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# Fairly Sustainable Forestry: Seven Key Concepts for Defining Local Sustainability in a Global Ecosystem

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## ABSTRACT

In the U.S. we increasingly restrict wood production in the name of sustainability while going abroad for a growing share of the wood we consume, even though our own forest resources per capita are far greater than the global average. The unintended consequence is that we transfer impacts (positive and negative) of our timber harvesting and wood consumption to other places. This is not sustainable in the broad sense of the word. Seven key concepts help define limits on sustainable forestry in the U.S.:

(1) we must ensure sustained timber yield;

(2) most people find harvesting unaesthetic and prefer not to see it;

(3) in the U.S. we annually consume the equivalent of about 20 billion cubic feet of wood products;

(4) the U.S. is a net importer of wood and has been for at least 90 years;

(5) as we import wood and wood products we also export to other nations the environmental, economic, and other social consequences (both the positive and negative) associated with wood production, manufacturing, and consumption;

(6) as a natural resource, wood is generally preferable to alternative commodities; and

(7) all the wood consumed on Earth must be produced from the 9.6 billion acres of forestland on the planet.

About 30 percent of the land mass of the earth is forested, about one-third of North America is forested, and about one-third of the United States is forested. Despite having a proportionate share of the world's forests, our national imbalance between domestic wood production and consumption annually sends billions of cubic feet of environmental consequences (positive and negative) to other nations. National Forests, for example, contain 19 percent of U.S. timberland and now produce less than 2 percent of the wood consumed in the U.S. The USDA Forest Service is rightly concerned about sustainability for National Forests, private forests, and global forests. In fact, we have separate divisions dealing with each constituency. We should think carefully about how the quest for sustainable management in any one sector affects forests elsewhere.


**Keywords**: consumption, growth, removals, national forest

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## INTRODUCTION

Sustainable forestry is hard to define in measurable or quantitative terms, so we tend to rely on conceptual or qualitative definitions. My favorite definition is the Native American proverb, "The frog does not drink up the pond in which it lives." It is pithy, easy to remember, and evokes a vivid mental image. And like much discussion related to sustainable forest management, the focus is more on what not to do than what to do.

The Dictionary of Forestry is more comprehensive in its definition of sustainable forest management (Helms 1998).

> **Sustainable forest management (sustainable forestry) (SFM)** this evolving concept has several definitions 1. the practice of meeting the forest resource needs and values of the present without compromising the similar capability of future generations—note sustainable forest management involves practicing a land stewardship ethic that integrates the reforestation, managing, growing, nurturing, and harvesting of trees for useful products with the conservation of soil, air, and water quality, wildlife and fish habitat, and aesthetics (UN Conference on Environment and Development, Rio De Janeiro, 1992 [see citation for United Nations 1992]) 2. the stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality, and potential to fulfill, now and in the future, relevant ecological, economic, and social functions at local, national, and global levels, and that does not cause damage to other ecosystems (the Ministerial Conference on the Protection of Forests in Europe, Helsinki, 1993) –note criteria for sustainable forestry include (a) conservation of biological diversity, (b) maintenance of productive capacity of forest ecosystems, (c) maintenance of forest ecosystem health and vitality, (d) conservation and maintenance of soil and water resources, (e) maintenance of forest contributions to global carbon cycles, (f) maintenance and enhancement of long-term multiple socioeconomic benefits to meet the needs of societies, and (g) a legal, institutional and economic framework for forest conservation and sustainable management (Montreal Process, 1993) [see citation for Montreal Process Working Group 1995].

That definition is more comprehensive in listing the components or the range of issues included in sustainable forestry. Moreover, it emphasizes the importance of addressing multiple spatial or geographic scales from local to national to global. This definition offers little guidance for measuring or quantifying the listed dimensions of forest sustainability, but it explicitly references the Montreal Criteria and Indicators (Montréal Process Working Group 2005) and lists the widely accepted seven criteria (or dimensions) of sustainable forestry as items (a) through (g) in definition 2.

The Montreal Criteria and Indicators (Montréal Process Working Group 2005) are especially important because they also provide a list of things to measure, count or otherwise quantify in order to describe the current status of each of the seven criteria and to monitor changes over time.

Consequently in the U.S. and elsewhere there are significant, ongoing efforts to measure and monitor over time the set of Montreal indicators. The Forest Inventory and Analysis (FIA) data (USDA Forest Service 2007a) provide a remarkably detailed and highly accessible statistical profile of forest resources across a wide range of spatial scales. Moreover, FIA data have been combined with other sources of information to specifically summarize and report the conditions of U.S. forests in the framework described by the Montreal Criteria and Indicators (e.g., Carpenter et al. 2003, USDA Forest Service, 2004).

Armed with this growing body of data and standardized summaries, we now can track the way many of these important indicators of forest sustainability change over time. What we still lack in most cases is knowledge of what values of the indicators are associated with sustainable or unsustainable forestry. For example, area by forest type relative to total forest area is one of the indicators used to measure biological diversity. Forest area by cover type has changed over time in many parts of the U.S. Does that indicate a sustainable or unsustainable condition? Timber harvest, another indicator, has decreased greatly on National Forests over the past 25 years. Does that indicate sustainable or unsustainable forestry? The area burned by wildfire (another indicator) has increased dramatically over the past two decades. Does that indicate sustainable or unsustainable forestry? It is often hard to determine.

In this paper I offer my own thoughts on a quantitative context for sustainable forest management. Although it is primarily addresses timber—the forest output that we are best able to measure—it frames a set of constraints that affects all other dimensions of sustainable forestry at local, state, regional, national, and global spatial scales. Additionally, the same concepts can be applied to other measurable dimensions of forest sustainability.

## SEVEN CONCEPTS RELEVANT TO SUSTAINABLE FORESTRY

In my own thinking about forest sustainability I have been able to arrive at seven concepts that collectively help me more clearly understand how to quantify the wood commodity aspect of sustainable forestry (Shifley 2006). Each concept is fairly simple, but collectively I find them enormously instructive with regard to sustainable forestry at many different spatial scales.

**Concept 1: Sustained Yield**

Sustained yield is at the core of professional forest management. Forest ecosystems are not sustainable if volume or biomass losses exceed growth over large areas or long time periods. Losses can be removals for wood products or fuel, the result of land clearing, or the consequence of fire, insects or disease. Whatever the cause, if there is a net decline in volume or biomass over large areas (e.g., thousands of acres) or over long periods of time (e.g., a decade or more), there is broad agreement that the situation is not sustainable. The concept of large-scale, long-term, non-declining volume is clear, measurable, and deeply rooted in our conservation ethic.

An examination of FIA inventories of U.S. forest resources indicates that we are clearly sustainable with regard to this first tenant of forest sustainability. Although the volume of U.S. timber decreased dramatically with the great waves of industrial logging, land clearing, and European immigration that occurred in the 1800's and early 1900's, since the 1950's (the beginning of contemporary statistical forest inventories) the volume of U.S. timber increased steadily from 616 to 856 billion cubic feet (39%) (Smith et al. 2003). Over the same period the total area of timberland decreased by only one percent. This pattern of increasing timber volume over the past 50 years is consistent across all regions of the U.S.

Over the same 50-year period (1953-2002), the volume on National Forest land increased from 218 to 260 billion cubic feet (19%) while timberland area increased from 95 to 97 million acres (but varied considerably from year to year over the period) (Smith et al. 2003). The increase in timber volume was not evenly distributed geographically. National Forest timber volume more than doubled in the eastern U.S., increased by nearly 60 percent in the intermountain region, increased by 6 percent on the Pacific Coast (exclusive of Alaska), and decreased by nearly 50 percent in Alaska. In Alaska and states along the Pacific Coast the changes in timber volume have been influenced by policies and legislation that reduced the amount of timberland available for harvest. For example, between 1953 and 2002, the area in Alaska classified as timberland decreased by 40 percent (8.4 million acres). Timberland area inWashington and Oregon decreased by a combined 3.7 million acres over the same period. For all states in U.S.combined, the net loss of timberland was only 5.3 million acres for the same period because timberland area increased in the Northern and the Rocky Mountain regions of the U.S.

On the surface, at least, this is good news with respect to forest sustainability. Forest growth exceeds timber harvest and other losses to land use change or damaging agents. However, an examination of our patterns of forest growth, removals, and consumption in a broader context raises the concern that our current situation is not sustainable in a global context.

**Concept 2: Timber Harvests are Unattractive and Unappreciated**

As forestry professionals we understand that timber harvesting serves many important purposes such as producing commodities, maintaining biodiversity, providing specific types of wildlife habitat, and improving forest health. However, most people find harvesting unaesthetic and would prefer not to see it where they live, recreate, or travel. This attitude is often evident in public responses to proposed management actives on National Forests. Thus, decisions about where, when, and how much to harvest must have a sound scientific and social basis, because harvesting is unpopular with a large segment of the public and is likely to remain so.

**Concept 3: We Consume a Lot of Wood in the U.S.**

We consume about 20 billion cubic feet of wood per year in the U.S. (Howard 2003, Haynes 2003). This annual wood consumption is equivalent to about 67 cubic feet per person and far more than the global average annual consumption of 21 cubic feet per person (Gardner-Outlaw and Engelman 1999). U.S. annual per capita consumption gradually decreased from 83 to 67 cubic feet between 1986 and 2002, but total consumption did not decrease substantially because the population of the U.S. increased over that period. Projections from the most recent Resources Planning Act (RPA) (USDA Forest Service 2007c) documents indicate that by 2050 growth in the U.S. population will drive U.S. wood consumption up to 27.5 billion cubic feet per year. That is an increase of 40 percent relative to 1996 values, even with a projected slight decline in per capita wood consumption over that period (Haynes 2003, table 11).

**Concept 4: The U.S. is a Net Importer of Wood**

The U.S. has been a net importer of wood for at least 90 years (Haynes 2003). We participate in the global wood market, and we constantly import and export logs, lumber, and finished wood products. For example, about one-third of the softwood lumber we consume comes from Canada (Howard 2003, Society of American Foresters 2004), and we obtain many finished wood products from abroad. At the same time we export veneer logs, wood chips, and finished products throughout world. When imports and exports are converted to their equivalent cubic feet of roundwood and compared, imports substantially exceed exports.

In 1991, net imports amounted to about 2 percent of total U.S. consumption. By 1996 they were 9 percent of consumption, and by 2002 they were 16 percent of total consumption (Howard 2003, Haynes 2003). The net balance of imports over exports is projected to increase to about 19 percent of total U.S. wood consumption by 2050 (Haynes 2003).

**Concept 5: When We Import Wood We Export Consequences of Production and Consumption**

As we import wood and wood products we also export to other nations the environmental, economic, and other social consequences (both the positive and negative) associated wood production, manufacturing, and consumption. This is what former Forest Service Chief Dale Bosworth said about it in 2003 (Bosworth 2003):

> "'Out of sight, out of mind'—that is the danger of a system that separates consumption of forest products in one place from production in another. Our system today raises serious questions of both equity and sustainability. We need more of a dialog on how to bring consumption in the most developed parts of the world into balance with production elsewhere."

Currently we export the consequences associated with net annual imports of about 3 billion cubic feet of wood products. By 2050 we could be exporting the consequences associated with net annual imports of nearly 5 billion cubic feet of wood products (Haynes 2003).

This fifth concept is the key concept in the list of seven. If we believe there are no positive or negative consequences associated with timber production, then the other six concepts are largely irrelevant and we could presumably meet all our current and future demand for wood by purchasing it on the global market. However, based simply on public comments related to National Forest management policies, one would be hard pressed to assert that people believe there are no social, environmental, or economic consequences associated with timber production.

**Concept 6: Better to Use Wood than Most Substitutes**

We could substitute other products for wood and thereby greatly reduce current and future demand for wood. However, wood is environmentally benign compared to alternatives such as steel, plastics, or concrete. Wood is abundant, renewable, recyclable, and biodegradable. It has many desirable properties for construction and manufacturing. Clearly, forests can provide numerous other commodities and amenities such as clean water, wildlife, recreation, biodiversity, and carbon sequestration while producing wood.

Compared to alternative materials it requires relatively little energy to convert wood to useful products. Total product life cycle analysis compares the total energy balance and environmental impact of wood and other construction materials from production, to processing, utilization (e.g., in a building), and eventual disposal. This research has shown wood and wood fiber construction materials to be preferable from an environmental perspective when compared to substitute materials (e.g., metal, concrete) (Lippke et al. 2004).

**Concept 7: There is a Finite Area from Which the Wood We Use Must Come**

All the wood consumed on Earth must be produced on the 9.6 billion acres of forestland on the planet. That acreage changes a little from year to year due to forest clearing and afforestation, but the bottom line is that the Earth has a finite amount of forestland and many competing land uses that are incompatible with forestry. If we view U.S. forest resources within that global context, we get a new way to gauge sustainability of our own forests. By sheer coincidence, the proportion of forest in the United States is nearly identical to that of the Earth as a whole. Specifically:

- about 30 percent of the land mass of the earth is forested (Food and Agriculture Organization 2000) (fig. 1)
- about one-third of North America is forested (Natural Resources Canada 2005, Smith et al. 2003), and
- about one-third of the United States is forested (Smith et al 2003).

The analogy can be taken further for a more local view. For example, it turns out that the seven-state North Central Region of the U.S. (where I reside) is nearly one-third forested, the state of Missouri (where I reside) is one-third forested, and even Boone County (where I reside) is nearly 30 percent forested (Miles 2007). That series of statistics is enormously instructive in defining sustainable forestry in the U.S. and at smaller spatial scales. In the United States we have forest resources that are proportional in area to those found in the rest of the world. In fact, because our population is relatively low, we have the benefit of more forest per capita than the world as a whole. U.S. forestland is 2.7 acres per capita and falling; global forest land is 1.6 acres per capita and falling.

## RETHINKING SUSTAINABLE FORESTRY

Sustainable forestry requires a conceptual link between the consumption and production of wood at global, national, and regional levels (Strigel and Meine 2001). This is something that we have for the most part failed to do, and for U.S. forests it has resulted in a situation that is not globally sustainable. Contemporary notions of sustainable forestry stipulate that we must be concerned about dozens of different measures of forest condition and social well being (Montréal Process Working Group 2005). However, contemporary notions of sustainability do not discourage us from creating "sustainable" forests at home by simply going elsewhere to get the wood and products we consume. This disconnect between consumption and the location of

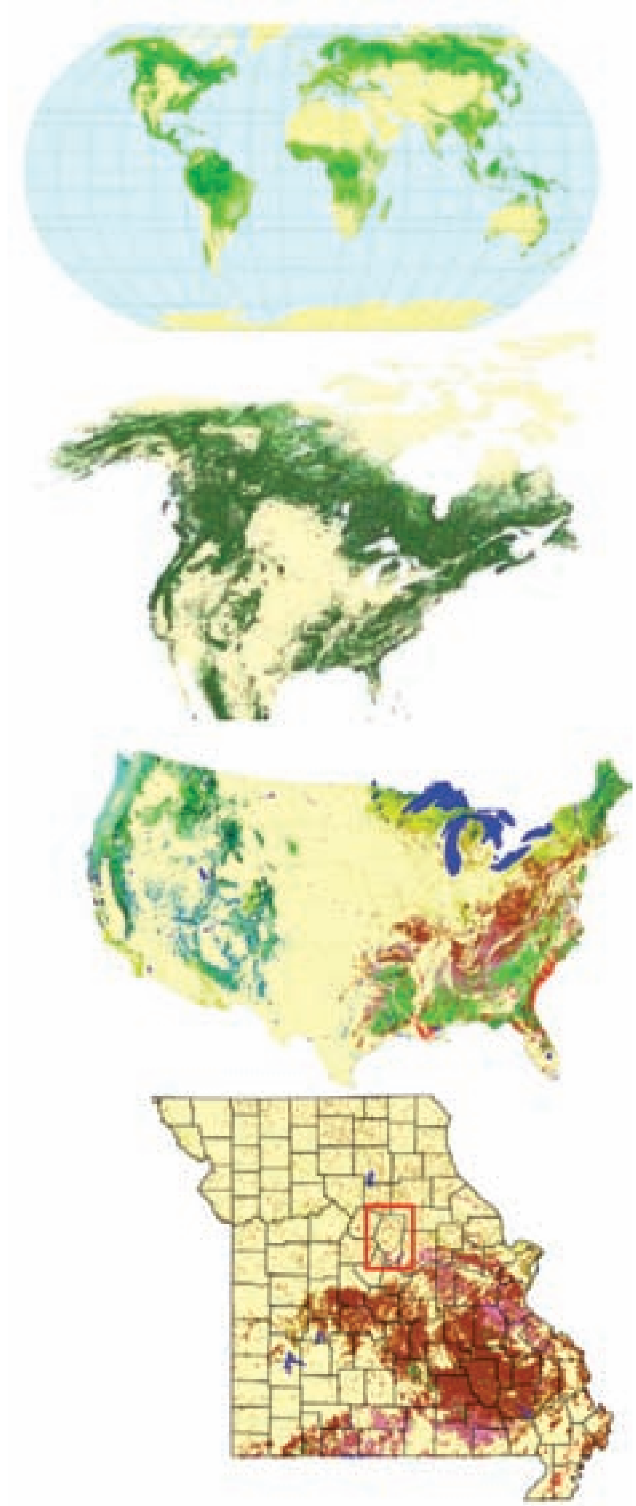

*Figure 1. U.S. forest resources in a global context. Dark shades indicate forest land. The land mass of the Earth is about one-third forested, North America is about one-third forested, the United States is about one-third forested, and Missouri is one-third forested. Sources: World map; Food and Agriculture Organization (2000), North America map; United Nations Environmental Programme (2005), Food and Agriculture Organization (2000), United States and Missouri (Zhu and Evans 1994). Composite figure follows Shifley (2006).*

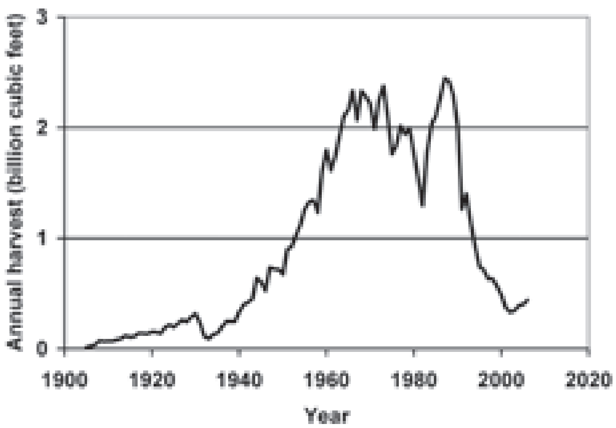


*Figure 2. National Forest timber harvest 1905 to 2006. Conversion to cubic feet based on 5.2 board feet per cubic foot. Harvest peaked in 1987 at 2.4 billion cubic feet (12.7 billion board feet). In 2006, harvest was 0.4 billion cubic feet (2.3 billion board feet). Data from USDA Forest Service (2007b).*

production leaves a huge void in our current notions of sustainable forestry. There is currently no social or economic penalty associated with over-consumption and/or under-production of forest products as long as we can export any associated environmental issues to the other nations that feed our demand for wood.

We expend a great deal of time and energy in this country in discussions, debates, and court battles over individual timber sales or other management actions, particularly on public lands. National Forests are focal point of much of that interaction. For the most part those discussions take place in the absence of explicit, over-arching principles regarding our national role as a global partner in sustainability. The outcome is that we increasingly restrict our domestic wood production in the name of sustainability while going abroad for the wood we consume. The unintended consequence is that we push the impact of our consumption of wood products to other places. Those impacts (both the positive and negative) go out of sight and out of mind to places where we have neither the will nor the means to ensure that local forestry practices are sustainable. Is that a sound policy for sustainable forestry given that:

- our own forest resources are every bit as abundant as on the rest of the Earth,
- our own forest resources per capita are far greater than the global average,
- and the growth of our own forests greatly exceeds harvest and natural mortality?

Can we tout our own efforts directed at forest sustainability in the U.S. if success comes at the expense of an ever increasing reliance on wood products produced elsewhere where we take little or no responsibility for the methods of production?

Sustainable forestry cannot be achieved in the U.S. by simply transferring to other nations the consequences we do not care to deal with in our own public and private forests. An integral part of sustainable forestry in the U.S. must be to balance the quantity of wood we produce with the quantity of wood we consume (on a volume equivalent basis). If we cannot do that with our proportional share of the world's forest resources, how can we expect others to do it for us?

Clearly, issues of wood consumption, wood production, and harvest levels alone cannot define sustainable forestry. However, if we fail to use those issues to guide decisions about sustainable forest management (in all its dimensions) at local, state, regional, national, and global scales, we run the risk of simply transferring impacts to someone else's forest.

## SCALABLE SOLUTIONS TO SUSTAINABLE FORESTRY

An underlying premise of the proceeding discussion is that approaches to sustainability are scalable. The appropriate scale varies with the issue, but national, state, and county scales are essential. Those are the scales at which most laws, regulations, policies, penalties, and subsidies that affect forests and forest management are debated and enacted.

If we were to adopt a national goal of annually producing a volume of wood that is commensurate with our consumption, FIA statistics provide abundant information about how the nation, the 50 states, and the thousands of counties are progressing with respect to that goal (e.g., Smith 2003, USDA Forest Service 2007a). The math is easy; there are about 500 million acres of timberland in the U.S. that we can draw upon to produce the roughly 20 billion cubic feet of wood we consume each year. Note that timberland excludes forestland that is inaccessible, unproductive (e.g., due to climatic conditions), or administratively or legislatively restricted from harvesting (e.g., parks and wilderness). If we summarize the percent of timberland by state we get a rough estimate of how much wood each state might expect to contribute to a combined national production of 20 billion cubic feet of wood (Table 1). Policy decisions based on such goals are not easy in the face of the many competing interests for all the things that forests provide, but such goals provide an essential point of reference for sustainable forestry at state, national, and global scales.

There are minimum relevant scales for this type of analysis. For example, we can readily compute what would be required of each acre of U.S. timberland if we were to balance current domestic wood production with current wood consumption, but we don't manage individual forest acres. Rather, we manage stands which are components of forest ownerships that occur with other ownerships on landscapes that simultaneously provide many products and amenities. Thus, sustainable forestry must be approached simultaneously at multiple spatial scales. Sustainable forestry occurs hierarchically across landscapes, ecoregions, states, and nations when we measure progress in the context of specific, cumulative, scalable goals. State and national scales of reference are particularly important because those are the scales where policy, legislation, and incentives related to forest management are crafted. Moreover, if there are many instances where sustainable forest management is not practiced at the ecoregion or state scale, sustainable forestry at the National scale will be impossible to achieve.

We can look at the state of Missouri as an example. Missouri is an average state with about 2 percent of the U.S. population, and it is one-third forested. Missouri has about 15 million acres of timberland, or 2.7% of the nation's total (Table 1). Thus, as a "fair share" we might expect Missouri to contribute about 530 million cubic feet of wood towards 20 billion cubic feet of annual domestic wood consumption (Table 1). Missouri's annual removals amount to about 170 million cubic feet. Moreover, the latest on-line FIA data for Missouri show mean annual removals dropped to 120 million cubic feet while annual growth continued to increase beyond 600 million cubic feet (Miles 2007), and growth is still well below potential. Perhaps those of us who live in Missouri should be concerned about the imbalance between what we produce relative to our share of U.S. timberland.

We can look at National Forests in the same context. National Forests include 19 percent of the Nation's timberland, about 97 million acres. Using the same logic applied to Missouri or other individual states in Table 1, National Forests might be expected to produce the equivalent of 3.8 billion cubic feet of wood each year (roughly 20 billion board feet). Over the past 6 years harvest on National Forests has averaged about 380 million cubic feet cubic feet (about 2 billion board feet) (USDA Forest Service 2007b) (S. 2). That is only 10 percent of the "fair share" we might expect from an equivalent area of other U.S. timberland. This is relevant to sustainable forestry at the national and global scales.

We manage National Forests differently than most other forest land, and rightly so. They provide unique opportunities to meet a wide array of multi-resource objectives and the citizen-owners of the National Forests play an important role in guiding forest management. As an agency with commitments to sustainable management of private forests, public forests, and global forests (and separate divisions devoted to those constituencies) we need to look closely at how management decisions in one sector affect other sectors and be devoted to a joint, scalable approach to sustainable forestry across public and private ownerships, here and abroad.

## CHANGING THE BALANCE

We need to be concerned about balancing consumption and production of wood products in the U.S., but harvesting more timber is not the only way to achieve such a balance. We could, for example, simply consume less wood, provided we did not replace wood with products that created adverse environmental impacts. Recycling can also be a large part of reducing net consumption of new wood. Manufacturers can change the balance of wood production and consumption by increasing the efficiency with which they convert wood into products or by engineering new products that extend the utility of a given amount of harvested timber. And it is certainly possible to increase timber productivity by elevating management intensity for selected natural forests on some sites, through greater reliance on intensive plantation management, and by increasing forested acreage through afforestation or agroforestry. When the goal is to sustainably balance wood production and wood consumption, everyone has a part in the solution.

**Table 1. Current forest area, timberland area, growth, and removals by state and region with estimates of a hypothetical "fair share" of volume production if states and regions produced wood in proportion to their timberland. Based on Smith et al. (2003) and U.S. Census Bureau (2007b) with additional computations by the author**

| (1) | (2) Total land area | (3) Forest land | (4) Percent forest | (5) Timberland | (6) Percent of U.S. Timberland | (7) "Fair share" wood production | (8) Current Removals | (9) Current Growth | (10) Approximate consumption |
|---|---|---|---|---|---|---|---|---|---|
| | *Thousand acres* | *Thousand acres* | % | *Thousand acres* | % | *Million cu ft/yr* | *Million cu ft/yr* | *Million cu ft/yr* | *Million cu ft/yr* |
| **North:** | | | | | | | | | |
| **Northeast:** | | | | | | | | | |
| Connecticut | 3,101 | 1,859 | 60 | 1,696 | 0.3 | 67 | 12 | 55 | 240 |
| Delaware | 1,251 | 383 | 31 | 376 | 0.1 | 15 | 8 | 16 | 56 |
| Maine | 19,753 | 17,699 | 90 | 16,952 | 3.4 | 673 | 442 | 402 | 90 |
| Maryland | 6,295 | 2,566 | 41 | 2,372 | 0.5 | 94 | 41 | 107 | 379 |
| Massachusetts | 5,016 | 3,126 | 62 | 2,631 | 0.5 | 104 | 16 | 97 | 466 |
| New Hampshire | 5,740 | 4,818 | 84 | 4,503 | 0.9 | 179 | 140 | 170 | 89 |
| New Jersey | 4,748 | 2,132 | 45 | 1,876 | 0.4 | 75 | 11 | 55 | 596 |
| New York | 30,223 | 18,432 | 61 | 15,389 | 3.1 | 611 | 141 | 590 | 1,329 |
| Pennsylvania | 28,685 | 16,905 | 59 | 15,853 | 3.1 | 630 | 216 | 630 | 856 |
| Rhode Island | 668 | 385 | 58 | 340 | 0.1 | 14 | 2 | 8 | 74 |
| Vermont | 5,920 | 4,618 | 78 | 4,482 | 0.9 | 178 | 77 | 190 | 43 |
| West Virginia | 15,415 | 12,108 | 79 | 11,900 | 2.4 | 473 | 167 | 510 | 125 |
| **Total Northeast** | 126,815 | 85,031 | 67 | 78,370 | 15.6 | 3,113 | 1,272 | 2,832 | 4,342 |
| **North Central:** | | | | | | | | | |
| Illinois | 35,580 | 4,331 | 12 | 4,087 | 0.8 | 162 | 69 | 172 | 874 |
| Indiana | 22,957 | 4,501 | 20 | 4,342 | 0.9 | 172 | 97 | 224 | 428 |
| Iowa | 35,760 | 2,050 | 6 | 1,944 | 0.4 | 77 | 25 | 41 | 204 |
| Michigan | 36,359 | 19,281 | 53 | 18,616 | 3.7 | 739 | 316 | 756 | 698 |
| Minnesota | 50,955 | 16,680 | 33 | 14,723 | 2.9 | 585 | 316 | 370 | 349 |
| Missouri | 44,095 | 13,992 | 32 | 13,365 | 2.7 | 531 | 168 | 239 | 394 |
| Ohio | 26,210 | 7,855 | 30 | 7,568 | 1.5 | 301 | 101 | 293 | 792 |
| Wisconsin | 34,761 | 15,963 | 46 | 15,701 | 3.1 | 624 | 347 | 489 | 378 |
| **Total North Central** | 286,677 | 84,653 | 30 | 80,346 | 16.0 | 3,191 | 1,439 | 2,585 | 4,116 |
| **North Total** | 413,492 | 169,684 | 41 | 158,716 | 31.5 | 6,304 | 2,711 | 5,418 | 8,458 |
| **South:** | | | | | | | | | |
| **Southeast:** | | | | | | | | | |
| Florida | 34,520 | 16,285 | 47 | 14,636 | 2.9 | 581 | 560 | 685 | 1,159 |
| Georgia | 37,068 | 24,405 | 66 | 23,802 | 4.7 | 945 | 1,448 | 1,519 | 593 |
| North Carolina | 31,180 | 19,302 | 62 | 18,664 | 3.7 | 741 | 958 | 1,160 | 577 |
| South Carolina | 19,272 | 12,495 | 65 | 12,301 | 2.4 | 489 | 683 | 945 | 285 |
| Virginia | 25,343 | 16,074 | 63 | 15,371 | 3.1 | 611 | 655 | 848 | 526 |
| **Total Southeast** | 147,383 | 88,561 | 60 | 84,774 | 16.8 | 3,367 | 4,304 | 5,157 | 3,140 |

Even with dedicated efforts to reduce unnecessary consumption and increase recycling, it is projected that U.S. wood consumption will increase at a rate slightly less than the rate of population increase (Haynes 2003). That does not take into account the mounting interest in using wood as biofuel to reduce net carbon additions to the atmosphere (Perlack et al. 2005). We will need to harvest and process more wood in the U.S. if our collective forest resources are to be utilized at a globally sustainable level. We are fortunate in a sense, because our projected rate of population increase will be slightly less than that for the rest of the world (U.S. Census Bureau, 2007a, b) and our total forest area per capita will be much greater than for the rest of the world. Nevertheless, harvest levels may need to increase by about 40 percent in the next 45 years to keep pace with projected increases in U.S. population (Haynes 2003). That future scenario could lead to (Shifley 2006):

- Increased harvest—from 18 billion cubic feet currently to more than 27 billion cubic feet in 2050 (projections on total consumption from Haynes 2003, table 12).
- A more even geographic distribution of harvests, and greater visibility of harvesting practices.
- A stronger commitment to the use of best management practices.

**Table 1. (Con't.) Current forest area, timberland area, growth, and removals by state and region with estimates of a hypothetical "fair share" of volume production if states and regions produced wood in proportion to their timberland. Based on Smith et al. (2003) and U.S. Census Bureau (2007b) with additional computations by the author**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **South Central:** | | | | | | | | | |
| Alabama | 32,481 | 22,987 | 71 | 22,922 | 4.6 | 910 | 1,299 | 1,460 | 311 |
| Arkansas | 33,328 | 18,771 | 56 | 18,373 | 3.6 | 730 | 796 | 896 | 188 |
| Kentucky | 25,428 | 12,684 | 50 | 12,347 | 2.5 | 490 | 276 | 384 | 284 |
| Louisiana | 27,883 | 13,812 | 50 | 13,722 | 2.7 | 545 | 959 | 834 | 311 |
| Mississippi | 30,025 | 18,580 | 62 | 18,572 | 3.7 | 738 | 1,150 | 1,105 | 199 |
| Oklahoma | 43,955 | 7,665 | 17 | 6,234 | 1.2 | 248 | 133 | 243 | 242 |
| Tennessee | 26,381 | 14,396 | 55 | 13,956 | 2.8 | 554 | 384 | 738 | 402 |
| Texas | 167,626 | 17,149 | 10 | 11,774 | 2.3 | 468 | 770 | 705 | 1,510 |
| **Total South Central** | 387,107 | 126,044 | 33 | 117,900 | 23.4 | 4,683 | 5,766 | 6,365 | 3,447 |
| **South Total** | 534,490 | 214,605 | 40 | 202,674 | 40.2 | 8,050 | 10,070 | 11,522 | 6,588 |
| **Rocky Mountain:** | | | | | | | | | |
| **Great Plains:** | | | | | | | | | |
| Kansas | 52,367 | 1,545 | 3 | 1,491 | 0.3 | 59 | 7 | 26 | 188 |
| Nebraska | 49,201 | 947 | 2 | 898 | 0.2 | 36 | 10 | 14 | 120 |
| North Dakota | 44,156 | 672 | 2 | 441 | 0.1 | 18 | 1 | 7 | 44 |
| South Dakota | 48,574 | 1,619 | 3 | 1,511 | 0.3 | 60 | 21 | 40 | 53 |
| **Total Great Plains** | 194,298 | 4,783 | 2 | 4,341 | 0.9 | 172 | 39 | 87 | 405 |
| **Intermountain:** | | | | | | | | | |
| Arizona | 72,732 | 19,427 | 27 | 3,527 | 0.7 | 140 | 14 | 124 | 378 |
| Colorado | 66,387 | 21,637 | 33 | 11,607 | 2.3 | 461 | 21 | 291 | 313 |
| Idaho | 52,960 | 21,646 | 41 | 16,824 | 3.3 | 668 | 253 | 635 | 93 |
| Montana | 93,157 | 23,293 | 25 | 19,185 | 3.8 | 762 | 168 | 583 | 63 |
| Nevada | 70,276 | 10,204 | 15 | 363 | 0.1 | 14 | 1 | 6 | 151 |
| New Mexico | 77,674 | 16,682 | 21 | 4,359 | 0.9 | 173 | 19 | 140 | 129 |
| Utah | 52,587 | 15,676 | 30 | 4,683 | 0.9 | 186 | 8 | 77 | 161 |
| Wyoming | 62,147 | 10,995 | 18 | 5,739 | 1.1 | 228 | 14 | 119 | 35 |
| **Total Intermountain** | 547,920 | 139,560 | 25 | 66,287 | 13.2 | 2,633 | 498 | 1,975 | 1,322 |
| **Rocky Mtn Total** | 742,218 | 144,343 | 19 | 70,628 | 14.0 | 2,805 | 537 | 2,062 | 1,727 |
| **Pacific Coast:** | | | | | | | | | |
| Alaska | 365,041 | 126,869 | 35 | 11,865 | 2.4 | 471 | 142 | 207 | 45 |
| **Pacific Northwest:** | | | | | | | | | |
| Oregon | 61,442 | 29,651 | 48 | 23,831 | 4.7 | 947 | 863 | 1,728 | 244 |
| Washington | 42,612 | 21,790 | 51 | 17,347 | 3.4 | 689 | 867 | 1,426 | 421 |
| **Total Pacific NW** | 104,054 | 51,441 | 49 | 41,178 | 8.2 | 1,636 | 1,730 | 3,154 | 666 |
| **Pacific Southwest:** | | | | | | | | | |
| California | 99,824 | 40,233 | 40 | 17,781 | 3.5 | 706 | 634 | 1,325 | 2,431 |
| Hawaii | 4,111 | 1,748 | 43 | 700 | 0.1 | 28 | 0 | 1 | 86 |
| **Total Pacific SW** | 103,935 | 41,981 | 40 | 18,481 | 3.7 | 734 | 634 | 1,326 | 2,517 |
| **Pacific Coast Total** | 573,030 | 220,291 | 38 | 71,524 | 14.2 | 2,841 | 2,506 | 4,687 | 3,227 |
| **United States Total** | 2,263,230 | 748,923 | 33 | 503,542 | 100.0 | 20,000 | 15,824 | 23,689 | 20,000 |

Notes: Column (7) is percent timberland (from column 6) multiplied by 20 billion cubic feet, the estimated annual U.S. consumption. Consumption in column (10) is 2002 population multiplied by 69.5 cubic feet per capita. Results were rounded for tabular presentation, but not during computations.

- More professionals on the ground guiding decision-making.
- Greater involvement of nonindustrial private owners in managing their forests and selling timber through forest management plans.
- Improved forest health via proactive management to reduce negative impacts of disturbance by fire, insects, disease, weather, or other undesirable agents of change.
- Matching regional forest harvest levels to the area and productivity of forest resources.
- Estimating the "right-size" for commercial forest production by state and ecoregion based on forest resources. (e.g., Table 1).
- Changing the context of local debates away from isolated battles over individual timber sales toward addressing the question "How do we sustainably

produce a quantity of wood that is in balance with our consumptive pressures and our local forest resources viewed in a global context, now and in coming decades?"

These are not quick fixes. They initiate an ongoing journey, if it is a road we choose follow. It takes time to change attitudes, to build consensus, to build infrastructure, and to educate future citizens. Our current forests bear the imprint of management decisions made over the previous century; we inherit that legacy with all its opportunities and its constraints as we move ahead.

## CONCLUSIONS

This paper has focused primarily on forest sustainability in terms of wood production and consumption. Wood or timber issues alone cannot define forest sustainability. Neither can they be overlooked. The availability (or unavailability) of wood products has an enormous impact on people's well being. Wood consumption is directly linked to timber harvest, and timber harvest directly impacts forests somewhere on the Earth. This creates specific constraints and opportunities related to forest sustainability in all its other (nontimber) dimensions. Only by addressing the impacts of consumption and production of wood at local, state, regional, national, and global scales can we move forward with realistic approaches to sustainable forestry.

It is my opinion that our current course of action with regard to timber production and consumption is not sustainable in a global context. In light of our abundant forest resources, it is difficult to see how the current imbalance between our production and consumption of wood products makes us an equitable partner with regard to global forest sustainability. A first step would be to bring our aggregate national volume of timber harvest into balance with our aggregate rate of domestic wood consumption, now and for future decades. There are many complementary ways to work toward that goal while considering all the other dimensions of forest sustainability.

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# Desired Vegetation Condition and Restoration Goals in a Changing Climate: A Forest Management Challenge

*Linda C. Brett*

## ABSTRACT

The importance of forest structure, function, and processes is well recognized by the research and management communities, and is an important consideration in formulating vegetative desired conditions in forest plans. The current policy guidance and the laws underlying them implicitly assume relatively stable ecosystems; but, climate science is telling us that we are building our forest management strategies and goals on shifting sands, and that sustainability and restoration goals will not be met if we use forest conditions that developed over the last 500 years as the benchmark for reference conditions. This paper briefly reviews information from the 2007 IPCC report and other relevant climate-related research, existing agency planning guidance for formulating desired conditions, and suggests a framework for managers to use to incorporate climate change considerations into forest plans.

**Keywords**: climate change, forest plans, desired conditions

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# INTRODUCTION

The importance of forest structure, function, and processes is well recognized in the research and management communities throughout the world as essential components of sustainable forest management. Ecological restoration, as used by the USDA Forest Service in the Restoration Framework (2007), is defined as "the process of assisting the recovery of an ecosystem that has be degraded, damaged, or destroyed" (Society for Ecological Restoration 2004). As first defined by the Society for Ecological Restoration, and later modified by the USDA Forest Service for its own use, healthy ecosystems generally exhibit these attributes:

- The suite of species and biological structures characteristic of the reference ecosystem are present and are free from non-natives to the greatest practicable extent.
- A physical environment that is representative of the reference ecosystem or, if degraded, is still capable of supporting native species and basic processes necessary for development along the desired trajectory.
- Disturbances indicative of the historic disturbance regime continue to operate within the range of variation (disturbance types, frequencies, intensities, etc). (Restoration Framework 2007: 1-2)

In the USDA Forest Service, the legal sideboards for sustainability and restoration are set by the National Forest Management Act of 1976 (16 U.S.C. 1600). Other laws, such as the Endangered Species Act of 1973 (16 U.S.C. 1531-1536, 1538-1540) and the Clean Water Act of 1977, as amended (33 U.S.C. s/s 1251 et seq.), add to, and reinforce, the legal mandate to manage for healthy and resilient forest ecosystems. Over the past 15 years, forest plans have placed increasing reliance on the concepts of vegetative desired condition. The relevant factors in determining vegetative desired condition include carefully chosen reference conditions, inferential constructions of historic vegetation or the natural range of variation, professional judgment, and social values. The 2005 planning rule provides explicit national policy guidance on the use of desired conditions as the centerpiece of ecologically and socially sustainable forest plans (Federal Register vol. 70, 2005:1023-1061).

The existing policy guidance and the laws underlying them implicitly assume slowly changing stable ecosystems where management impacts can be readily distinguished from natural processes. Increasingly, climate science is telling us that we are building our forest management strategies and goals on shifting sands, and that sustainability and restoration goals will not be met if we use forest conditions that developed over the past 500 years as the benchmark for reference conditions (Millar [and others] 2007).

The emerging scientific consensus on global climate change presents us with many challenges. In the past forest plans have commonly said that global climate change is "beyond the scope" of the plan. Clearly the emerging information on the effects of climate change on vegetation, hydrology, disturbance regimes, plant and animal species should be considered as we revise forest plans but, the devil is always in the details. How should forest plans address climate change issues? If we cannot rely on historically derived reference conditions to provide a baseline for forest plan desired conditions, then what information should we use to establish a narrative for future forest conditions that has a sound quantifiable scientific basis? How do we facilitate restoration in changing ecosystems if the line between management induced change and changes induced by climatic shifts is blurred?

# GLOBAL CLIMATE CHANGE AND FORESTS

In February 2007 the Intergovernmental panel on climate change (IPCC) released Part I of its fourth in a series of assessments of global climate change. The IPCC report represents the consensus opinion of scientific experts from around the world on global climate change. The 2007 Summary for Policy Makers (IPCC 2007) is a sobering document. Among the findings presented:

Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level. (IPCC 2007:2)

Paleoclimate information supports the interpretation that the warmth of the last half century is unusual in at least the previous 1300 years. The last time the Polar Regions were significantly warmer than present for an extended period (about 125,000 years ago), reductions in polar ice volume led to 4 to 6 metres of sea level rise. (IPCC 2007: 9)

Average Northern Hemisphere temperatures during the second half of the 20th century were very likely higher than any other 50-year period in the last 500 years and likely the highest in at least the past 1300 years. Some recent studies indicate greater variability in Northern Hemisphere temperatures….particularly finding that cooler periods existed in the 12th to 14th, 17th, and 19th centuries. (IPCC 2007:9)

For the next two decades a warming of about 0.2 degrees Centigrade is projected for a range of emission scenarios. Even if the concentrations of all greenhouse gases and aerosols had been kept constant at year 2000, a further warming of about 0.1 degree Centigrade would be expected.(IPCC 2007:12)

The IPCC report outlines several trends of particular interest for forest land managers including:

- Warmer and fewer cold days and nights over most land areas;
- Warmer and more frequent hot days and nights over most land areas;
- The frequency of warm spells/heat waves increases;
- More heavy precipitation events;
- The areas affected by drought increase;
- There is an increase in the frequency and intensity of tropical cyclones. (IPCC 2007:9)

The implications of these trends for extreme disturbance events, insect and disease outbreaks, greater vulnerability to invasive species, and permanent long-term shifts in vegetative patterns are evident to many in the research community (Westerling [and others] 2006; Millar [and others] 2007; Salwasser 2007; Neilson [and others], 2007; Joyce and Haynes 2007; Gucinski 2007). Among the trends noted in the literature we see significant increases in wildfire activity, cold tolerant vegetation moving upslope or disappearing in some areas, reductions in the area occupied by tundra species, and the explosive expansion of mountain pine beetle into British Columbia that threatens to move into eastern areas where this species was previously unknown.

Current research shows that climate is much more variable than is commonly understood and that this variability is expressed in nested temporal and spatial scales. (Millar [and others] 2007:32-39) provides an elegant summation of natural climatic variability and its implications for forest managers. There are three key points from this research that should be considered in forest planning:

- The past climatic record clearly shows that ecological conditions change constantly in response to climate. Plant and animal species will shift even in the absence of human influence. (Millar [and others] 2007:39)
- Species ranges and demographics are expected to be highly unstable as the climate shifts. (Millar [and others] 2007:30)
- There is no easy way to precisely predict these changes at the forest planning scale, although the science community is working on meso-scale models that will assist forest managers in forecasting vegetation trends under different climate scenarios (Gucinski 2007: 48-52).

## DESIRED CONDITION FORMULATION IN FOREST PLANS

Desired conditions are the centerpiece of forest plans and sustainable forest management. Objectives, management strategies, and guidelines are formulated based on desired conditions for the landscape. The National Forest Management Act (NFMA) mandates that the agency manage national forests in a way that sustains ecosystem and species diversity over time. Ecosystem diversity is defined in 36 CFR 219.6 as "…the variety and relative extent of ecosystem types including their composition, structure, and processes." The Responsible Official is instructed to evaluate ecosystem diversity in the following way:

- Identify selected ecosystem characteristics;
- Assess their natural variation under historic disturbance regimes;
- Compare that information to existing and projected future conditions. (Forest Service Handbook (FSH) 1909.12 Ch. 43).

The handbook provides specific advice on developing the natural range of variation to be used in developing desired conditions for forest plans (FSH 1909.12 43.13).

This guidance is largely premised on assumptions that we are working with stable ecosystems or, if the ecosystem is unstable, the instability is largely the result of past management. We now know that the assumption that historical climatic and ecological conditions are a good model for future conditions is fatally flawed. Further, ecological processes and conditions are not the sole consideration in devising desired conditions, economic and social conditions also play a part. Desired conditions in forest plans must be based on sound science, but they are also negotiated with the public as part of the collaborative process.

For example: restoration of mountain meadows is a common desired condition in some parts of the west. Meadows are highly valued by the agency and the public for habitat, esthetic, and economic reasons. A paleo-ecologist might tell you that meadows are not a permanent landscape feature and, given the current warming and drying trends, many meadows will likely disappear in the next several decades, whatever management interventions take place to preserve them. Does that mean that the agency should not engage in meadow restoration? No, but it does mean that we should choose our restoration goals carefully, and that we should be candid with the public about the all the ecological processes in play. It may be that by protecting key ecological features, like meadows, we buy species some time to move and adapt to changing conditions, or it may be that our efforts are better invested elsewhere. Forest plans exist to make those kinds of strategic judgments.

Since the new planning guidance was issued in 2005, a number of forests have formulated proposed plan revisions based on this guidance. As you would expect, the desired conditions in these plans often do not consider the implications of climate change and, instead, largely base vegetative desired condition on reference conditions and historic ranges of variability as per the guidance. This gap has not gone unnoticed by the public. For example, consider this comment from the 2007 Western Montana Zone proposed land management plans content analysis report (WMPZ Proposed Land Management Phase Content Analysis Report 2006). The Western Montana Zone forests include the Lolo National Forest, Bitterroot National Forest, and the Flathead National Forest.

We find the complete lack of any mention or consideration of global climate change to be a serious shortcoming of this plan. This is especially troubling given that the plan sets specific targets for vegetation conditions, yet those conditions seem an attempt to mimic a perceived condition of the past. For example, the Desired Future Conditions call for the distribution of living and dead trees to be "consistent with historic conditions". The same is said for tree densities and fuel conditions. If the consensus of local, national, and international climate scientists can be believed, and if the documented climate trend in the Northern Rockies continues, the future will not be like the past. (WMPZ Proposed Land Management Plan Phase Content Analysis Report 2006:30)

This comment is one of several questioning the use of historic conditions as a model for desired condition. The comments register from the full range of public opinion including both advocates for active vegetation management and advocates of letting natural processes prevail. Given that climate change is real, is affecting the natural processes that drive ecological change, and that these changes are taking place much faster than we once believed possible, the agency cannot formulate desired conditions and restoration goals without considering climate change effects.

## A MODEST PROPOSAL

The Forest Service and university natural resources research communities have developed considerable information on the potential consequences of climate change to forests and rangelands throughout the United States, along with some potential adaptation and mitigation strategies for forest managers. The sweep of the vegetation change forecast from the various models is breathtaking but, unfortunately, the information cannot yet be directly applied to the local level because the current models predictive power cannot be stretched that far and remain scientifically credible. More general model forecasts of changes in forest types at the regional level may be possible and useful to planners. But absent an accurate and precise scale-appropriate model, we are left with applying the best available science on climate change effects and our own professional judgment to the information and landscape vegetation models we do have for forest and rangeland conditions, and devising management strategies based on informed supposition. Here are a few suggestions on how we might begin this process.

## TREAT DESIRED CONDITION AS A WORKING HYPOTHESIS

While many forest plans portray desired conditions, management strategies, and objectives that are fundamentally invested in the historic range of variability paradigm, eastern and southern forests are sometimes less invested in this approach because so much of the "original" ecosystem elements of these forests were irrevocably altered before they were included into the national forest system. Nevertheless all forests have taken the "range of variability" approach to some degree in formulating forest plans and in doing so; make at least a passing reference to historic conditions.

Instead of expending a lot of energy on developing a detailed vision of historic conditions, I would suggest we focus on existing conditions, apply what we do know about natural processes and the natural range of variability for existing forest types, the value of ecological diversity, and informed supposition on the potential effects of climate change on these factors to devise a working hypothesis of quantifiable desired conditions for the planning period. We do know how today's climate differs from the reference condition. We could extrapolate that shift into the future at appropriate scales.

One thing is certain; we will know more about the effects of climate change on forests and rangelands in 10 years than we know today. NFMA anticipated that periodic reevaluation of forest conditions and our management strategies would be necessary. We probably can't anticipate all the changes that may take place in 50 or 100 years because of climate change. A 10 to 15 year planning horizon is realistic for a working hypothesis that offers some prospect of actually achieving plan objectives. Working hypotheses can and do build on one another and are likely a more realistic approach than the current desired condition formulations.

In reality the desired conditions found in some current forest plan revisions will likely be difficult to attain considering the resources we have at our disposal to make landscape level shifts in ecological complexity, structure, and function. We should remember that the landscape and planning models we currently use are useful for more than providing the required estimates of sustained yield and timber sale program quantity. Planning teams should use the models for scenario planning as they develop desired conditions with the public. Using the models for evaluating the options is a way we can discern whether the desired conditions, objectives, and strategies are realistic and likely to be effective over the planning period given the likelihood of climate change. Developing models to build credible local climate change scenarios is also advocated by (Millar [and others] 2007: 52) in their most recent paper entitled Climate Change at Multiple Scales.

## FOCUS ON MITIGATING THE THREATS

Uncharacteristically severe fires along with extensive outbreaks of insects and disease are two harbingers of the large scale ecological changes we can expect from climate change. Indeed there is evidence that the large scale die-off of forest vegetation posited by Nielson [and others] 2007 may have already begun. (Breshears [and others] 2005) documents the abrupt die off of nearly 90% of pinyon pine in its existing range in the southwestern United States as the result of an unprecedented warm drought cycle within last 10 years. (Westerling [and others] 2006) point to increases in spring and summer temperatures and earlier spring snowmelt as the proximate cause of the sudden increase in large wildfires in the mid-elevation northern Rockies. The authors point to climate change as the likely suspect and, in fact, the IPCC (2007) also notes these general trends in its report on global climate change. Large-scale disturbances also favor invasive species, making a relatively intractable problem more difficult to address.

I advocate focusing our desired condition and restoration goals on mitigating known threats for several reasons.

- First, public policies such as the National Fire Plan are already in place, and the public is already aware of the concerns about fire threats, insects and disease, and invasive species. These concerns are likely to grow if, or when, the threats become even more severe than they are now. There is fairly widespread public agreement that action is needed to protect forests, even if there are disagreements about strategies and the tools.
- Second, our current efforts to use thinning and prescribed fires to restore forests and reduce fuels are also excellent strategies for addressing global climate change effects on forests.

- Third, restoration of healthier forest conditions with a bias towards preserving and enhancing ecological diversity is one of the few actions we can take that will ameliorate the impacts of a warming climate and provide species the opportunity to adjust to changing climate conditions has they have done over the millennia and allows forests to store more carbon; a fact that will be increasingly important to future management.
- Fourth, according to some authors (Salwasser 2007:14-15), we may need to favor a diversity of tree species in fire prone forests, keep stocking levels lower than full site occupancy, and perpetuate and encourage carbon storage in old growth through the use of longer rotations. It may also be desirable to revise our current seed zones to anticipate warmer conditions.
- Fifth, Millar [and others] 2007 argue for the creation of "porous landscapes" meaning large landscapes with continuous habitat and few physical and biotic barriers so that species, including plants, can move and adjust to changing conditions as much as possible (Millar [and others] 2007: 53). Clearly, public forest lands are one of the few places where such continuity is possible to maintain over the long term.

Salwasser (2007) suggests: "If we want diverse, productive and resilient future forests, we need to prepare them for a warmer future. And we need to look for ways forest resources can mitigate or ameliorate undesired climate change."

## TRIAGE

Millar [and others] 2007:53 uses the term triage to refer to making reasoned management choices between the various ecosystem components that may be lost as species, plant communities, and regional vegetation respond in their individual ways to climate change. These concepts under-score the importance of restoring ecological processes, rather than focusing on trying to maintain beloved landscape features.

Returning to the earlier example of Sierran meadow restoration, we can ask ourselves if a program of removing encroaching lodgepole pine is restoring a natural process or maintaining a landscape feature. Making reasoned choices about where to focus desired condition and restoration goals is not simple. Even if the decision-maker has a reasonably clear picture of regional vegetation trends; legal mandates, public desires, and economic considerations will all play a role in that choice. In the end we will probably expend resources trying to preserve habitats that cannot be preserved, for any or all of the reasons listed above.

## MITIGATING GREENHOUSE GASES

National level policy changes on regulation of greenhouse gases are clearly on the horizon. Several individual states have already set CO2 reduction targets in the absence of federal regulation and Congress appears to be ready to consider CO2 reduction targets, perhaps through a cap and trade system. Public forests will likely be asked to play a role in sequestering carbon. Private entities are already offering to plant trees on public lands provided that they can claim carbon credits for doing so.

Salwasser 2007:14-16 along with numerous others, points to a number of relevant forest management strategies that could play a role, particularly in devising strategies for meeting desired condition and restoration goals. These include:

- Increase forested land area
- Manage and protect forests from fire and insects to store more carbon per acre
- Capture more carbon in wood products
- Use mill waste, woody biomass for bio-based renewable energy
- Favor wood products over more energy-demanding materials
- Reward forest landowners for ecosystem services.

Clearly some of these suggestions refer to forest policy choices that are well outside the realm of forest plans, but other suggestions are relevant, and should be considered as part of forest plan revisions.

## CONCLUSIONS

Change is upon us. Climate change is probably the key evolutionary force that sets the conditions for change in species and ecosystems. We are in a time of rapid climate change where the management models that look to historic conditions as a baseline and that assume stable ecosystems will not be useful for setting desired conditions and restoration goals. While the research and models for forecasting the effects of climate change are rapidly improving, the tools and techniques to accurately forecast vegetation changes at the local forest level do not yet exist. Nevertheless we need to use the information we do have to design realistic and quantifiable desired conditions for forest plan revisions and consider climate change in our restoration strategies.

As importantly, we need to educate ourselves and the public about the likely effects of climate change on forest resources and take action to mitigate those effects where it makes sense to do so. We have the opportunity to manage our forests, grasslands, and wood products to increase carbon sequestration and to offset fossil fuel use though bio-energy, bio-products, and bio-fuels. Innovative and scientifically credible silvicultural practices will be crucial to all of these efforts, if the nation is to have healthy and resilient forests well into the future.

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# Learning, Connecting, Reconnecting: Summary of the 2007 National Silviculture Workshop

*Russell T. Graham and Theresa B. Jain*

## NATIONAL SILVICULTURE WORKSHOP

The National Silviculture Workshop's genesis in 1973 was the result of forward thinking individuals within the Timber Management staff of National Forest Systems. Several national issues of the 1970s including, but not limited to: 1) the passing of the National Forest Management Act, 2) the mandate that all timber removal, reforestation, and timber stand improvement on Forest Service lands be prescribed by trained and certified silviculturists, and 3) a national policy of intensive timber management on Forest Service lands provided the impetus for "National Silviculture Work Conferences" (Nelson 1974, Gillespie 1977). In 1973, a group of 70 to 80 individuals, primarily from the Division of Timber Management along with several members of the Timber Management Research Staff of the Forest Service, met in Marquette, MI to discuss the theme of hardwood management (uneven-aged management). The organizers, the Silviculture Group from the Timber Management Staff in the Washington Office, recognized the need for National Forest System Silviculturists and their associates to become acquainted and share information often of regional and national consequence. In addition, they recognized that Forest Service Research was an integral part of this information exchange so individuals from Forest Service Research were included in the Workshops. Proceedings followed the Workshops and were initially published by the Timber Management Staff in the Washington Office. These proceedings had minimal numbers printed, minimal review, lacked a consistent format, and no library deposition. Because the proceedings contained information addressing issues relevant to the practice and evolution of silviculture, Forest Service Research and in particular, the Station co-hosting the meeting, began to publish the proceedings in 1991. As a result, the proceedings are readily retrievable from libraries, meet the highest standards (e.g., peer, policy, statistics review) for Forest Service publications, and are available from Station Internet sites.

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The early meetings were held annually and their locations moved around the country and were hosted by different Regions and associated Research Stations (Table 1). These conferences addressed various topics of local, regional, and national concern. For example, several of the meetings in the 1970s addressed how forest management would be impacted by the National Environmental Policy Act of 1969 and how timber management and silviculture could fulfill the goals of the National Forest Management Act of 1976 (Doolittle 1975, Berntsen 1977) (Table 1). Uneven-aged management and uneven-aged silviculture were common topics throughout the life of the Workshop beginning in 1973 and are still topics in 2007 (Marquis 1978). Two research sponsored workshops were devoted to the subjects partly in response to the "alternatives to clearcutting issue" and a large portion of the Workshop in Petersburg, AK (1989) was devoted to the subject (Berntsen 1977, Forest Service 1990).

Silviculture and timber management are often considered synonymous by many within the Forest Service and those on the outside (Graham and Jain 2004). Even though timber management was central to most National Forest Management in the 1970s, the recognition of other resources such as water and wildlife were frequent topics during early Workshops (Schneegas and Sundstrom 1977, Lewis 2005). In 1987 the entire Sacramento Workshop was devoted to silviculture for all resources and the 2004 Workshop was devoted to silviculture in special places (Table 1). As these examples show, the practice of silviculture within the Forest Service has been very inclusive. Other evidence of inclusiveness in the Workshops is the multitude of disciplines both from National Forest Systems and Research, including but not limited to wildlife, forest ecology, hydrology, fisheries, soils, range, economics, social, management, and policy that have made presentations and attended the Workshops. By far the National Silviculture Workshop is one of the most well attended national meetings and the 2007 meeting in Ketchikan, AK continued this standard with a diversity of attendees and overflowing attendance.

## 2007 KETCHIKAN MEETING

In 1905, Gifford Pinchot suggested the Forest Service strive to provide the greatest good, for the greatest number, for the longest time (Lewis 2005). The dedication and commitment of Forest Service silviculturists exemplifies this ethic and it is showcased biannually with the planning, execution, and attendance at the National Silviculture Workshop. The 2007 meeting was a return visit of the Workshop to Alaska. The 1989 meeting, in Petersburg (93 attendees) was hosted by the Tongass National Forest, Region 10, and the Pacific Northwest Research Station. The 1989 meeting overwhelmed the commercial accommodations available and the Forest Service Family opened their homes providing rooms and meals to several attendees. Ketchikan, being frequented by cruise boats, had sufficient infrastructure to support the meeting but it too felt the meeting's presence (121 plus attendees) (McDowell 2007). The meeting planners, who did a superb job, secured the Ted Ferry Civic Center overlooking downtown Ketchikan for the Workshop.

### Issues, trends, and setting

In the welcoming addresses it was obvious that the issues, trends, and concerns facing the management of southeastern Alaskan forests reflect those of forests throughout the United States (Ginn this proceedings). The forests of Alaska, and throughout the United States, are changing and the expectations of local, regional, and national stakeholders are also changing. For example, the nearly 6.9 million hectare Tongass National Forest, the largest National Forest in the United States, began its modern timber program in the 1940s by producing Sitka spruce logs for airplane construction. As the need for airplane spruce rapidly declined there was a desire locally, regionally, and nationally to provide economic stability and job opportunities in Southeast Alaska (Byers 1960, Durbin 1999). The Tongass Timber Act of 1947 authorized the Forest Service to develop long-term timber supply contracts and in 1954 the Ketchikan Pulp Company opened a mill in Ketchikan and in 1959 the Alaska Lumber and Pulp Co.'s mill opened in Sitka. These two mills anchored the forest products industry in southeastern Alaska until both mills closed in 1990s impacting the lives of many Alaskans (Durbin 1999). These changes in Alaska reflected the changes that occurred in western Oregon and Washington when the timber industry receded in the late 1980s as result of forest simplification, loss of old-growth, and protection of spotted owl habitat (Byers 1960, Durbin 1999, Donovan and others 2005, Lewis 2005).

Although timber production has decreased dramatically in the United States in the last decade, its citizens consume approximately 20 billion cubic feet per year or 67 cubic feet per person compared to a global average per capita

Table 1. The evolution of the national silviculture workshop. Various national silvicultural meetings hosted by both National Forest Systems and Research developed into what is now a national biannual meeting that began in earnest in 1979 in Charleston, SC.

| Year | Location | Title/theme |
|---|---|---|
| 1973 | Marquette, MI | Hardwood management |
| 1975 | Morgantown, WV | Uneven-aged silviculture and management in the eastern United States |
| 1976 | Eugene, OR | Stocking control and tree density |
| 1976 | Redding, CA | Uneven-aged silviculture and management in the western United States |
| 1977 | Flagstaff, AZ | Silvicultural implications of Section 4 of National Forest Management Act |
| 1978 | Missoula, MT | Silvicultural examination, prescriptions and related activities |
| 1979 | Charleston, SC | Shelterwood regeneration method |
| 1981 | Roanoke, VA | Hardwood management |
| 1983 | Eugene, OR | Economics of silvicultural investments |
| 1985 | Rapid City, SD | Success in silviculture |
| 1987 | Sacramento, CA | Silviculture for all resources |
| 1989 | Petersburg, AK | Silviculture challenges and opportunities of the 1990's |
| 1990 | Wenatchee, WA[1] | Genetics/silviculture workshop |
| 1991 | Cedar City, UT | Getting to the future through silviculture |
| 1993 | Hendersonville, NC | Silviculture from the cradle of forestry to ecosystem management |
| 1995 | Mescalero, NM | Forest health through silviculture |
| 1997 | Warren, PA | Communicating the role of silviculture in management of the National Forests |
| 1999 | Kalispell, MT | The role of silviculture in the stand, forest, landscape, and beyond |
| 2001 | Hood River, OR | Silviculture odyssey to sustaining terrestrial and aquatic ecosystems |
| 2003 | Grandby, CO | Integrated restoration of forested ecosystems to achieve multi-resource benefits |
| 2005 | Lake Tahoe, CA | Restoring fire adapted forested ecosystems |
| 2007 | Ketchikan, AK | Integrated restoration efforts for harvested forest ecosystems |

[1]Although the genetics workshop held in 1990 was not organized as a National Silviculture Workshop it took on such a flavor as both the genetics and silviculture disciplines from the throughout Forest Service were represented.

consumption of 21 cubic feet (Shifley this proceedings). A high proportion of the wood consumed in the United States is imported though the citizens of the United States enjoy an abundance of parks, wildernesses, and other wildlands (Haynes and Horne 1997). Alaskans reflect this trend with the majority of their wood building products being produced in the lower 48 States despite the state's abundance of forest lands. This conundrum provides context for use, preservation, and restoration of United States forests in the 21st century.

Even though the large timber markets have declined in Alaska, similar to the declines in the western United States, the concept of ecosystem services is evolving into a forest management issue, for which silviculture is essential for its success. Ecosystem services include a wide variety of benefits humans gain from ecosystems and include such things as purification of air and water, mitigation of droughts and floods, detoxification and decomposition of wastes, and the sequestration of carbon in which forests and silviculture play important roles (Daily and others 1997, Collins this proceedings). The sequestration of carbon and the evolving carbon markets are integral to reducing emissions of the greenhouse gases that cause climate change. Both National Forest Systems and Forest Service Research will have critical roles addressing this issue in the future. For example, the National Service Center in Fort Collins, CO in cooperation with Research and Development, provided the Forest Vegetation Simulator (FVS) the ability to produce and project carbon metrics for forests (Collins this proceedings, Dixon 2002).

United States forests have changed as the result of fire exclusion, introduction of invasive species, urbanization, land-use changes, and timber harvesting. As a result, there is considerable interest in restoring forests and the Forest Service has developed a framework outlining several principles for restoration, and the practice of silviculture is critical for these restoration activities (Crow this proceedings).

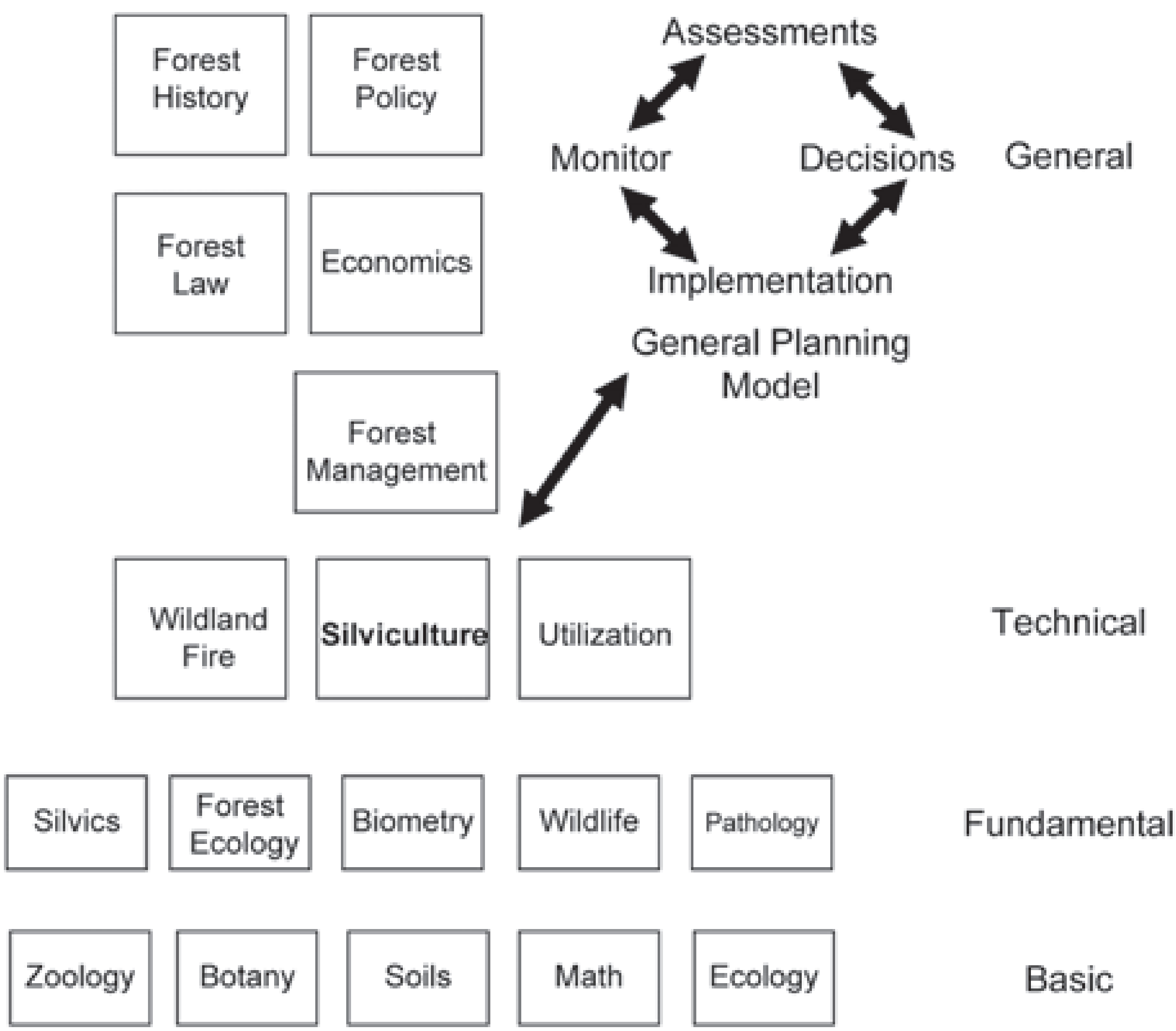


*Figure 1. Silviculture is an integrative discipline incorporating basic, fundamental, and general knowledge into management frameworks (silvicultural systems) applicable for managing forests and woodlands (adapted from Nyland 2002).*

There are several issues intertwined with forest restoration including, but not limited to, restoring degraded ecosystems, restoring watersheds valued for domestic water production, and restoring wildlife habitat. Restoring wildlife habitat is especially important for those wildlife species considered threatened and endangered under the Endangered Species Act. A prime concern inextricably connected to these issues and to forest restoration is the protection of communities and developments from wildfire (Graham and others 2004). As mentioned before, climate change is the overriding constraint or over-arching unknown influencing forest management policy, decisions, and silvicultural practices no matter the landowner or their objectives. For example, in Alaska there is evidence that the decline of yellow cedar is related to climate change. Specifically, warmer springs and reduced snow pack initiate premature dehardening and predispose trees to spring freezing injury (Hennon this proceedings). Even though other disciplines, and the public at large, have now (2007) brought climate change to the forefront, silviculturists have been cognizant of how it may impact silvicultural activities for years, as noted by Sesco (1990) at the 1989 National Silviculture Workshop.

Other disciplines may disagree, but silviculture is at the center of forest management (Figure 1) (Nyland 2002). Through the years silviculture has been closely allied with timber management and the production of wood crops (Evelyn 1664, Schlich 1906, Nyland 2002). As a result, the majority of the silvicultural practices were developed and honed over the years to grow trees efficiently and rapidly. As the early speakers in the Ketchikan Workshop articulated, this objective is very relevant. However starting with the 21st century exciting and challenging times are ahead for silviculture to respond to contemporary and evolving needs of forest management. More than ever people, enjoy, cherish, and often live in the forests the Forest Service manages. As such, the protection of communities, homes, and fire fighter safety are going to be of paramount importance. Developing and maintaining wildfire resistant and resilient forests and other issues such as biodiversity, carbon credits, maintaining sense-of-place, and old-growth will challenge silviculturists to be forward looking, adaptive, relevant, and responsive in the face of climate change.

**Information and Knowledge**

A key goal of the National Silviculture Workshop has always been for both practicing silviculturists and research silviculturists to exchange knowledge, information, and information needs. This approach, which furthers the development of the art and science of silviculture began in mid-1600s in England (Evelyn 1664) and continuing with Schlich (1906) in the late 1800s in England and India. Over the last 34 years, the proceedings from the Silviculture Workshops traces the evolution of silviculture within the Forest Service and evidence indicates that such approaches have influenced current silvicultural thought (Nylan 2002, Tappeiner and others 2007).

A key need within all National Forests is for information and assistance in planning processes. The National Forest Management Act requires the Forest Service to prepare Forest Plans. Presently (July 2007), the rules for completing plans are somewhat uncertain, however, forest restoration will most likely be a theme for most plans along with sustainability and the maintenance of fire adapted ecosystems (Brett this proceedings). As Forests revise their plans, a suite of vegetation models are available, but they are rarely used to their full potential (Peterson and others 2007, Brett this proceedings). Other integral parts of the planning process are science use and scientist involvement during plan preparation. For example, the Tongass is in the process of finalizing their Plan and the Pacific Northwest Research Station, in 1997 and again in 2007, has been instrumental in this planning effort. Relationships between Research and National Forest Systems can transcend more than one Forest such as the Tongass. Research can be integral in developing projects by providing site specific information and models applicable for landscape planning. For example, the Daniel Boone and Bankhead National Forests partnered with the Southern Research Station to conduct large scale landscape studies using the Forest Plan and typical NEPA processes (Schweitzer and others this proceedings). This collaboration provides both National Forest and Research personnel a better understanding of mutual procedures, information needs, and most importantly proved information and protocols which benefit both organizations. Another key collaboration of Research and National Forests Systems is for Research organizations to participate and provide assistance in monitoring activities on National Forests. Monitoring has always been a part of forest management but it is often intermittent and inconsistent. For the most part monitoring protocols developed for timber production may not be adequate or appropriate for addressing many of today's management objectives such as forest restoration or maintaining wildlife habitat.

Often these types of issues cover multiple National Forests and/or large landscapes. Moreover, it has been suggested that by developing a unified monitoring strategy applicable to many Forests, comprehensive information could be assembled and progress towards restoration objectives would more likely be recognized and applied (Yaussy and others this proceedings).

In contrast to the forests of Alaska, the forests of the southern United States have been managed (harvested) since the 1600s and by the turn of the 20th century the removal of high value pines or high grading left many of them in a depleted condition. Restoration of these degraded conditions offer insight and/or principles that are applicable to the success of restoring forests anywhere. In general, restoration activities are dependent on the silvics of the species inherent to the site, the plasticity of the species, the abilities and insight of silviculturists (both current and past), and the application of evolving and developing scientific silvicultural knowledge (Guldin this proceedings). Again, from the experiences in the South it is obvious that restoration will be easier in some forest types than it will be in others regardless of the efforts of the silviculturist.

Some have suggested that climate change is impacting the size and extent of wildfires throughout the United States and elevating the level of insect and disease caused mortality in many forests (Dale and others 2001). In response to such forest changes, silvicultural strategies for restoring forests to a state in which they are more resilient and resistant to wildfires, insect outbreaks, and disease infestations have been suggested (Stanturf and Madsen 2005). In addition, invasive species (exotics) often exacerbate the impact wildfires have and controlling the abundance and distribution of invasives is also central to many restoration strategies (Graham and others 2004). For example, the introduction of cheat grass in the western United States has displaced native species, disrupted successional pathways, and made the forest and shrub lands extremely susceptible to intense and severe wildfires (Graham and others 1999). Also, throughout the West, white pine blister rust has devastated forests once dominated by 5-needle pines (e.g., western white pine, sugar pine, white bark pine). In concert with increasing forest resilience to wildfire, integrated management of western white pine and white pine blister rust has been the focal point of many restoration strategies (Jain and others this proceedings). Another example includes work associated with developing strategies for controlling the hemlock woolly adelgid, an introduced species, in concert with activities aimed at restoring the central Appalachian and southern New England forests (Fajvan and others this proceedings).

Often forest restoration directly or indirectly implies the changing of species composition from one susceptible to fire, insects, and diseases to one more resistant and resilient (Stanturf and Madsen 2005). Through fire exclusion, grazing, and timber harvest the changes and the need for restoration are exemplified by restoring ponderosa pine and western white pine forests in the western United States and restoring Missouri Ozark forests in the eastern United States (Jain and others this proceedings, Nelson and Studyvin this proceedings, Zhang and Ritchie this proceedings). The latter restoration effort was designed to restore forests to ones containing assemblages of native species reminiscent of historical forests. This strategy was developed in collaboration with the Nature Conservancy and it, like many other efforts, recognized the role native disturbances played in maintaining and sustaining the Ozark Forests.

Linking the stand to the landscape is often the ultimate determinant of successful forest restoration. Finney (2001) suggested that forest structures could be modified and strategically placed in the landscape to disrupt a fire's progress. Jain and others (this proceeding) demonstrated how fuel treatments, even though they were small, could accomplish this task. The fuel treatments Jain and others developed and applied initiated a silvicultural system aimed at restoring the moist forests while providing structures and compositions relevant to many contemporary forest management objectives (e.g., sense-of-place, wildlife habitat, watershed protection). Another innovative fuel treatment discussed at Ketchikan was from the Bitterroot Forest where they used fuel treatments to reduce the fire hazard in a mixed conifer forest yet maintained hiking trails through an old apple orchard that people of the Bitterroot Valley cherish (Johnson this proceedings).

Riparian areas provide habitat for a wide range of game and non-game wildlife, they reduce the amount of sediment entering the stream, shade the stream, contribute woody material that increases hydraulic and structural complexity of the stream, provide habitat for aquatic and terrestrial organisms, and are integral to properly functioning watersheds. A very common method of addressing riparian areas in the proximity of timber harvest is through the establishment of stream management zones (buffers). These reserve areas have ecological benefits but they also have opportunity costs that are valuable information for both decision and policy makers (LeDoux this proceedings). A key to restoring watersheds, especially after disturbance, is prompt and robust vegetative regeneration (see field trip below). For example, in Alaska, mixing red alder with conifers when regenerating the rainforests following timber harvest offers prospects for increasing biodiversity and wildlife habitat abundance. Headwater streams with plentiful riparian alder had more invertebrates and supported more downstream fish biomass compared to basins with little or no riparian alder (Deal and Russell this proceedings).

Depending on the species, fish and wildlife habitat needs can be very site specific, but often habitat needs exceed stand and forest boundaries thus requiring silvicultural treatments to be relevant at these multiple spatial scales. For example, the habitat of the northern goshawk covers large landscapes often exceeding 3,000 hectares in size necessitating silvicultural treatments to transcend many different spatial scales. Although this is often recognized, integrating silvicultural activities across large areas often makes the preparation and implementation of silvicultural prescriptions more difficult. Nevertheless there are tools available to assist silviculturists in applying treatments at the site level while insuring they are relevant within the landscape (Youtz and others this proceedings). These silvicultural protocols developed for sustaining goshawk habitat represent and are presented as an uneven-aged silvicultural system.

Uneven-aged silviculture and uneven-aged management have been topics of discussion throughout the history of the National Silviculture Workshop. Probably nowhere in the United States has uneven-aged silviculture been practiced longer than in the South. For the past 70-years, selection systems have been used on the “Good and Poor Farm Forestry Forties” on the Crossett Experimental Forest producing high quality saw timber. Information from these studies has quantified forest development and produced multiple silvicultural strategies applicable for growing and sustaining old-growth characteristics of the southern pines. More importantly, these studies provide relevant information useful for treating the dry pine systems in the remainder of the United States (Bragg and others this proceedings).

Multiple canopy layers, heterogeneous horizontal structures, and a high interspersion of vegetation cohorts from young to old, are often desirable forest attributes for meeting wildlife and other contemporary forest management objectives. Most often uneven-aged silvicultural systems are a viable option for producing and maintaining these kinds of conditions (Graham and others 2007, Jain and others this proceedings, Youtz and others this proceedings). However, the conversion from even-aged structures to uneven-aged structures especially in stands developed from plantations can be problematic. It may take several entries and several decades to develop the desired forest conditions and for understory plant communities to differentiate in response to subtle differences in microclimate and light (Anderson this proceedings, Youtz and others this proceedings).

Regeneration and the disposition of high forest cover are often the major determinants for evaluating the success of silvicultural applications. High forest cover is fundamental for determining fire relations, many wildlife needs, product production, and the over-all character of the forest. Nevertheless regeneration is requisite for the success of all silvicultural systems and the abundance, juxtaposition, and species of regeneration are highly dependent on the biophysical conditions of a site and the amount and kind of natural or management disturbance to the forest floor and high forest cover (Jain and others this proceedings). Usually, canopy gaps or canopy openings are required for the regeneration of even the most shade-tolerant species, however, following abundant acorn crops, northern red oak can regenerate and develop even in the dense shade of closed-canopied forests (Dey and Miller this proceedings). Desired species with this attribute give rise to opportunities for managing the species and mixtures containing the species using a wide variety of even-aged and uneven-aged silvicultural systems.

The success of a silvicultural system is often predicated on effective and timely intermediate treatments (e.g., cleanings, weedings, thinnings). Intermediate treatments set the structure, composition, and developmental trajectories of the forest (Nyland 2002, Graham and others 2005). For example, in southeastern Alaska, clearcutting has been the dominant regeneration method and has been very successful giving rise to plentiful young forests. These young forests provide abundant opportunities for establishing studies to determine the impact thinning has on the development of Alaskan rainforests (Bragg and others this proceedings, McClellan this proceedings) (see field trip below). Although this work was originally initiated to quantify forest growth and yield, these studies and other wide ranging plots throughout southeastern Alaska have been invaluable for understanding ecological and pathological relations and for calibrating forest development models (Poage and McClellan this proceedings). Not only in Alaska (Tongass-wide young-growth studies) but throughout the United States, these kinds of long-term studies have provided data on forest development which can inform a multitude of forest management decisions for a wide variety of objectives (e.g., wildlife habitat, sense-of-place, fuel treatments, timber production) (Bragg and others this proceedings, McClellan this proceedings, Graham and others 2005). With these manipulations of young stands not only are residual structures and compositions produced with value but they

Figure 3. Young western hemlock and Sitka spruce forest growing on the Maybeso Experimental located on Prince of Wales Island.

also set up the forest for future intermediate treatments which often produce commercial forest products (Lowell and others this proceedings).

*Figure 2. Loading the ferry in Hollis, Alaska for the return trip to Ketchikan and watching whales, eagles, and sea lions on the stern of the ferry.*

**Field trip to Prince of Wales Island**

Field trips have always been an integral part of the National Silviculture Workshop. They provide opportunities for attendees to see, touch, and learn about forests and silvicultural activities applied in them. Because the Workshop moves around the country, different forest types are visited and many different silvicultural techniques, presentations, and forest management objectives have been encountered. For example, at the 1973 meeting the attendees viewed the Dukes Experimental Forest, American Can Company lands, and areas on the Hiawatha National Forest near Marquette, MI displaying a variety of hardwood management techniques. In addition, while enjoying breakfast on a Convair 580 airplane, the group traveled to the Vinton Furnace Experimental Forest near Columbus, OH and then on to the Kaskaskia Experimental Forest near Marion, IL thereby viewing a variety of uneven-aged treatments on each Forest. This airplane travel set the standard for field

*Figure 4. Terry Fifield discussing the role and importance of Totems to Native Alaskans in Craig, Alaska.*

trip transportation, nonetheless school buses, tour coaches, and city transit buses are more the norm. More than once during National Silviculture Workshop field trips buses have broken down requiring alternate transportation and delaying the start of the ever important pre-dinner information exchange. For the Ketchikan Workshop a combination of busses and a ferry were used for the overnight field trip to Prince of Wales Island (Figure 2).

Prince of Wales Island offers many examples of silvicultural treatments representing timber production in Alaska. Mike McClellan hosted the first stop on the Maybeso Experimental Forest. The Forest was established in 1956 to investigate the effects of clearcut timber harvesting on forest regeneration and development, and on the physical habitat of anadromous salmon spawning areas. The watershed was treated with the first large-scale industrial clearcutting in southeast Alaska and nearly all of the commercial forest was removed from the watershed, including the riparian zone, from 1953 through 1960. The present forest consists of even-aged, second-growth Sitka spruce and western hemlock trees. The Old Tom Research Natural Area (an old-growth forested watershed) is located nearby and it provides an old-growth control for studies in the Maybeso. Patti Krosse hosted a tour stop displaying late successional forests similar to those occurring in the natural area. This experimental forest and the surrounding area, provides abundant research opportunities for studying succession and development of Alaskan rainforests (McClellan this proceedings, Poage and McClellan this proceedings, Deal and Russell this proceedings) (Figure 3).

A theme running through the Workshop was restoration and probably no other forest attribute exemplifies this more than stream restoration. Pink, chum, and coho salmon, Dolly Varden, steelhead, and cutthroat trout are present throughout the streams on Prince of Wales. Sheila Jacobson and KK Prussian showed the attendees the efforts being made by the Tongass National Forest throughout southeastern Alaska to restore streams modified by past timber harvesting and road construction.

*Figure 5. Kirk Dolstrum hosted the Viking Mill stop on the Prince of Wales Island.*

Table 2. National Silviculture Workshop award recipients. At the National Silviculture Workshop beginning in 1989 in Petersburg Alaska individuals from National Forest Systems, State and Private Forestry, and Research and Development Deputy areas of the Forest Service have been recognized for their contributions to the practice of silviculture and forest management.

| National Forest Systems and State and Private Forestry | | | Research and Development | | |
|---|---|---|---|---|---|
| Individual | Title[1] | Current status | Individual | Title[2] | Current status |
| 1989 Petersburg, Alaska | | | | | |
| C.R. Blompquist | R-9 Reg. Silviculturist | Retired | Wyman Schmidt | INT Res. Silviculturist | Retired |
| John Standwerwick | R-10 Silviculture Group Leader | Retired | David Marquis | NE Res. Silviculturist | Retired |
| Jerry Hamilton | R-4 Reg. Silviculturist | Retired | Nelson Loftus | WO Forest Management Research | Retired |
| 1991 Cedar City, Utah | | | | | |
| David Thomas | R-5 Eldorado Silviculturist, | Deceased | Dean Debell | PNW Res. Silviculturist | Retired |
| John “Bob” Naumann | R-1 Reg. Silviculturist | Retired | Russell Graham | INT Res. Silviculturist | RMRS |
| 1993 Hendersonville, North Carolina | | | | | |
| Richard Fitzgerald | WO, Asst. Director (Forest Products) Forest Management | WO | Phil Aune | PSW Program Manager | Retired |
| Richard Miller | WO Geneticist | Retired | David Loftis | SE Res. Silviculturist | SRS |
| Walter Knapp | R-6 Reg. Silviculturist | Retired | | | |
| 1995 Mescalaro, New Mexico | | | | | |
| Dick Bassett | R-3 Reg. Silviculturist | Retired | Wayne Shepperd | RMRS Res. Silviculturist | Retired |
| John Fiske | R-5 Reg. Silviculturist | Retired | Bill Oliver | PSW Res. Silviculturist | Retired |
| Bobby Kitchens | R-8, Reg. Silviculturist | Retired | | | |
| Ralph Johnson | WO FVS Group Leader FMC, Ft. Collins | Retired | | | |
| Milo Larson | R-3 Timber Management Director | Retired | | | |
| Dennis Murphy | WO Silviculturist | Retired | | | |
| 1997 Warren, Pennsylvania | | | | | |
| Jack Amundson | R-4 Reg. Silviculturist | Retired | Clint Carlson | RMRS Res. Silviculturist | Retired |
| Barry Bollenbacher | R-1 Reg. Silviculturist | R-1 | Carl Edminster | RMRS Res. Silviculturist | Retired |
| Frank Burch | WO National Silviculturist | WO | Bob Powers | PSW Program Manager, Res. Soil Scientist, Res. Silviculturist | PSW |
| Ken Denton | R-6 Reg. Silviculturist | Retired | Susan Stout | NE Res. Silviculturist | NRS |
| Susan Gray | R-2 Reg. Silviculturist | R-2 | | | |
| Mike Landram | R-5 Reg. Silviculturist | R-5 | | | |
| Doug MacCleery | WO Asst. Director (Policy) Forest Management | WO | | | |
| Richard Teck | WO NRIS Project Manager, FMC, Ft. Collins | WO | | | |

[1]FMC = Washington Office Forest Management Service Center, Fort Collins, CO, Reg. = regional position, WO = Washington office.

[2]Intermountain (INT) and Rocky Mountain (RM) Research Stations combined to form the Rocky Mountain Research Station (RMRS) (1997), the North Central (NC) and Northeastern (NE) Research Stations combined to form the Northern Research Station (NRS) (2007), and the Southeastern (SE) and Southern (SO) Research Stations combined to form the Southern Research Station (SRS) (1995), Res. = research position, WO = Washington Office.

Table 2 cont. National Silviculture Workshop award recipients. At the National Silviculture Workshop beginning in 1989 in Petersburg Alaska individuals from National Forest Systems, State and Private Forestry, and Research and Development Deputy Areas of the Forest Service have been recognized for their contributions to the practice of silviculture and forest management.

| National Forest Systems and State and Private Forestry | | | Research and Development | | |
|---|---|---|---|---|---|
| Individual | Title[1] | Current status | Individual | Title[2] | Current status |
| | | 1999 Kalispell, Montana | | | |
| Peter Laird | R-1 Reforestation/Nursery Specialist | Retired | Dick Tinus | SRS Plant Physiologist | Deceased |
| Gary Dixon | WO, FVS Group Leader, FMC, Ft. Collins | WO | Phil McDonald | PSW Res. Silviculturist | Retired |
| | | | Gary Fiddler | PSW Forester | Retired |
| | | | Jim Chew | RMRS Forester | RMRS |
| | | 2001 Hood River, Oregon | | | |
| Fred Zensen | R-6 Reforestation/Nursery Specialist | R-6 | Ray Shearer | RMRS Res. Silviculturist | Retired |
| | | | Jim Jenkinson | PSW Res. Plant Physiologist | Retired |
| | | | Bob Curtis | PNW Res. Silviculturist | Retired |
| | | | Nicholas Crookston | RMRS Forester | RMRS |
| | | 2003 Grandby, Colorado | | | |
| Brian Ferguson | R-4 Reg. Silviculturist | Retired | Jim Guldin | SRS Res. Silviculturist | SRS |
| Mary Frances Maholovich | R-1 Reg. Geneticist | R-1 | Kurt Gottschalk | NE Res. Silviculturist | NRS |
| Monty Maldonado | WO Reforestation/ Nursery /Genetics Programs | WO | Paul Johnson | NC Res. Silviculturist | Retired |
| Tom Tibbs | R-8 Reg. Geneticist | Retired | | | |
| | | 2005 Lake Tahoe, California | | | |
| William “Bill” Jones | R-9 Reg. Silviculturist | Retired | Jim Barnett | SRS Res. Silviculturist | Retired |
| Glenda L. Scott | R-1 Reforestation/Nursery Specialist | R-1 | | | |
| Tom Landis | National Nursery Specialist, State and Private Forestry | Retired | | | |
| Jim Russell | R-10, Tongass Silviculturist | R-10 | | | |
| | | 2007 Ketchikan, Alaska | | | |
| Marlin Johnson | R-3 Forestry Asst. Director | R-3 | Terrie Jain | RMRS Res. Silviculturist | RMRS |
| Kathy Sleavin | WO FSVeg Project Coordinator, FMC Ft. Collins | WO | Steve Shifley | NRS Res. Silviculturist | NRS |
| Dave Evans | R-5 Lassen Silviculturist | R-5 | | | |
| Bill McArthur | R-6 Reg. Silviculturist | R-6 | | | |

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Traveling throughout southeastern Alaska, and in particular on this field trip, the current and historic reverence Native Americans have for forests and their intimacy with all natural resources was very evident. Totems, their display and carving are special to Alaskan Native Americans and the Workshop attendees were shown by Jon Rowan and Terry Fifield how totems are carved and displayed (Figure 4). As stated earlier the extent and impact forest industries have in southern Alaska has changed dramatically with the closing of the pulp mills. However a limited number of saw mills do harvest forests and produce wood products (Figure 5). The Forest Service is trying to support these kinds of small and essential forest industries with the development of the 2007 Plan for the Tongass.

The town of Craig is on the opposite side (western) of Prince of Wales Island from the Inter-Island Ferry dock at Hollis therefore, the field trip members traversed the width of the Island with the evening dinner and accommodations being in Craig. A local blue grass band provided music during dinner at the Craig Community Center and the lodging in Craig was creatively arranged by the Workshop planners. No bus break downs or delays getting to dinner were encountered, allowing all to have a good time at the pre-dinner information exchange and the post dinner wrap-up late into the evening. These informal information exchanges are a key element of the Silviculture Workshops and provide quality time for all of the participants to interact, make new friends, and rekindle old associations. The three plus hour ferry and bus ride to and from Craig provided high-quality time to reflect on the field trip, the role of silviculture in forest management, and the information presented at the Workshop. In addition, Jim Baichtal described the karst geology and caves of the Tongass, Terry Fifield discussed the history of the Thorne Bay Logging Camp, and Gary Lawton described the recreational opportunities on Prince of Wales. These excellent presentations on the ferry competed with the whale, eagle, and sea lion watching occurring on the stern of the ferry (Figure 2).

**Workshop Banquet**

The food caterers at the Ted Ferry Civic Center did an excellent job the entire Workshop and the Halibut Oscar served at the banquet was superb. Continuing the trend of understanding the native peoples of southeastern Alaska, Terry Fifield did an excellent job of showing how the Civilian Conservation Corp restored totems in Southeast Alaska beginning in 1938 and continuing until 1954. The Ketchikan Indian Community Intertribal Dancers sang, drummed, and danced to an appreciative audience and enticed several to join the dancers on stage.

## NATIONAL SILVICULTURE AWARDS

The practice of silviculture has several aspects but most importantly its aim is to sustain forests through their establishment and tending to fulfill the management objectives of the forest landowner, and in the case of the Forest Service, for the citizens of the United States (Figure 1). Forest management is a long-term endeavor as articulated by the likes of Evelyn in the 1600s, Schlich in the 1800s, and Nyland in 2002. Because of this long-term nature of forestry it takes individuals committed to the practice of silviculture and to the forests for which they are caring. At each Workshop since 1989 in Petersburg, led by the Silviculture Group in the Washington Office, individuals showing outstanding contributions to the practice of silviculture have been acknowledged (Table 2). Six such individuals were recognized at the Workshop in Ketchikan on May 10, 2007 including Terrie Jain, Research Forester, Rocky Mountain Research Station, Moscow, ID, Steve Shifley, Research Forester, Northern Research Station, Columbia, MO, Marlin Johnson, Region 3, Assistant Director for Forestry and Forest Health, Albuquerque, NM, Kathy Sleavin, Washington Office, FSVeg Project Coordinator, Ft. Collins, CO, Dave Evans, Forest Silviculturist, Region 5, Lassen National Forest, Susanville, CA, and Bill McArthur, Region 6, Regional Silviculturist, Portland, OR. These individuals exemplify the outstanding people the Forest Service has committed to providing the greatest good, for the greatest number, for the longest time.

## CONCLUSION

People, experience, knowledge, and research are essential for an organization to succeed and for the Forest Service these requisites have proved to be invaluable. The biannual National Silviculture Workshop provides a forum where individuals can share information, learn, develop relations, and further their professional and personal growth. The Ketchikan meeting was a challenge for the organizers but Region 10, Pacific Northwest Research Station, and the Tongass Forest did a superb job of hosting the Workshop. The ferry and the over-night stay in Craig were integral parts of the field trip, once again raising the bar for future field trip successes. As with all National Workshops many new faces were evident and others were conspicuous in their absence. Nevertheless, the overlap of individuals attending past meetings, led by Dick "Fitz" Fitzgerald who was on that Convair 580 for the field trip in 1973, with new attendees this year provides continuity, learning, and institutional memory. This strong tradition will continue in 2009 when Region 4 and the Rocky Mountain Research Station host the National Silviculture Workshop.

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