develop forest conservation plans, to review plans, and to grow, install and monitor required forest plantings. Education and training is needed to help these professional perfect and develop the skills and expertise they will need.

There is little research on the subject of reforestation and afforestation in urban and suburban settings. Much of the current forestry research is related to silviculture focusing on timber primarily as an economic rather than an environmental resource. Areas of needed research include techniques for preparing a disturbed site for reforestation, plant installation methods, plant species lists and planting patterns for establishing native forests, management techniques to aid survival of new forest plantings, the use of production techniques for growing stock, methods for encouraging natural regeneration, techniques for selective clearing and supplemental planting, and post-construction evaluation.

Conclusions

Although the Forest Conservation Act has been in existence for three years, it is still too early to evaluate its effect. Required annual reports from local jurisdictions and the state will show the number of acres that have been retained under long term protective agreements and the number of acres of new forests planted. It may take decades to determine whether the program will slow the rate of loss of forests and improve environmental quality in new developments.

The Act and the regulations for implementation of its provisions are continuing to evolve. For example, recent amendments addressed the particular needs of densely developed urban jurisdiction. The second edition of the Manual will include streamlined procedures for sites where there are no forests or where priority forests are retained and protected, clearing is limited so that no afforestation or reforestation is needed. For further information about the state program or to voice concerns, contact Ginger Page Howell, Forest Conservation Manager, Forest Service, Department of Natural Resources, Tawes State Office Building, 580 Taylor Avenue, Annapolis, Maryland 20401.

References

1. The major provisions of the Forest Conservation Act are found in the Code of Maryland (COMAR), Title 08, Department of Natural Resources, Subtitle 16 Forest Conservation, 5-1601 through 5-1613.
2. COMAR, Article 66B, Sec.3.05 (a)(1)(viii)
3. Senate Bill 915, enacted June 1, 1993 and incorporated into COMAR, Natural Resources Article, 5-1607 (b)(2)(i)(ii).

Plant Species Richness Following Chemical or Mechanical Site Preparation in Mississippi

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Abstract

Clear-cutting pine-hardwood forests, followed by site preparation affects plant community characteristics. Effects of mechanical or chemical site preparation on plant species richness are an important forest management issue. Therefore, we compared plant species richness on replicated four-acre plots by site preparation method: roll-chop and burn ($n=5$), Imazapyr (Arsenal) at 1 lb./acre and burn ($n=5$), Imazapyr and no burn ($n=4$), and two 50-year-old pine-hardwood forests in Noxubee county, Mississippi. A 100% inventory of plant species on the plots was conducted during May-June 1991 and May 1992; one and two years post site preparation and planting of loblolly pine (*Pinus taeda*) seedlings. Mean number of plant species did not differ ($P > 0.05$) among the following treatments: roll-chop and burn 152 (1991) and 129 (1992), Imazapyr and burn 140 and 119, Imazapyr no burn 135 and 119, and pine-hardwood 123 and 137. A total of 427 plant species was found on the plots and ranged from a high of 178 on roll-chop and burn in 1991 to a low of 101 on roll-chop and burn in 1992. Most plants, 74% or 327 species in 1991 and 79% or 360 species in 1992 were perennials. Forbs were the most abundant plant category, averaging 56% in 1991 and 51% in 1992 of all plant species found on site prepared plots, followed by woody plants, grasses, then vines.

Introduction

Pine (*Pinus* spp.) plantations are a major forest and habitat type in the southeastern United States.

There are nearly two million acres of plantations in Mississippi. Often, intensive site preparation is performed to enhance planting conditions, and subsequent seedling survival and growth. Mechanical site preparation was prevalent for several decades, but chemical (i.e., herbicide) site preparation has recently become dominant (Miller et al. 1990). Chemical site preparation reduces soil disturbance, lowers erosion rates, can be performed on steep slopes or wet soils, and achieves more complete control of competing vegetation.

Plant species richness refers to number of plant species encountered in a given area. Plant community characteristics, including species richness, determine habitat conditions for wildlife. Mechanical or chemical site preparation alter forest habitat conditions. Our objective was to determine plant species richness on areas site prepared by mechanical or chemical methods.

Methods

The study area was located near Macon, (Noxubee county), Mississippi, USA. Site index for loblolly pine (*P. taeda*), at age 50 years, ranged from 76 to 83 feet. All merchantable sawtimber and pulpwood were removed (i.e., clearcut) from the area in fall 1989. Fourteen rectangular plots, four acres in size were installed on the area and the following site preparation treatments were performed: roll-chop and burn (D-8 bulldozer pulled a drum roller, 1 pass, broadcast burn 14 days later), herbicide and burn (Imazapyr, aerial application at 1 lb. a.i./acre, burned 6 weeks later), herbicide but no burn (Imazapyr, 1 lb./acre), no treatment (50-year-old

pine-hardwood forests). Number of plots by treatment was five for roll-chop and burn and herbicide and burn, four for herbicide but no burn, and two for pine-hardwood forests. Genetically improved loblolly pine seedlings were planted in February 1991, and spacing was 8 x 9 feet (605 seedlings/acre).

The relatively small size of the plots allowed for a complete inventory of plant species. Treatment plots were systematically traversed to observe the entire plot. Two people walked parallel lines approximately 5 - 10 feet apart, depending on vegetative density. Each new species encountered was identified. Inventories were conducted in May and June, 1991, and May 1992 (Wilson 1993).

Number of plant species was compared between treatments within years using analysis of variance (Steele and Torric 1980). Comparisons between years were not conducted due to marked differences in weather conditions in winter and spring.

Results

A total of 427 plant species was found on the plots. Mean number of plant species varied from 123 on pine-hardwood forests to 152 on roll-chop plots in 1991 and 119 on herbicide treated plots (burned and not burned) to 137 on pine-hardwood forests in 1992 (Table 1). The greatest range in number of species was found on roll-chop plots in both years. There were no significant ($P > 0.05$) differences in number of plant species, richness, among treatments or pine-hardwood forests in 1991 and 1992.

Most plants, 74% or 327 species in 1991 and 79% or 360 species in 1992 were perennials. Forbs were the most abundant plant category, averaging 56% in 1991 and 51% in 1992 of all species observed, followed by woody plants, grasses, then vines.

Discussion

Plant species richness was similar on mechanical and chemical site prepared plots, and also was

similar to richness on pine-hardwood forests. Blake et al. (1987) and Hurst and Blake (1987) reported no difference between number of plant species found on chemically (Hexazinone) and mechanically site prepared (shear, rake, disk, bed) areas in east-central Mississippi. Likewise, Hurst and Perkins (1987) found 99 species of plants on mature pine-hardwood forests and 95-99 species on loblolly pine plantations, age 1 - 4 years that had been chemically (sprayed 2-4-5-T, injected 2-4-D) site prepared in east-central Mississippi.

Because there were no significant differences in plant species richness between mechanical and chemical site preparation methods, other factors, such as effects or impacts on soil, economics, efficacy in controlling vegetative competition, and application restraints, must be considered. Plant community characteristics, other than plant species richness, must be determined before assessing effects of site preparation method on wildlife habitat or populations. Vegetative conditions in pine plantations change rapidly, with pine canopy closure occurring at age 5 - 6 years. At this age, abundance and diversity of herbaceous plants are greatly reduced; however, woody and vine types persist.

Literature cited

1. Blake, P. M., G. A. Hurst, and T. A. Terry, 1987. Responses of vegetation and deer forage following application of hexazinone. *Southern Journal of Applied Forestry* 11(4):176-180.
2. Hurst, G. A. and P. M. Blake, 1987. Plant species composition following hexazinone treatment-site preparation. *Proceedings Southern Weed Science Society* 40:194.
3. Hurst, G.A. and C. J. Perkins, 1992. Plant species composition following chemical site preparation. *Proceedings Southern Weed Science Society* 46:224-225.
4. Miller, K. V., P. B. Bush, J. W. Taylor, and D. G. Neary, 1990. Herbicide and wildlife

habitat: a review of 35 years of research.
Proceedings Southern Weed Science Society
43:202.

5. Steel, R. G. D. and J. H. Torrie, 1980. Principles and procedures of statistics: a biometrical approach. 2nd ed. McGraw-Hill Book Company, New York. 835pp.
6. Wilson, L. M., 1993. Vegetative responses to chemical and mechanical site preparation methods in Noxubee county, Mississippi. M.S. Thesis, Mississippi State University, Mississippi State, Mississippi. 61pp.

Table 1. Mean number (range in parentheses) of plant species by site preparation treatment and year, Noxubee County, Mississippi.				
Year	Roll-chop and burn	Imazapyr and burn	Imazapyr not burn	Pine-hardwood forest
1991	152 (137-178)	140 (130-155)	135 (128-141)	123 (101-144)
1992	129 (101-157)	119 (103-130)	119 (106-134)	137 (129-144)

No significant ($P > 0.05$) differences found among treatments by year.

Acknowledgements

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Wood Works™

Cinda Hartman Jones, Director of Marketing, American Wood Council, American Forest & Paper Association, 1111 19th Street, NW, Suite 800, Washington, D.C. 20036

Wood Works™ is a comprehensive environmental communications program of the wood products industry. It was developed to meet the growing need for accurate information regarding the environmental benefits of wood products. Current supporters of Wood Works include the American Forest & Paper Association, American Plywood Association, Canadian Wood Council, Southern Forest Products Association, West Coast Lumber Inspection Bureau, and founder of the Wood Works program, the Western Wood Products Association.

Traditionally, building product selection has been determined by price, availability, quality, and performance. Now customers throughout the chain of distribution are considering the environmental impact of using our natural resources, manufacturing efficiency, energy consumption, and recyclability of materials before making a purchase decision.

The Wood Works™ initiative demonstrates that wood is a solution to environmental issues and concerns because wood products are made from an infinitely renewable, reusable, and recyclable resource, require less energy to produce than competing products, and are for many other reasons, the environmentally sound choice.

Regardless of the temporary price competitiveness of alternative building materials, wood continues to account for 95% of residential framing in the United States. The only reason why steel is being considered as an alternative to wood is because over-regulation, and lawsuits by environmental extremists have tied up available supplies of timber which has caused the price of lumber to rise.

Annual forest growth exceeds harvests by 33%, therefore there is no danger of "running out of trees." Conversely, in utilizing non-renewable,

finite resources that make up concrete, steel, and aluminum, natural resources are being depleted.

While producing some building materials generates CO₂ and other air pollutants, forest growth produces oxygen and stores carbon, which lessens the impact of global warming.

Concrete requires nearly three times as much energy to produce as wood. Even more environmentally damaging than concrete's natural resource depletion and energy-intensive production is this building material's emission of extraordinarily high amounts of nitrous oxide, sulfur, and carbon dioxide during its manufacture. Producing one ton of concrete releases more than one ton of carbon dioxide into the atmosphere while wood manufacturing produces far fewer toxic emissions and wood's production actually improves air quality because growing one ton of wood absorbs more than one ton of carbon dioxide and generates over a ton of oxygen. Young, well-managed forests are more efficient at taking in carbon dioxide and emitting oxygen than are older, untended forests. Steel is even more energy intensive than concrete.

Wood is the best insulator of all structural building materials. A wood-frame house keeps you cooler in the summer, warmer in the winter, and can save you a small fortune on your heating and cooling bills. An inch of wood is 16 times as efficient an insulator than concrete, 415 times as efficient as steel, and 2,000 times as efficient as aluminum.

When designed and built in compliance to local building codes, homes of wood, steel and concrete perform equally well in hurricanes and earthquakes -- and insurance rates do not vary because of framing material used.

Alternative building materials such as steel, plastic, and aluminum boast about their recyclability.

Wood is recyclable too, and the rate of wood recycling is on the rise. An estimated 400,000 tons of wood waste were recovered in 1990. This waste included barrels, boxes, Christmas trees, construction & demolition waste, crates, pallets, posts, poles, prunings, railroad ties, sawdust, slab wood, and yard trimmings.

Recycled and reused wood products are currently being utilized as animal bedding, boiler fuel, carbon and fiber composite materials, cellulose (batts, blankets), cement-bonded particle and fiber boards, chip boards, composite boards, erosion control material, fuel, gypsum-bonded wood fiber panels, humus, landfill cover, landscaping material, mulch, oriented strand board, panel products, particle board, plastic wood, pulp and paper, resin material for automobile doors and interiors, spaceboard, structural material for buildings and furniture, wet-formed fiber products, wood/inorganic composite (w/ cement/gypsum), and wood stove pellets.

An independent newsletter on environmentally Sustainable Design and Construction compared the attributes of wood and steel and concluded that:

"The extraction of raw materials used to make steel can have serious environmental impacts, and the manufacturing process, even from recycled steel, is extremely energy intensive. Wood, on the other hand, is naturally renewable, requires less processing energy, and is ultimately biodegradable."

"Where wood is available from a certified, well-managed forest, it's probably the best choice environmentally."

**Environmental Building News
July/August, 1994**

Beauty, value, longevity, durability environmental soundness -- wood has it all. Wood is reusable,

recyclable, biodegradable, and it's renewable. No wonder it's the primary material in more than 9 out of 10 American and Canadian homes. From floors, paneling, decorative moldings, and structural framing, to siding, roofing, decks, and windows -- wood is the natural choice. Wood Works.

The American Forest & Paper Association (AF&PA) is the national trade association of the forest, paper, and wood products industry, representing member companies engaged in growing, harvesting, and processing wood and wood fiber, manufacturing pulp, paper, and paperboard products from both virgin and recycled fiber, and producing solid wood products. AF&PA represents a segment of industry which accounts for over 7% of the total U.S. manufacturing output.

Lessening Demand on Eastern Forests Through Timber-Frame Construction

Jonathan Orpin, Timber Framers Guild of North America, President, New Energy Works of Rochester, Inc., Rochester, NY

Introduction

Amory Lovins, co-founder of the Rocky Mountain Institute, an energy conservation think-tank, proved that utility companies could actually earn a profit from managing and conserving energy rather than promoting energy use and thereby having to build the required production capacity. His concept was dubbed "negawatts", and is now a widely accepted understanding.

Similar thinking is required in the forest products industries, for until demand on forest resources is lessened, no management plan can hope to stem the loss and over-harvesting of eastern forest ecosystems. Today's residential building technologies, which employ large amounts of wood products in new structures with short life spans are an important part of the problem. Replacing wood with other material, such as steel or structural plastic that consume large amounts of energy in the raw material and manufacturing stages is not the answer. Trees are indeed a valuable and renewable resource. Our goal should be their better utilization.

If we were to add 50% to the life of new homes, we would need that many fewer trees over the longer time period; homes that lasted twice as long would save half the trees, and so on. Timber-frame construction, with its emphasis on securely connected heavy timbers, has proven through the centuries to create a much longer lasting structural frame than today's light framed housing, while using only slightly more board footage of lumber per cubic foot of enclosure.

This greater efficiency of timber utilization due to the longer lasting construction methodology will be examined.

Historical overview of light and heavy framing

For definition, light framing refers to the use of 2"x4", 2"x6" and other dimension lumber and plywood to work together as studs, trusses, and sheathing in the "rough framing" of the structure. This creates a platform framed home, and is so called because the loads that result from usage and the environment (i.e. snow, wind, people, furniture) are spread out more or less evenly. The entire length of walls, and the total area of roof, etc. using plywood or other sheathing as the outside membrane, work as a unit to spread these loads and limit racking. This method allows the use of many smaller structural members that are fastened with great quantities of nails and plates, to achieve what was once thought to be the realm of large and heavy timber members.

Platform framing techniques allowed more homes to be built in shorter amounts of time with less skilled help. Beginning in Chicago in the 1880's as "balloon" framing, and further developed through the first half of this century, this style is best exemplified by Levittown (Gans, 1967), on New York State's Long Island. This huge development-turned-community was built right after World War Two to accommodate the incredible demand for housing by returning veterans. Coupled with the almost unbridled economic growth and little regard for forest or other natural resources, the Levittowns of that era would have been less possible without the mass-production capacity of light framing.

Heavy timber framing is the concentration of the loads on a structure to a few large, well-joined and secured members that do most of the work. Also known as post and beam, and timber-frame construction, it is a point-loaded, rather than

platform loaded, building technique. Where the primary economic advantage of light framing as stated above is its capacities in mass production, the primary economic advantage of timber-framing is in its longer life-spans.

There is a great deal of literature available to support the suggestion that timber-framed buildings last a long time. Many examples exist, particularly in the pre-twentieth century homes and barns in the eastern states. But to really appreciate the long view of timber-framed buildings, one must go back further than our own country's settlement by European emigrants to Europe itself, where homes built after 1776 are often the new kids on the block.

A large body of work exists on the history of timber-framed buildings in Europe. A particular standout is *English Historic Carpentry*, by Cecil Hewitt, (1980). This definitive work explores numerous examples of buildings standing today dating back as far as the twelfth century. The barley barn at Cressing Temple, Essex, which was carbon-dated to 1200 A. D. +/- 60 years is a good example of an 800 year old heavy timber building.

Extremely old structures should be considered only to emphasize timber-framing's potential for longevity. If, however, the assumption rested just on the basis of a few buildings still in use from a particular era, then it could be credited to exception, and therefore have limited value. Of greater value is the review of timber-framed structures built between 1600 and 1850 in this continent, and easily seen today in the thousands of old barns that dot the country side. One can clearly see all the structural members of these buildings by simply walking inside and looking around. The huge timbers (posts if vertical, beams if horizontal), often connected with traditional mortise and tenon joinery and held in place with wood dowels called pegs are not only interesting, but extremely functional. These barns, well described by Fink (1987), and Hubka (1984), have often survived heroically through adverse conditions of poor upkeep and hard use.

Timber-frame homes, too, abound as examples from previous centuries. *The Framed Houses of Massachusetts Bay, 1625-1725*, by Abbott Lowell Cummings ((1979), and *Early Domestic Architecture of Connecticut* by J. Frederick Kelly (1924) chronicle many homes of that era, examining their construction styles and techniques by studying many of the homes as they stand today.

This author maintains that the use of heavy timber construction is largely responsible for these long life spans; that had they been light framed (or log built, for that matter), they would not still be of value, and that heavy timber-framing should be re-examined as a viable building technique in light of today's demands on our forests and our need to limit that demand.

Heavy Timber's Role in Today's Construction

No one can point to a specific study or experiment to prove that light framing can not compete with the longevity of timber-framing. The use of small dimension lumber has not been around long enough for a full review of its potential. And as stated, light framing techniques have some clear advantages over its more labor intensive predecessor. Light framing has a place in our time. There are, however, many old (and new) timber-framed buildings that can be studied and documented.

Given identical use, wear and tear, and environmental conditions, it is suggested that a home built with a heavy timber structural method with outlast a light-framed home by a factor of two or more. Specifically, if the usable life of a stud-framed home is 100 years, the usable life of a timber-framed home is 200 years, and so on. (Note that this figure was chosen simply because it is used by the insurance industry for depreciating the framing component of light framed homes.) This conclusion is reached with a variety of inputs. Discussions with firemen, insurance adjustors, historical architects and contemporary timber

engineers have been pieced together to paint a picture that can support an intuitive understanding.

A heavy timber-framed home is more likely to survive a natural disaster than a light-framed home. Wil Wilkins (1991), a timber-framer from Hamilton, Montana, found that a recently completed timber frame of his was the only intact home in a neighborhood near the epicenter of the San Francisco earthquake. Good foundation attachment of the post bottoms was an important component, but could not by itself explain this sole survivor.

Merle Adams (1993), another Montana timber-framer, reports on a fire that started inside a timber frame home he had built. Due both to the tightness of the house and propensity of heavy timber to resist burning, a fire that would have burned most homes to the ground smoldered and sputtered for a long enough time to require drywall replacement and sandblasting of timbers, but no structural damage. More than one fireman has told this author that he would rather be on the roof of a burning heavy timbered structure than any other, due to the mentioned ability of a timber to char over on the outside and insulate itself.

A favorite story is that of Toni and Bob Donahoe, whose timber-framed home in western Pennsylvania was in the middle of a tornado's path. Toni hid under the kitchen table as her roof was sucked off overhead. To get it, the tornado had to split the oak rafters in half longitudinally, leaving an otherwise messy but intact home behind. The rest of the tornado's pathway had no standing homes, and very few trees.

Normal wear and tear, and the general ravages of aging, can also be addressed. In a perfect world, both light framed and timber-framed buildings rest on strong foundations, have fully maintained roofs, and have complete control of interior and exterior moisture relationships. In that same world, all homes would be built by precise, committed craftspeople using the highest quality materials available and installing them not only to the building code specification, but beyond. Because that is not

the case, timber-framing holds some practical advantages. These include a fully exposed structural system for closer monitoring, and, in traditional timber-framing, a minimal use of ferrous fasteners.

Finally, with the structural system exposed and the work requiring a greater degree of craftsmanship, it would be hoped that a more consistent and better grade of attention to detail and care would be a result. One of the lessons of Hurricane Andrew and Homestead, Florida goes beyond questions of whether the construction style was sufficient. It was obvious that even the minimum standards of workmanship were ignored in too many cases. Pride of craft, and pride of ownership go hand in hand to ensure that a product is up to its own standard.

Conclusions and implications for further study

The building of high quality, heavy timber-framed homes will ultimately lower the demand on forest resources by requiring fewer replacements of required housing stock. (See accompanying chart "200 Years of Serviceable Life.") The benefit to the forest products industries will be felt as longer rotation harvesting cycles create a better grade of log, thereby yielding higher value timber and grade boards. Mark Wiggs (Levin, 1988) a forest economist from Salem, Oregon proved that 180 year rotations of western forest harvests could yield greater profit than 60 or 90 year rotations. While this work has not been extrapolated to eastern forests, it flew in the face of recent west coast business practices, and may well apply here.

General wisdom holds that the greater the quality of construction the higher the initial cost. Specifically, timber-framing is assumed to be more expensive than light framed homes. In fact, most timber-frame homes cost more than their stud framed cousins. When factoring in the generally higher insulation values and resulting lower utility expenses, larger interior volume to square foot ratios, and typically

higher quality components throughout the project, the difference in cost is greatly reduced.

In sum:

- 1) Each home requires natural resources not only to be built, and then to be maintained and operated. Few people think that there are unlimited resources to be used without foresight. As stated, the longer life spans of these homes result in less replacement material over the life of the home. The higher initial costs per square foot often results in a somewhat smaller home, necessarily using fewer materials for its completion. The generally high insulation and low infiltration rates found in these homes translates to lower costs in heating and cooling.

But beyond the benefit of reducing forest resource demands, there is compelling rationale to re-examine our attitudes towards home building. The housing stock of the country represents enormous collective investment. We all hold a stake in these homes because their construction affects us so dramatically. Therefore:

- 2) The construction of each home represents jobs and the socio-economic sustenance that jobs create. The increased labor intensiveness and greater skill requirements typically experienced in timber-frame construction should be celebrated. In a time when class after class of lawyers and stock brokers graduate into bloated ranks, the crafting of high quality buildings offers an exciting manufacturing alternative for our young people.
- 3) Each home adds to or detracts from the quality of life for its inhabitants and the neighborhood in which it stands. The lack of a national consciousness on the effect of space on family and neighborhood continues to be reviewed. High quality homes play an important role in this issue, and some great thinkers on the subject refer specifically to timber-framing in

their discussions (Alexander, 1979; Brand, 1994.)

Heavy timber construction and timber-framing should be reviewed as an alternative to light framed structures in light of this discussion.

The two homes above are identical in plan and size, with construction method the only difference. Represented is a one-and-a-half story cape-style home with 2,200 square feet of usable floor space. Based on data collected by New Energy Works of Rochester, Inc. the timber-framed home would require 8,000 board feet of wood in the 8"x8" posts and beams, and 5"x7" floor joists and roof rafters required to form the structural skeleton. The light framed structure would require 6,250 board feet in 2"x6" studs, 2"x6" joists and rafters, and miscellaneous other dimensional stock for the same structural result. Components that are identical to both construction methods have been factored out for clarity. These include: first floor joists; sub and finish flooring; interior non-load bearing partitions, and; sidewall and roof sheathing.

The projected serviceable life for the timber frame structure is projected as 200 years, while the light framed structure is projected to be 100 years. Please refer to text for further information.

d, only wood construction techniques are reviewed here: There may well be other materials, including steel and masonry that should be continually reviewed for their applicability from a resource and life-cycle cost perspective. At present, the large energy requirements of steel manufacturing, the higher cost and lower thermal efficiencies of masonry, and the still-emerging potential of recycled plastic building material leave wood the clear front-runner in residential buildings. Our goal here is to examine the difference between light framing and heavy timber-framing.

Environmentally Motivated Consumer Behavior: Implications for the Household Furniture Industry

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Abstract

Recently a new influence is impacting the marketing planning and implementation process of modern business - the environment. Specifically, the environmental impacts of the raw materials procurement, manufacturing, distribution, product use, and disposal issues as measured by regulators, environmental organizations, investors, and the consuming public. Of particular interest, consumers who are concerned about the environmental impacts of the products they purchase and use have created a demand for more environmentally friendly products, referred to as green or environmental consumerism. Several researchers have suggested that what lies at the heart of these environmental concerns are different beliefs and values concerning human relationships to and uses of the natural environment, especially the forest environment. A major impact of these new environmental values on the practice of forestry and the wood products industry has been to restrict the harvesting of timber in many areas. However, it is believed that not only will the public's beliefs and values impact policy issues, but they will also impact consumer demands for "environmentally friendly" wood products.

This paper will examine many of these issues, and will also review a study that is being conducted by the authors. This study attempts to determine for which consumers environmental impact is an important purchase criteria for household furniture. The study also examines consumer environmental beliefs and values for their effects on the perceptions of the environmental friendliness of wooden household furniture as compared to current and potential non-wood substitutes.

Introduction

After declining somewhat in the 1980's, consumer environmental concerns are again rising to the surface in the 1990's. Numerous environmental events and disasters in the late 1980's have alerted consumers to the consequences of industrialization and their own consumption decisions. The Valdez oil spill, loss of endangered species and biodiversity, global warming, the Chernobyl nuclear accident, and the solid waste crisis are just a few of the images that indicate to consumers the extent of the environmental crisis and make our world seem out of control.

Both Ottman (1992) and Coddington (1993) suggest that a significant implication of this trend in environmental concern for marketers of consumer products and services is that individuals will act upon their environmental beliefs through the power of their purchasing decisions. Consumers, it is suggested, are voicing their concerns in the marketplace by evaluating products not only on performance and price, but also on the environmental and social responsibility of manufacturers.

The implications of consumer environmental concerns are far-reaching for the wood products industry. Consumer demands for more environmentally friendly products are growing, as is pressure for legislation requiring the industry to deal with environmental problems. This combined opportunity and threat may lead wood products marketers to acknowledge that the green challenge will force the industry to change dramatically. Corporate environmentalism is defined by Banerjee (1993) as "an organization wide recognition of the legitimacy and importance of the biophysical

environment in the formulation of organizational strategy." When practiced successfully, it can lead to increased market share and profitability, enhanced corporate and brand image, consumer goodwill, and access to new market segments.

Although the current environmental movement has often been seen as a threat to the wood products industry, with those associated having to defend the harvesting of trees and the use of wood, it now appears there is an opportunity for the industry to take advantage of consumers demands for "greener" products. In their efforts to protect themselves and their world, consumers are scrutinizing products for environmental safety and friendliness. This environmental scrutiny should lead consumers to find that, when grown and harvested in a sustainable fashion, wood has many environmental advantages. One study being conducted to assess the total environmental impact of wood has found that among wood's advantages are the renewability of the resource, the removal of carbon dioxide from the air by actively growing forests, low energy use in the manufacturing process, as well as biodegradability, reusability and excellent insulation qualities (Anon. 1993).

Although there are many environmental advantages of using wood compared to other substitute materials, that message does not seem to have reached the majority of the consuming public. For instance, Winterhalter and Cassens (1993) found that a majority of consumers believe North American forest are under threat and that few forests in the U.S. are managed for sustainability. Also, Michael and Smith (1993) found a "green gap," or no available product which matched the "ideal" for a convenient, green product, in parents' diapering decisions. This previous work suggests there is a need to further explore consumers environmental beliefs and values in order to determine the most effective marketing strategies to enhance the competitiveness of wood products on the green dimension.

Profiling the environmentally concerned consumer

If a manufacturer of wooden household furniture decides to market to environmentally concerned consumers, a major consideration for marketing segmentation purposes will be to identify and profile these environmentally concerned consumers. In other words, which consumers constitute the market segments for wood products which are marketed and promoted based on their environmental advantages. As explained by Webster (1975), management must have a clear understanding of the characteristics of those consumers most likely to respond to appeals to their environmental consciousness. Marketing researchers have looked at demographic, socioeconomic, personality variables as well as values and attitudes to identify the environmentally concerned consumer. We will briefly review some of the most important findings from this literature.

Demographics and socioeconomic variables

Previous research in this area has suggested that demographic and socioeconomic variables alone have not been adequate descriptors of the environmentally concerned consumer. Although previous findings have been somewhat inconsistent, the environmentally concerned consumer has been found to be: young, better educated, white, politically liberal, higher in income, occupational and socioeconomic status, not employed in a resource extractive/dependent industry, and lives in an urban area.

Personality variables

Several studies have found personality variables to be better predictors of environmentally concerned consumers than demographics. On such variable which has received a great deal of attention and shown consistently positive results is perceived consumer effectiveness (PCE). PCE represents an individual's perception of whether or not they have the ability to bring about change through their own

behavior. In this case, a consumer's perception of their ability to have an impact on environmental problems through their purchase behavior.

Values

A value is a mental construct with both cognitive and affective elements. In other words, a value is composed of two dimensions: an emotional dimension involving feelings; and a cognitive aspect which refers to dispassionate facts. Values are central in a person's belief system, and thus they form the basis for evaluative beliefs or attitudes. Rokeach (1973) describes the concept of value as "an enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an opposite or converse mode."

Several researchers have suggested the debate over forests and the proper use of forest resources is a result of the different values concerning forests and human relationships to forests (Shands 1988; Kennedy 1985). Shindler et. al. (1993) found evidence of broad support for a more environmentally oriented, multiple valued, and publicly influenced approach to federal forest management. They refer to this as a more "biocentric" value orientation as opposed to an "anthropocentric" value orientation.

An anthropocentric orientation is defined as a human centered orientation toward the non-human world. In effect, the non-human world is reduced to a storehouse of resources and is considered to have instrumental value only, that is, it is valuable only as a means to human ends (Eckersley 1992). A biocentric value orientation recognizes the full range of human interests in the human world for both this generation and future generations; recognizes the interest of the non-human community; and adopts a holistic rather than a reductionist perspective insofar as it values populations, species, ecosystems as well as individual organisms.

Environmental attitudes

An attitude is a hypothetical mental construct which is inferred from verbal reports and behavioral observation (Heberlein 1981). Like values attitudes are conceptualized as being composed of beliefs and affect toward an object (Fishbein and Ajzen 1975). As Heberlein (1981) shows in his review of the environmental attitudes literature, values, beliefs and affect function to form an attitude toward some aspect of the environment. Thus, concern for the environment has usually been conceptualized as an attitude.

A model of the environmentally concerned wood products consumer

Based on our review of the literature and work done by Balderjahn (1988), we hypothesize the following model or profile of the environmentally concerned wood product consumer. A consumer that will consider environmental impact when purchasing wood products: 1) will have a higher educational level, income, occupation, and socioeconomic status, they will be younger, and more politically liberal; 2) they live in an urban area and be employed in a non-resource dependent occupation; 3) they will believe they have the ability to impact natural resource problems through their own purchase behavior; 4) they will have more biocentric values towards forest resources; 5) they will be concerned regarding the environmental welfare of forest resources; and 6) they will support forest management practices they perceive to be less damaging to forest resources. Figure 1 gives a graphic representation of these relationships.

The current study

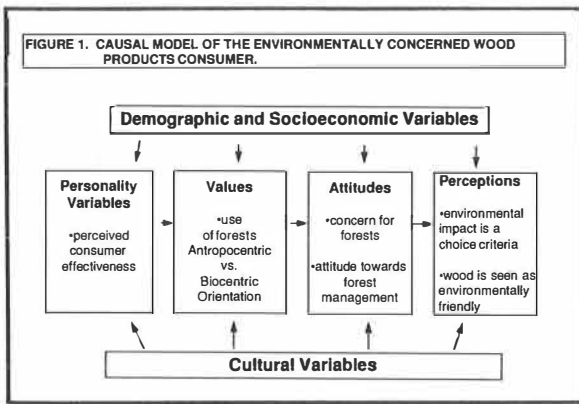
A study is being conducted by the authors, to determine the profile of those consumers for which environmental impact is an important purchase attribute for household furniture products, or to test the accuracy of our proposed model. The study will also determine the consumer perceptions of the

environmental impact of solid wood compared to current or potential solid wood substitutes for household furniture. In order to investigate the consuming public on environmental beliefs and values, and how they may impact the perceptions and subsequent purchase of wooden household furniture, a mail survey is being sent to 3,000 potential consumers of household furniture. A marketing research firm has provided a list of residential consumers who have lived in their home for less than one year. It is believed that recent home purchasers are likely to also have made a new home furniture purchase, and thus will serve as an adequate sample frame for possible home furnishings purchasers. The sampling, survey procedures, follow-up efforts and data analysis have all been conducted in accordance with the well documented and verified techniques of Dillman's (1978) Total Design Method. In analyzing the data extensive use will be made of Classical Multidimensional Scaling Techniques.

References

1. Anonymous (1993), "Studies Show Wood's Environmental Pluses," *Random Lengths, The Weekly Report on North American Forest Products Markets*, March 12, 1-2.
2. Balderjahn, Ingo (1988), "Personality Variables and Environmental Attitudes as Predictors of Ecologically Responsible Consumption Patterns," *Journal of Business Research*, 17, 51-56.
3. Banerjee, Bobby (1993), "Corporate Environmentalism: The Greening of Strategy," in *AMA Educators' Proceedings, Enhancing Knowledge Development in Marketing*, eds. David W. Craven and Peter R. Dickson, American Marketing Association: Chicago, IL, 234-235.
4. Coddington, Walter (1993), *Environmental Marketing, Positive Strategies for Reaching the Green Consumer*, McGraw-Hill, Inc: New York, NY.
5. Dillman, Don A. (1978), *Mail and Telephone Surveys: The Total Design Method*, John Wiley & Sons: New York, NY.
6. Eckersley, Robyn (1992), *Environmentalism and Political Theory: Toward an Ecocentric Approach*, State University of New York Press: Albany, NY.
7. Fishbein, M. and I. Ajzen (1975), *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*, Addison-Wesley: Reading, MA.
8. Heberlein, Thomas A. (1981), "Environmental Attitudes," *Journal of Environmental Policy*, 2, 241-270.
9. Kennedy, James J. (1985), "Conceiving Forest Management as Providing for Current and Future Social Values," *Forest Ecology and Management*, 13, 121-132.
10. Michael, Judd H. and Paul M. Smith (1993), "The 'Green Gap' in Proenvironmental Attitudes and Product Availability: Parental Tradeoffs in Diapering Decision-Making," in *Proceedings of the 1993 Marketing and Public Policy Conference*, edited by Mary Jane Sheffet, 97-112.
11. Ottman, Jacquelyn A. (1992), *Green Marketing, Challenges & Opportunities for the New Marketing Age*, NTC Business Books: Chicago, IL.
12. Rokeach, Milton (1973), *The Nature of Human Values*, Prentice-Hall: Englewood Cliffs, NJ.
13. Shands, William E. (1988), "Beyond Multiple Use: Managing National Forests for Distinctive Values," *American Forests*, March/April, 14-15, 56-57.
14. Shindler, Bruce, Peter List and Brent S. Steel (1993), "Managing Federal Forests: Public Attitudes in Oregon and Nationwide," *Journal of Forestry*, July, 36-42.
15. Webster, Frederick E. (1975), "Determining the Characteristics of the Socially Conscious Consumer," *Journal of Consumer Research*, 2(December), 188-196.
16. Winterhalter, Dawn and Daniel Cassens (1993), "Telling the Sustainable Forest From the Trees," *Furniture Design and Manufacturing*, August, 101-106.

FIGURE 1. CAUSAL MODEL OF THE ENVIRONMENTALLY CONCERNED WOOD PRODUCTS CONSUMER.



1994 Issues for Forestry Professionals

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Abstract

Who's Fooling Whom? Are "environmental" groups and the legislation they have encouraged really having a desirable societal and environmental impact?

Forestry and forest products are sustainable activities and products.

American lifestyle is on a collision course with the unacknowledged impacts of our profligate consumption.

Global trade is based on massive use of fossil fuels.

American transportation and use of low cost energy has displaced local sustainable agriculture.

Substitution of steel, masonry, plastic for wood in the name of environmental quality is a lie.

What are Forests For?

Sanctuary?

Protection of biodiversity?

Benign source of renewable products and energy?

Supplier of materials as the market requires?

Investment opportunity for long term sources of capital?

Participant in the global market?

Where do People Belong in the Broad Scheme of Things?

Major predators?

Disinterested bystanders?

Protectors of the genome of the planet?

Major consumer of all energy resources available on the planet?

As a species isolated from the normal competitive battle for global resources?

What Part Should Forestry Play?

Source of local energy and materials to be used primarily within stable communities?

Prime mover for social change?

Suggested basis for dialogue:

There are 3 kinds of "environmentalists" - "protectionists", "preservationists", & "sustainable solution seekers."

Forests and forestry are being converted from sustainable providers of energy and materials because of a lack of a global energy policy.

The extent to which U.S. financial problems are exacerbated by purchases of foreign oil.

Current energy consumption is supplied from sources that damage both our community structures and our environmental stability.

Consumption is facilitated by promotion of unsustainable life styles based on energy costs that do not reflect the full costs of the energy use.

"Preservation & Environmental Protection" at home must not result in the displacement of pollution and environmental damage to other countries.

Proposed actions:

Proactively describe the position of forests and US economics

Forests produce real wealth from water, CO₂, land, (human care), and time

Describe the degree of vulnerability faced by the oil based consumption patterns being encouraged by our economic model

Describe wood as a local resource that should get modified for its highest use close to the point of growth

Develop a national CO₂ recovery certificate program that funnels the revenues from CO₂ liberators to CO₂ recoverers.

Advocate for responsibility by the financial community to develop local sustainable business plans that wean the region from reliance on imports for energy and exports for cash.

Encourage all corporations to rewrite their charters with sustainable energy systems as the base for all operations.

For our own benefit and as a role model we could advocate:

Refusal to create impediments to forest use without total energy cost analysis of alternatives necessitated by these impediments.

Education of all students in what a sustainable life style entails and educate all students in biology and ecology.

Research funding for local small-scale cogeneration systems that use locally available renewable fuels.

Exposure of the "global market place" as the fossil energy-dependent system that it is.

Efforts to develop intraregional trade as the norm (with barter between regions).

Exposure of the sources of funding for the massive "Environmental Organizations" that dominate the "preservation/protection" discussions today.

Issues for forestry professionals in 1994:

Who's Fooling Whom? Are "environmental" groups and the legislation they have encouraged really having a desirable societal and environmental impact?

Environmental regulation is causing shifts from sustainable activity toward the consumption of non-solar energy sources. This happens because it appears that there is a collective surplus of funds and a need for protection of various facets of our lives from our consumption. This appearance of surplus develops from the largess associated with the use of energy that is priced at less than the total economic and environmental cost of the commodity. Thus, American lifestyle is on a collision course with the unacknowledged impacts of our profligate consumption. In 1990 a sustainable level of CO₂ emission per person for the earth was 1.69tons/year. The average 1990 US CO₂ emission per person was 19 tons or more than ten times what an acceptable level was. The UN CO₂ Information Analysis Center predicts that by 2025 the global sustainable emission level may be down to 1.05 tons per person per year. This consumption gap is being encouraged by the regulations that seek to protect us from the impacts of consumption. The impact of governmental regulations must be weighed by comparing the value of the protection against the environmental cost of the regulation. Today too often regulation is targeted at sustainable activities by using fossil fuels to fund the protection efforts.

Forestry and forest products are sustainable activities and products. Trees are made of a major waste product of our society, carbon dioxide (CO₂). Products made from wood are carbon storage items even if they were not designed that way. Even landfilled organic material is a carbon storage mechanism as long as it doesn't rot. Removing old trees makes room for young vigorous trees to grow. Young forests are much better CO₂ accumulators than are older forests. Old forests are unreliable storage vehicles for the carbon tied up in the wood because there are many risk factors that are more effective on trees that are tall, out of balance

physiologically, stressed by environmental factors, etc., and older trees are more likely to share all of these factors and hold very large amounts of carbon in each individual. Recent research in high elevation forests of the southeast indicate that mortality of old trees is 3 times previously observed levels. It is speculated that this problem is caused by pollution coming from the west.

Forests provide real wealth for people of communities to modify and use for their benefit. The long distance transport of wood with fossil fuels to a plant that runs on fossil fuels is an example of an industry that uses significant amounts of fossil fuels. The forestry community needs to encourage the research community to develop ways of using our wood waste, mortality, and small thinnings in small quantities to power local energy production and manufacturing. Research is also needed to develop ways of adding as much value as possible close to where the trees grow.

Let us not also fool ourselves while others are trying to fool us. "Environmental" regulations must balance the need for a reasonable quality of life with the need to drastically reduce our dependence on imports of all kinds, including fossil fuels. The forested areas of our country must come to be an integral part of the energy and material supply system as we are weaned from these other sources. All ecosystems are energy transfer systems from an energy source (producer) of some sort through several to many species with an eventual increase in entropy -- waste heat or disorder. Ecosystem management must start with the high end predators or it is doomed to failure. Our lives today are lived as if this were not the case. The compromises by the forestry and forest products community have been made as if good forestry was part of the problem rather than a significant ameliorator of human resource consumption.

Global trade is an example of economics based on false assumptions. Global and interregional trade is based on massive use of fossil fuels that are currently priced at less than their full economic and environmental cost. The subsidization of the most

common modes of transport, truck and air has enabled the development of unsustainable agriculture in very distant regions and has reduced the rail and barge transport to fractions of their potential. The use of low cost fossil fuel has displaced local sustainable agriculture. These forces have destroyed communities throughout this nation by requiring the choice between products that are cheap but with long term side effects and local sustainable products that were more expensive. These choices have become even harder to make as the information about the process of production becomes harder to gather and comprehend. The cheap energy and long distance transport has forced farmers who practiced sustainable agriculture to either use fossil fuels and get bigger or to move out. Substitution of aluminum, steel, masonry, or plastic for wood in the name of environmental quality is frequently a deception. These materials all have fossil fuels used in their production and the volume of energy used is significantly higher than the energy needed to produce the same item from wood.

What are forests for?

What are forests for: Sanctuary? Protection of biodiversity? Supplier of materials as the market requires? Investment opportunity for long term sources of capital? Participant in the global market? Our "environmental" leaders today would have us believe that forests are most important for the aesthetics, diversity, and genetics that they embody. If one accepts the notion that humans are above the normal ecosystems that inhabit forests, that may seem plausible. But it is not true. Humans are little different from ants except that we can see the impact of our actions better. Human economic activities operate within the same envelope of air and on the same resources as the ant community. Humans have come to occupy a very significant portion of the total ecological space available on earth. They are likely to attempt to acquire more. This tension for more resources does not negate the value of the other members of the eco-community in which we reside. It does place the responsibility of our energy decisions squarely where they belong, on

our own shoulders. Each of us should use no more energy than is ecologically sustainable within the community we choose to frequent. Forests are benign sources of renewable products and energy. Forests that are not declared preserves for very good reasons must become much more significant providers of real resources for local communities.

Where do People Belong in the Broad Scheme of Things?

Should people be: Major predators? Disinterested bystanders? Protectors of the genome of the planet? Major consumer of all energy resources available on the planet? As a species isolated from the normal competitive battle for global resources? All these positions are now taken for granted. Each special interest group chooses one of these as the penultimate "good". Some of these we can balance. For instance, we can choose what we eat and where it comes from. Our communities will always consume a quantity of energy that is affected by the numbers of people in the community and the amount of non human assistance and environmental modification we require. Minimizing local impact is not enough to say that impact of humans has been mitigated. The "NIMBY" syndrome merely exports negative impacts. Today the atmospheric impact of all the things that humans demand is pervasive and potentially massively upsetting to areas that have never even had any physical presence of a single human. Although decisions of individuals drive the global impact, these decisions are largely based on economics; economic policies are set or encouraged by governments. Tinkering with individual ecosystems, in ways that seek to maintain them, without addressing the impact of our life style on the global scene is like counting grains of sand.

What part should forestry play?

The potential of forestry is to be something that can be done forever. It can continue as is until the impact of the fossil energy use therein (transportation and processing) catches up with it. As part of the global economy it is also part of the

problem of negative cash flow, pollution, and CO2 accumulation. As part of a society that wants to use fossil and nuclear fuel "servants" because of their low present cost, it is still part of the problem. The long-distance transport of unprocessed wood is an example of "economics of scale" that are completely dependent on fossil fuel use. Forests can become a source of local energy and materials to be used primarily within stable communities as a means to stabilize these communities and to ameliorate fossil CO2 release. For this to happen it must be realized that we have been protecting both ourselves and our children from life. This protection has been bought with the largess from cheap fossil and nuclear energy. The choice of an energy source must be made very carefully because it may eventually come to devalue parts of the ecosystem that have lower energy concentrations or lower flow rates (such as biomass). This devaluation then results in the elimination of the possibility of sustenance from these lower-value sources or occupations connected to them. Recognition of the value of renewable energy (solar) as well as materials that come from forests can make forestry a prime mover for social change.

Suggested basis for dialogue:

There are 3 kinds of "environmentalists" - "protectionists", "preservationists", & "sustainable solution seekers."

The dialogue from the first two of the above advocates for "environmental" solutions has been dominated by either poorly informed individuals and groups or those that have very limited agendas, including maintenance of their own financial positions. The activities of these two groups has not sought to direct humanity into sustainable pathways. Forestry and the use of nonpreserve forests can integrate of all three facets of environmental action.

Forests and forestry are being converted, to uses other than sustainable provision of energy and materials, due to a lack of a national and international energy policy.

Forests are the only long term natural terrestrial solar collectors that we have. They are relatively easy to manage. It is quite likely that directed research would find ways to use the mortality of nonpreserve forests for efficient local energy production. The lack of an "environmentally" sound national and international energy policy is resulting in the development of a group of roving transnational resource and labor manipulators that prey on forests as they do any other resource. They then sell the products to whatever country has the liquidity to pay for their wares. The U.S. is in the process of being stripped of its industrial productive capacity and its forests are being used as a raw material in the export cash market. Even third world countries have learned that they must not sell unprocessed timber for cash. Such sales eliminate the value-added multiplier from conversion to finished products. The lack of a coherent energy policy allows the promulgation of uncoordinated regulations in the name of "environmental" action which do not target total energy use nor the type of energy used. Frequently these regulations require the use of revenues from fossil fuel use in order to be implemented and destroy sustainable solutions in the process.

The extent to which U.S. financial problems are exacerbated by purchases of foreign oil.

Today the Northeastern U.S. has a fiscal hemorrhage that no one talks about. It is as if it is normal for us to send 85% of the price of every purchase completely out of the country. This can not continue for very long. At some point either the fiscal reality of this drain on this region will surface or the impact of the use of the atmosphere and rural landscape as an unending dump will create inescapable dilemmas. Then there may be little that can be done to change the conditions. Today we could recognize that we are on the wrong path and take steps to move toward less damaging energy sources.

Current energy consumption is supplied from sources that damage both our community structures and our environmental stability.

If one stands on a street corner today and asks how much of what happens in that vicinity is sustainable (e.g., that does not use the atmosphere as a dump and does not devalue all human labor), there is only one answer - very little. Today our communities are in a meltdown condition because the price we pay for energy is so low that human effort has little value. Fossil and nuclear energy have devalued human labor in our society. Thus farmers and loggers can no longer compete if they are not using a 100+ horsepower tractor or skidder. Neither they nor their industrial counterparts today are real "knowledge" workers as the popular press and the government would have us believe, rather they are energy managers. They are also subject to replacement by computerized energy managers as the facilities that are used become larger and more centralized. The trend today is to displace these workers with fossil fueled mechanization; rather than systems that are powered from the resource being harvested. Communities of the past were interdependent societies. They bought little from outside their limits because the inhabitants used the local resources to supplement each others' production. Today communities are bedrooms for managers of energy. The layout of the community is designed for privacy and aesthetics. Pleasure and relaxation for an energy manager is all that matters. Every phase of life today requires the use of fossil fuel energy. The food we eat frequently has more energy in the packaging than it does in the food.

Consumption is facilitated by promotion of unsustainable life styles based on energy costs that do not reflect the full costs of the energy use.

The wrong turn that led us to the path that we are now on was taken over 150 years ago. President Lincoln thought that he would preside over a nation of small farms and towns that were designed to service those farms. He was wrong. The marshaling of energy for manufacturing that the North used to win the Civil War changed the fabric

of the country in unexpected ways. The technologies that developed later also contributed to the divergence of the path from one that would be truly sustainable. Today our methods of communication, our financial system, and the marketing community have convinced us that the only good life is one that is dominated by the use of fossil and nuclear fuels. This conviction is so strongly held that the politicians do not have the will to even try to raise badly needed cash from that resource, to say nothing of trying to wean us away from it over a short time period. Thus the demand that energy be kept cheap is a major obstacle to progress away from the current path. How have the Europeans managed to have retail energy costs four times ours and still maintain what most would consider a reasonable standard of living?

"Preservation & Environmental Protection" at home must not result in the displacement of pollution and environmental damage to other countries.

The global economy is a reality. It is driven by low cost fuel and a flexibility in supplying resources and labor to any point in the world at low cost. There is little guarantee that the locations chosen for the combination points will either be permanent homes for the employment of the local residents or be fairly treated by the owners of the mobile facilities. When costs get too high they will move to the next cheapest location. The separation of production and buyer that the global economy allows makes it much less likely that the consumer will be able to choose wisely in terms of pollution abatement, fair labor practices, and the like in the purchase of variously priced goods. One of the best way to avoid untoward consequences is to buy from your neighbor. At that point you know that the pollution is in your own backyard and you can deal with it.

Proposed actions by the forestry and forest products community:

Proactively describe the position of forests and US economics.

- We should not be defensive when describing what forests produce and how they work.
- We should not yield high ground to people who fly around the world telling lies or incomplete truths.
- We should be open about the trap that we all find ourselves in and describe how companies can cope as things change. They will change. You can plan for several eventualities. One can not do it alone, but one can respond in an appropriate manner. The alternative is to fight to maintain the status quo. Luckily most of the forest industry is still community-based and can change appropriately without too much baggage.
- We can illustrate that forests produce real wealth from water, CO₂, land, (human care), and time. This is a unique characteristic shared only with farming and fisheries. Our economic system has forced the owners of small amounts of forestland, particularly in populated areas, to neglect or abuse it in the past. The techniques that are being marketed today for harvesting and processing forest products depend almost entirely on fossil fuels. The expense of these systems makes the care needed to leave a healthy forest after harvesting very difficult to provide. The buyout of wood burning power plants in New Hampshire is an example of the coercion applied to force oil and nuclear dependence on this region. The CO₂-recovery aspect of forest growth and wood use has received little attention. It should be on top of our list of our activities' positive attributes.
- We can show how the use of wood that is specifically designed as a carbon store can make a difference. This function will be even more important if our society continues to demand that most systems be fueled by fossil fuels.
- We can supply our raw material needs with our wood and power all of our processes on our own energy, and have more to spare, if the rest of society will pay a fair, all costs included, price for the energy source they choose.
- We can describe the degree of vulnerability of our economy from the oil based consumption patterns being encouraged by our economic

model. Use the fact that 85% of every energy dollar is spent outside the region as a lever to pry concessions from environmental groups before an inch is given for compliance with regulations that use cheap energy and discourage renewable energy production.

- We can describe wood as a local resource that should be manufactured for its highest use close to the point of growth. This is a very basic principle. Every third world country understands that shipping raw wood is tantamount to raping and pillaging the forest. There is no infrastructure to help with its maintenance after it is cut and the price paid is always less than what it really takes to grow it.

Develop a national CO2 recovery certificate program that funnels the revenues from CO2 liberators to CO2 recoverers.

A major step to good forestry is for forest owners to be paid for the things that the forest does. CO2 recovery by trees is real. It is needed unless the global climate maintenance system is already out of control. We won't know, if it is out of control or not, until it is too late so action now is appropriate. It would be even better if this were a global program because then the long distance transport of goods and services would be much more costly. It is much more likely that things will be done locally or at least regionally as the cost of transportation increases. In any case the U.S. is looked at as a role model. We need to start doing some sustainable things instead of exporting consumption patterns that should not be repeated.

Advocate for responsibility by the financial community to develop local sustainable business plans that wean the region from reliance on imports for energy and exports for cash.

The financial sector of our society has escaped the environmental reviews that most other sectors have had to struggle with lately. Yet they are primarily responsible for the decisions that most small and medium sized businesses make. If your costs are too high you can't pay the debt service.

Banks therefore encourage cost reduction - the use of cheap energy.

For our own benefit and as a role model we could advocate:

- Refusal to create impediments to forest use without total energy cost analysis of alternatives necessitated by these impediments.
- Education of all students in what a sustainable life style entails and educate all students in biology and ecology.
- Research funding for local small-scale cogeneration systems that use locally available renewable fuels. Fuel cells and liquefaction of wood should be included in this effort.
- Exposure of the "global market place" as the fossil energy-dependent system that it is.
- Efforts to develop intraregional trade as the norm (with barter between regions).
- Exposure of the sources of funding for the massive "Environmental Organizations" that dominate the "preservation/protection" discussions today.
- That all corporations rewrite their charters with conversion to sustainable energy and community systems as the goal for all operations.

Early Indicators of Acidification: A Whole-Watershed Approach to Studying Forest Response

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Abstract

A whole-watershed acidification experiment was conducted in which the impacts of additions of nitrogen and sulfur at triple ambient rates were monitored to document ecosystem level biological and chemical responses to acidification. The objective of this study was to develop field techniques to aid forest managers in assessing the health status of forests undergoing acidification stress. Soil and percolating soil water response to acidification involved decreased pH and increased levels of sulfur and the phytotoxic metals aluminum and manganese compared to unacidified control areas. The concentrations of calcium and magnesium increased in percolating soil water collected below the rooting zone. Response of Japanese larch (*Larix leptoleptis* Sieb. and Zucc.) planted on the watershed included decreased height and diameter of acidified trees compared to control trees. Foliar nutrient calcium and magnesium concentrations in Japanese larch, red maple (*Acer rubrum* L.), sassafras (*Sassafras albidum* (Natt.) Nees), mountain laurel (*Kalmia latifolia* L.) and blackberry (*Rubus* spp.) were lower in treatments receiving simulated acidification compared to control treatments. Higher concentrations of foliar manganese were evident in trees receiving the acidification treatment. Monitoring of soil, percolating soil water, and foliar chemistry and tree growth under the simulated acidification treatment revealed that all appeared to be pertinent indicators of ecosystem response to acidification.

Introduction

Controversy remains over the impact acidic deposition has on forested ecosystems.

Acidification of soils due to additions of nitrogen and sulfur has been well documented (Robarge and Johnson 1992). Net leaching of base cation nutrients has been reported (Robarge and Johnson 1992; Federer et al. 1989) in areas receiving large inputs of atmospheric sulfur and nitrogen. Gradual depletion of base cations and the increased solubility of aluminum and manganese at low soil pH values disrupt nutrient balance and may lead to depressed tree growth. The forest health perspective has broadened on the issue of acid deposition to include effects on forest soils, tree nutrition, accelerated soil base cation leaching and metals toxicity (Tomlinson and Tomlinson 1990).

This study was an attempt to document soil and soil water chemical changes under simulated acidification of a forested watershed in north-central West Virginia. These changes were then related to growth and nutritional status of selected plant species growing on the watershed.

Study design and methods

Clover watershed (11.6 hectares), located in north-central West Virginia, was selected for this study. A general description of the watershed and a history of past land use were provided by Kochenderfer and Helvey (1989). Beginning in 1983, vegetation from the entire watershed, excluding a 1.42 ha buffer zone along the stream, was removed and the watershed was planted with 2-0 stock Japanese larch in the spring of 1984. To simulate inputs of triple the ambient rates of N and S deposition, granular ammonium sulfate fertilizer was applied to Clover watershed by helicopter beginning in April 1987 and continuing through July 1994.. Three applications of ammonium sulfate are applied each year for a yearly addition of

150 kg/ha of N and S. Control plots established on the watershed prior to treatment did not receive treatment.

Soil samples were obtained from hand dug pits in control and treated areas. Calcium, Mg, Al and Mn were determined by atomic absorption spectrophotometry following 0.01 M SrCl₂ extraction and preparation as outlined by Joslin and Wolfe (1989). Soil NO₃-N and SO₄-S analyses were performed by the Agricultural Analytical Services Laboratory, at The Pennsylvania State University based on methods outlined in North Dakota State University (1988). Pan lysimeters were installed at 46 cm in 6 control areas and in 6 corresponding treated areas, and soil water analyses were performed by The Timber and Watershed Laboratory, Parsons, WV. Japanese larch height and diameter were measured on sample control and treatment trees in July of 1992 and 1993. Foliar samples were obtained from Japanese larch, red maple, sassafras, mountain laurel and blackberry in August of 1992 and 1993, and ICP analysis was performed on foliar samples by the Agricultural Analytical Services Laboratory.

Statistical analysis followed a Model I two-treatment ANOVA for a fixed treatment. The SAS statistical package was used for data analysis; all significant differences are reported at ($\alpha = 0.05$) (SAS Institute, Inc. 1985).

Results and discussion

Japanese larch trees which received 6 years of increased N and S deposition treatment had significantly reduced growth (height and diameter) compared to control trees (Figure 1). Data for larch height growth on the entire watershed also indicated significantly greater height growth on the control areas compared to larch receiving treatment (J. Kochenderfer, personal comm.). Treated soil had significantly lower levels of nutrient elements Ca and Mg and significantly greater N and S and the toxic metal Al compared to control soil (Figure 2). In 1993, soil Mn (0.01 M SrCl₂ exchangeable) was

also determined and was significantly greater in the treatment. These soil changes as well as a decrease in soil pH in the treated soil (control pH = 5.38, treatment pH = 4.91) indicate that the treated soil has become more acidic (Schlegel et al. 1992). Because the growth of larch is not stimulated by large N additions and the Ca demand of larch foliage is relatively high, N addition and Ca leaching may be contributing to the observed growth declines of the treatment trees (Tyrrell and Boerner 1987; VanGoor 1953).

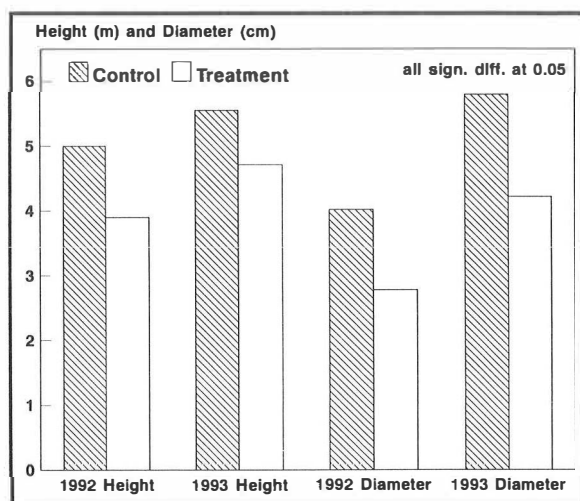


Figure 1. Height and Diameter Comparisons Between Control and Acidification Treated Larch Trees for Sample Dates August 1992 and 1993.

Results of Japanese larch foliar analysis indicated significantly greater Mn and Al and lower Mg and Ca (not significant) in the treated area. Similar results were obtained for red maple, sassafras, mountain laurel and blackberry (Table 1). In general the treatment area had lower foliar and soil Ca and Mg, and higher soil and foliage Al and Mn than the control area.

Reduced uptake of Ca and Mg in response to the treatment may be a consequence of leaching losses with the mobile SO₄²⁻ and NO₃⁻ anions. Soil water data also indicate accelerated loss of Ca and Mg as

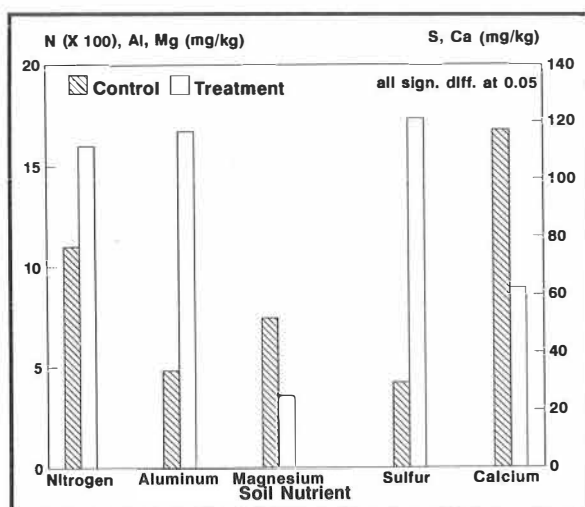


Figure 2. Soil Nutrient Comparisons Between Control and Acidification Treated Soil.

a result of the acidification treatment (Figure 3). Treatment larch height and diameter ($r = 0.83$ and 0.84 respectively) were positively correlated with foliar Mg, and foliar Mg was significantly reduced in treated larch. Magnesium deficiencies have been reported in declining Norway spruce (*Picea abies*) throughout Europe (Tomlinson and Tomlinson 1990) and in the eastern US (Ke and Skelly 1994).

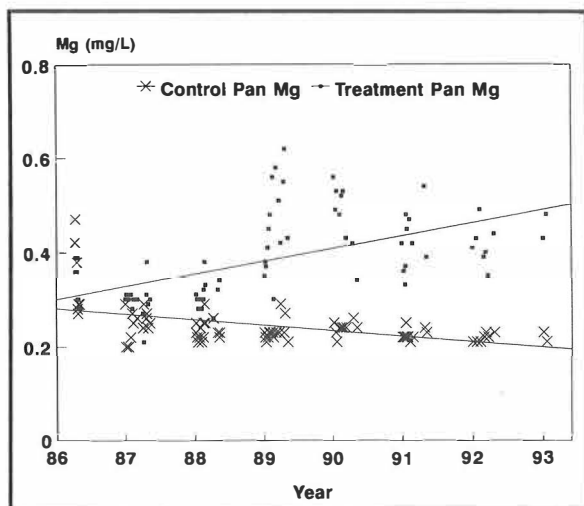


Figure 3. Mean Pan Lysimeter Magnesium for Clover Watershed, 10/1/86-2/18/93.

Conclusions

The chemical changes observed on this watershed, including soil acidification, increased leaching of Ca and Mg, increased foliar Mn concentrations, and decreased tree growth may be used as indicators in the early assessment of forest ecosystem response to acidification.

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Literature cited

1. Federer, C. A., J. W. Hornbeck, L. M. Tritton, C. W. Martin and R. S. Pierce. 1989. Long-term depletion of calcium and other nutrients in eastern U.S. forests. *Environ. Manage.* 13:593-601.
2. Joslin, J. D. and M. H. Wolfe. 1989. Aluminum effects on northern red oak seedling growth in six forest soil horizons. *Soil Sci. Soc. Am. J.* 53:274-281.
3. Ke, J. and J.M. Skelly. 1994. Relationships between symptoms expressed by Norway spruce and foliar and soil elemental status. *Water, Air, and Soil Pollution* 74:289-305.

4. Kochenderfer, J. N. 1994. Personal Communication. USDA Forest Service, Northeastern Forest Experiment Station, Timber and Watershed Laboratory, Parsons, WV.

5. Kochenderfer, J. N. and J. D. Helvey. 1989. Hydrologic impacts of mechanized site preparation in the central Appalachians. The 7th Central Hardwood Forest Conference, Southern Illinois University, Carbondale, Illinois, March 5-8. pp. 283-289.

6. North Dakota State University. 1988. Recommended chemical soil test procedures for the north-central region. North Dakota Ag. Exp. Sta. NDSU, Bull. 499 (revised). 37 pp.

7. Robarge, W. P. and D. W. Johnson. 1992. The effects of acid deposition on forested soils. *Advances in Agronomy*, Vol. 47. pp. 1-83.

8. SAS Institute, Inc. 1985. SAS User's Guide: Statistics, Version 5 Edition, SAS Institute, Inc., Cary, NC.

9. Schlegel, H., R.G. Amundson and A. Hutterman. 1992. Element distribution in red spruce (*Picea rubens*) fine roots; evidence for aluminum toxicity at Whiteface Mountain. *Can. J. For. Res.* 22:1132-1138.

10. Tomlinson, G. and E. Tomlinson. 1990. Effects of acid deposition on the forest of Europe and North America. CRC Press, Inc., Boca Raton, FL.

11. Tyrrell, L. E. and R. E. Boerner. 1987. *Larix laricina* and *Picea mariana*: relationships among leaf life-span, foliar nutrient patterns, nutrient conservation, and growth efficiency. *Can. J. Bot.* 65:1570-1577.

12. VanGoor, C. P. 1953. The influence of nitrogen on the growth of Japanese larch (*Larix leptolepis*). *Plant Soil* 5(1):29-35.

Table 1. Foliar Chemistry Comparisons Between Control and Treatment Species. The * indicates significant difference between control and treatment at $\alpha \leq 0.05$.

Foliar Chemical	Exp't Condition	Japanese larch	Red maple	Sassafras	Mountain laurel	Rubus spp.
Ca (%)	Control	0.54	0.93*	1.06	1.07*	1.27*
	Treatment	0.52	0.75	1.05	0.79	0.87
Mg(%)	Control	0.13*	0.16*	0.17*	0.20*	0.35*
	Treatment	0.10	0.09	0.14	0.13	0.28
Al (ppm)	Control	164.6*	18.7*	64.0*	55.6*	82.2
	Treatment	190.8	22.0	86.7	46.0	107.1
Mn (ppm)	Control	193.8*	1788.5*	269.5*	840.5*	1566.1*
	Treatment	2422.6	2206.2	611.0	1488.8	2350.8
S (%)	Control	0.19	0.18	0.40	0.14	0.18
	Treatment	0.19	0.18	0.42	0.14	0.19

Countering the Threat Posed by Invasive Exotic Plant Species; Efforts by the Virginia Native Plant Society

Theodore G. Scott, Jr., Conservation Chairman, Virginia Native Plant Society, 12493 Spicewood Road, Orange, Virginia 22960-2201.

Invasion of natural ecosystems by introduced or exotic species--including plants, insects, vertebrate animals, and various pathogens--is increasingly considered to be a major threat to ecosystem health and biological diversity. Nor is the problem confined to "island" ecosystems such as Hawaii or the southern portion of Florida. Exotic plants now comprise more than 20% of the species listed in Roger Tory Peterson's *Field Guide to Wildflowers*. At least 88 National Parks have reported problems associated with invasions of exotic plant species. Confirmation of the growing awareness of this threat is the study recently completed by the Office of Technological Assessment at the request of three Congressional subcommittees.

The Virginia Native Plant Society has formed a "partnership" with the Virginia Department of Conservation and Recreation on a project to combat the spread of the more harmful of these plants through citizen education and action.

Project SHARE

Atlantic Salmon Habitat Enhancement for Maine's Down East Rivers

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Background

Atlantic salmon (*Salmo salar*) once inhabited freshwater rivers on both sides of the north Atlantic, and as far south as the Housatonic River in Connecticut, and occurred in at least 33 rivers in Maine (MacCrimmon and Gots 1979, Thorpe and Mitchell 1981, Beland 1984). The species was extirpated throughout most of its range during the late 1800's and early 1900's through over-harvest, habitat loss and destruction, and pollution (ND&T and Ritzi 1994, Netboy 1968). Since the mid-1900's there has been a concerted effort to restore Atlantic salmon to many rivers in its historic range, but with only modest success.

Today, the primary cause for low salmon populations is believed to be commercial over-harvest and at-sea (wintering) habitat (ND&T and Ritzi 1994). The two primary commercial fisheries affecting the Atlantic salmon are the Newfoundland fishery and the West Greenland Fishery. The moratorium on the Newfoundland fishery begun in 1992 and the buy-out of the West Greenland fishery begun in 1993, both continuing today, offer the greatest potential for short-term relief from commercial over-harvest.

Fresh-water (nursery) habitat is also important, and will become increasingly so if limitations on commercial harvest are successful. The down east rivers of Maine (Machias, East-Machias, Dennys, Narraguagus, and Pleasant rivers), in part because of the relative lack of obstruction along these rivers, offer great potential for a successful conservation effort focused on riverine habitat. Such an effort, we believe, would contribute significantly to the restoration of Atlantic salmon. This is the area of initial focus for Project SHARE.

Origin of project SHARE

In early April, 1994, three of the major forest landowners in down east Maine -- Baskahegan Company, Champion International Corporation, and Georgia-Pacific Corporation, with more than 1 million acres combined in the area -- chose to develop a voluntary public/private approach to Atlantic salmon resource conservation and enhancement. On June 27, these three forest product companies joined with 16 other cooperators (including other forestland owners, agricultural landowners, state agencies, research and conservation groups, and local business) as charter members of Project SHARE (Salmon Habitat and River Enhancement). These are:

Baskahegan Company
Bangor Hydro-electric
Champion International Corporation
Cherryfield Foods Inc.
Down East Timberlands
Georgia-Pacific Corporation
Jasper Wyman & Son
Machias Savings Bank
Maine Atlantic Sea Run Salmon Commission
Maine Conservation Rights Institute
Maine Council, Atlantic Salmon Federation
Maine Department of Inland Fisheries and Wildlife
Maine Forest Service
Narraguagus Salmon Protective
National Council of the Paper Industry for Air and Stream Improvement
National Fish and Wildlife Foundation
S. D. Warren Company
Seven Islands Land Company
The Nature Conservancy

Organizational structure and objectives

Project SHARE was established as a cooperative effort to address the freshwater habitat needs of the Atlantic salmon on the rivers in down east (Washington County), Maine, and indirectly the other fisheries in the area. The objectives of Project SHARE fall into three general areas: habitat management, research, and education. Cooperators plan to identify habitat restoration/enhancement needs in the down east rivers, prioritize them, and bring the necessary resources together to address them. Information gaps in river habitat management and survey techniques, as well as land-use/forestry/fishery relationships, will be identified, and research developed to fill those gaps. Also, a public education program will be instituted to garner understanding of and support for the Project and the conservation of Atlantic salmon. To coordinate these efforts, Project SHARE established three standing committees: habitat management, research, and education (Figure 1).

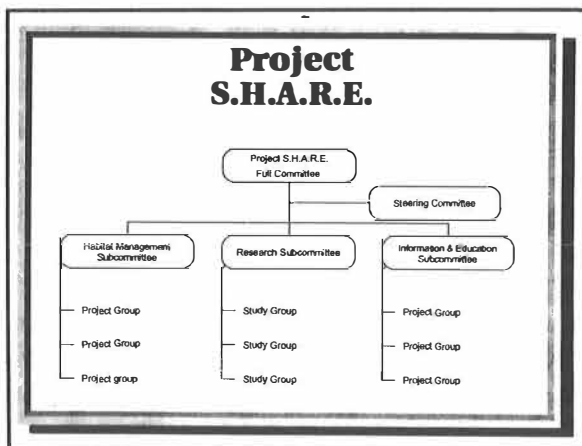


Figure 1. Project SHARE is a cooperative effort to address the freshwater habitat needs of the Atlantic salmon in down east Maine. Projects will be coordinated through three standing committees: Habitat Management, Research, and Education.

Key operating guidelines

Building successful cooperative partnerships, particularly those that include a mix of public agencies, private landowners, and other private organizations, requires mutual respect. Such respect

is earned if each member contributes something to the partnership. The "contribution" does not have to be equal in size or dollar value, but should be more than opinion. Simply offering one's opinion of what the others should do, and nothing else, can undermine respect. Such one-sided "help" is often perceived as a demand by a critic not aid by a cooperator. Respect is also built by each member demonstrating an acceptance of the others' objectives, and a willingness to work within those objectives. Recognizing these traits of human nature, the charter members of Project SHARE established a set of key operating guidelines:

- A voluntary, cooperative process that will provide for salmon habitat enhancement.
- Open to all who share a commitment to resource enhancement through cooperative means, and who can bring resources to the table in support of the overall objectives.
- Recognition of and respect for individual landowner, agency, local community, or group objectives.

Results

After only two business meetings, members of Project SHARE have identified five management projects, and subcommittees to coordinate them. These include removal of natural stream blockages (log jams etc.), beaver control (trapping and removal of dams), summary of existing regulations pertaining to salmon streams and associated watersheds, repair/replacement of specific water control facilities, and the installation of temporary population monitoring stations in selected streams. Two research projects were also identified -- review and assessment of irrigation water removals, and review and assessment of stream temperature data -- and teams appointed to draw up the necessary study plans. A number of education projects were also initiated including training sessions for foresters, video tapes on Atlantic salmon, and a logo contest for children.

Literature cited

1. Beland, K. F. 1984. Strategic plan for management of Atlantic salmon in the state of

- Maine. Maine Atlantic Sea Run Salmon Comm., Bangor.
2. MacCrimmon, H. R., and B. L. Gots. 1979. World distribution of Atlantic salmon, *Salmo salar*. J. Fish. Res. Bd. Can. 33:2616-2621.
 3. ND&T and Ritzi. 1994. Summary of information relevant to management of the Atlantic salmon in New England. Northrop, Devine, & Tarbell, Inc. Portland, Maine, and Charles Ritzi Assoc., Redfield, Maine. 168pp + appendices.
 4. Netboy, A. 1968. The Atlantic salmon: A vanishing species? Houghton Mifflin Co., Boston.
 5. Thorpe, J. E., and K. A. Mitchell. 1981. Stocks of Atlantic salmon (*Salmo salar*) in Britain and Ireland: discreteness and current management. Can. J. of Fish. and Aquatic Sci. 38:1576-1590.

Short Stream Impacts Associated with Forest Road and Skid Trail Crossings

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Abstract

Forest roads and skid-trail networks often cross headwater streams and associated small riparian wetlands. The environmental impacts of road and trail crossings on stream water quality, especially the relative merits of different types of crossings (bridges, culverts, and fords, etc.) have not been documented. A study was initiated at two sites in Pennsylvania to determine the short-term impacts of several types of commonly used crossings for haul roads and skid trails on stream total suspended solids. Sites chosen were: Penn State's Experimental Forest in Huntingdon County, Pennsylvania and Glatfelter Pulp Wood Company properties in Fulton County, Pennsylvania. Stream water samples were taken before, during, and after installation and use of the crossings. Crossing types used represent conventional as well as innovative technologies, including use of portable steel and treated timber bridges, culverts with clean shale fill and log fill, an unconfined stone ford and a GEOWEB{SYMBOL 210 \f "Symbol"} ford. Preliminary results indicate that increases in suspended solids and turbidity did occur during installation of all crossings. However, the impacts were generally confined to short sections of the stream ({SYMBOL 64 \f "Symbol"} 61 meters) and were reduced to insignificant levels within 24 hours.

Introduction

In Pennsylvania, forest road and skid trail networks constructed for harvesting activities are often located across headwater streams and associated small riparian wetlands. These types of crossings are generally exempt from Federal Regulation

(Section 404 of the Clean Water Act), but in Pennsylvania they are regulated by state permits. When a stream crossing can not be avoided, the common crossing methods used in Pennsylvania are culverts with local fill (shale, gravel, or log), or, less commonly, portable bridges and fords.

While the effects of forestry activities on water quality have been documented, research focusing on the impacts of stream crossings is sparse. Miller (1993) evaluated 70 crossings of stream/wetlands which were at least five years old in Pennsylvania to describe the long-term impacts of the crossings on habitat quality and channel stability. Results indicated no significant differences in channel stability and habitat quality when comparing conditions above versus below the crossing (Miller, 1993). However, stream bed fine sediment levels were higher, tree basal area lower, and percent herbaceous cover higher in the immediate vicinity (< 10 meters upstream and downstream) of some crossings (Miller, 1993).

Thompson and Kyker-Snowman (1989) evaluated short- and long-term impacts of non-point source pollution caused by logging equipment entering and crossing streams. During a simulated 'logging' operation, a portable bridge was most effective in reducing crossing water quality impacts (Thompson and Kyker-Snowman, 1989). Thompson and Kyker-Snowman (1989) concluded that the largest impacts to stream water quality occurred as a result of unmitigated crossings, crossings which did not meet best management practice standards, and the approach areas adjacent to the crossings.

The short-term impacts of road and trail crossings on water resources, however, have not been completely documented, especially the relative merits of different types of crossings (e.g. bridges,

culverts, fords, etc.) during construction and use. A study was initiated at two sites in Pennsylvania to determine the short-term impacts of several types of commonly used crossings for haul roads and skid trails on stream total suspended solids. Sites chosen were: Penn State's Experimental Forest in Stone Valley, Huntingdon County, in central Pennsylvania and Glatfelter Pulp Wood Company properties in Fulton County, which is located in southern Pennsylvania. The Stone Valley sites are part of the Susquehanna River watershed and the Fulton County sites are part of the Potomac River watershed, the largest and second largest freshwater contributors to the Chesapeake Bay.

Site description

Four different crossing types were evaluated on the 14.9 hectare (ha) Stone Valley site. They included skid trail crossings using a metal culvert with clean shale fill, a metal culvert with log fill, and a portable steel bridge and a haul road ford constructed of a GEOWEB{SYMBOL 210 \f "Symbol"} plastic confinement system with shale fill underlain by geotextile fabric. All crossings were made across unnamed intermittent tributaries to Shaver's Creek, a high quality trout stream. A shelterwood cut was completed on this site in April, 1994.

In Fulton County three haul road crossings were constructed at three separate locations. A culvert with shale fill was constructed on an unnamed intermittent tributary to Licking Creek on the 14.6 ha Kelso site. The crossing at the 13.8 ha Bailey site consisted of a bedrock-based, gravel ford across an unnamed intermittent tributary to Owl Creek. A wooden bridge constructed of treated railroad ties across the headwaters of Foster Creek was installed on the 20.2 ha Truax site. Logging is scheduled to begin in August, 1994 on all three Fulton County sites.

Methods

Field sampling was initiated in June, 1993 at the Stone Valley site. Sampling upstream, immediately downstream, and 61 meters downstream of each of the crossings was conducted during base flow and

storm flow periods before, during, and after installation of the crossings and during and after logging in an attempt to characterize ambient conditions during all levels of activity and flow. Unfortunately, flow was inconsistent and prevented continual monitoring for the culvert with shale fill and ford sites at Stone Valley.

A similar sampling strategy was applied to the installation of the Fulton County crossings but on a delayed time schedule. Due to logistical constraints, only daily samples were collected in Fulton County.

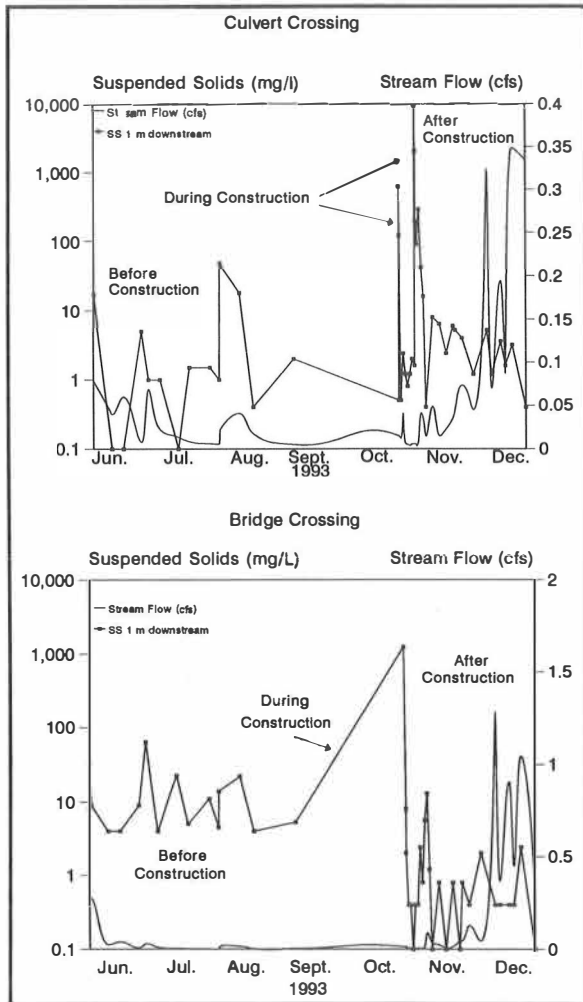
Approximately 1250 water samples were collected for total suspended solids analysis in the laboratory. Stream discharge or stream water level measurements were taken at the time of sampling to provide an indication of flow rates for each sample taken.

Preliminary report on construction and use at stone valley and construction at fulton county

Stone Valley: Baseline data collected prior to the installation of the crossings indicate a natural storm-induced variability in the total suspended solids of the streams but otherwise reflect typical values for headwater, intermittent streams in Pennsylvania. These data are being used as the basis of comparison for the disturbance periods of installation and use.

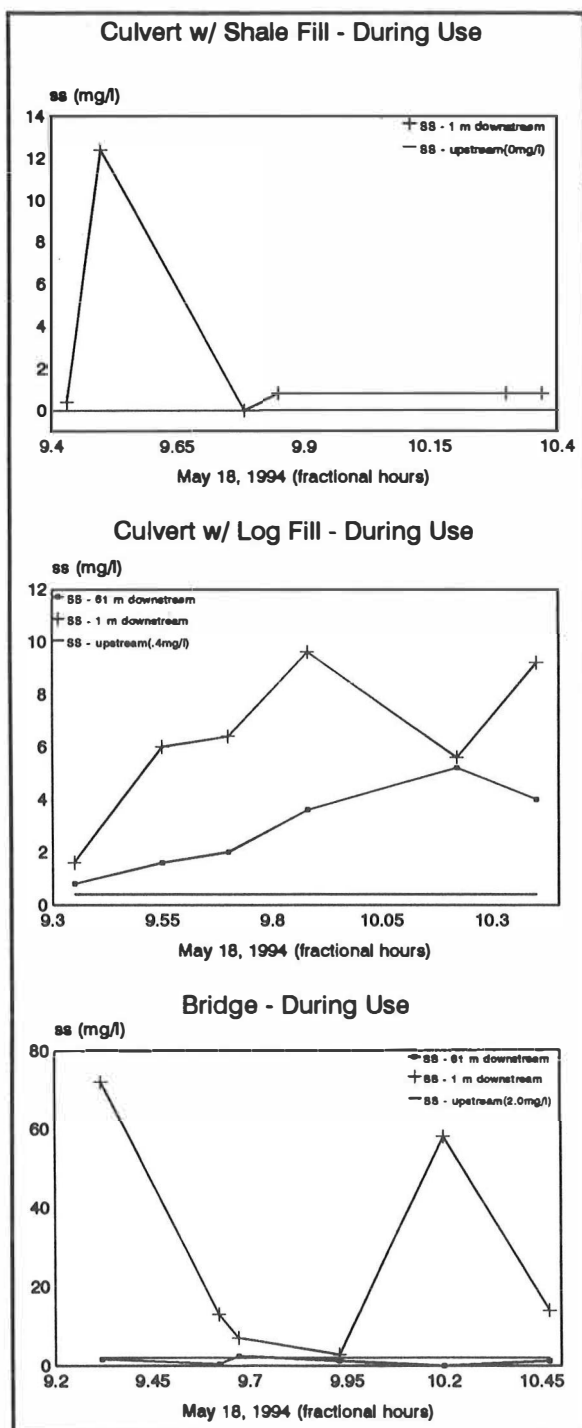
Installation of the crossings occurred during a period of extremely low flows and this fact should be kept in mind while interpreting the following results. To record installation impacts a series of samples were taken during and following construction. The installation of the bridge required one pass of a bulldozer while culvert installation required back hoe work within the streambed which resulted in significant alteration of the natural stream channel. Preliminary results indicate that increases in total suspended solids did occur during installation of all crossings relative to upstream conditions (Figure 1). However, the impacts were generally confined to short sections of the stream ({SYMBOL 187 \f "Symbol"} 61 m) and were reduced to insignificant

levels within 24 hours for the bridge and 96 hours for the culvert with log fill.



Crossing use was simulated by having a bulldozer pull logs across each crossing type six times. During crossing use in Stone Valley increases in total suspended solids occurred at the portable bridge and culvert with log fill crossings while use of the culvert with shale fill seemed to create no increases in the stream's sediment load (Figure 2). The increase at the bridge crossing occurred as a result of organic debris falling through gaps in the bridge planking and was not related to sediment input into the stream although this possibility exists if mud accumulates on the bridge deck during use. The culvert with log fill crossing impacts resulted primarily from increased sediment entering the stream. The stream bank area and the approach to

the crossings at this location underwent significant disturbance during use and the authors believe that it was these areas which contributed to the increased sediment load. It should also be noted that there were no increases in total suspended solids 61 m downstream of the bridge during use; however, there was an increase in total suspended solids at this same distance below the culvert with log fill. The natural storm-induced variability observed in the baseline sampling period was also present after the crossings were installed and used. The crossings however did not appear to add to the sediment load of the streams during these higher flow periods.



Fulton County: Installation of the crossings occurred during October, 1993. Each crossing and the associated approach road work required several days to complete. While an analysis of the installation data has not been completed, it appears that there were only minor increases in total

suspended solids. The presence or level of increase downstream of the crossings was dependent on the work in progress when the sample was collected.

Conclusions

The results to date indicate increases in total suspended solids during installation of all crossing technologies. For the Stone Valley crossings, the level of impact appeared to be less severe during bridge installation than culvert installation. Installation impacts were reduced to insignificant levels within 24 hours of bridge installation and 96 hours for culvert installation. Crossing use at Stone Valley resulted in different types of impacts for the bridge and culvert with log fill crossings and no impact for the culvert with shale fill crossing. The amount of impact attributed to the bridge crossing appeared to be related to the cleanliness of the bridge deck. Impacts associated with the use of the culvert with log fill crossing appeared to be related to the stability of the approach area and stream bank. Similar results are expected from the use of the Fulton County crossings.

Acknowledgments

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References

1. Miller, Robert L. 1993. The Long-Term Environmental Impacts and the Costs Associated with Forest Road Crossings of Wetlands in Pennsylvania. Masters Thesis. The Pennsylvania State University. University Park, PA.
2. Thompson, Charles H., T. D. Kyker-Snowman. 1989. Evaluation of Non-Point Source Pollution Problems from Crossing Streams with Logging Equipment and Off-Road Vehicles in Massachusetts: 1987-88. Prepared by the Department of Forestry and Wildlife

Management, University of Massachusetts,
Amherst. Prepared for Department of
Environmental Quality Engineering and
Department of Environmental Management. 78
p.

Dolan, J. Daniel; Riegel, Angela, eds. 1996. **Proceedings, Environmental Issues affecting the forestry and forest products industries in the Eastern United States**; 1994 August 24-26; Baltimore, MD. Gen. Tech. Rep. NE-219. Radnor, PA: U.S Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 166 p. <https://doi.org/10.2737/NE-GTR-219>.

The conference addressed the broad issues concerning environmental policies affecting the forestry and forest products industries, the driving forces behind them, and the effects they have on the national and global environment. A paradigm of three general factors or forces that drive environmental policy was proposed based on: 1) Society's Wants and Needs, 2) The Need to Maintain the Integrity of the Eastern Forest Ecosystems, and 3) The Role of Forest Management, Forest Products Research and Development and the Associated Improved Utilization of the Harvested Resource in satisfying forces (1) and (2). Within this system, it was recognized that the two drivers, Regulation and Incentive Systems, are used to provide direction for the paradigm to function.



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