Proceedings of the 2007 National Silviculture Workshop

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

This paper was published in: Deal, R.L., tech. ed. 2008. Integrated restoration of forested ecosystems to achieve multiresource benefits: proceedings of the 2007 national silviculture workshop. Gen. Tech. Rep. PNW-GTR-733. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 306 p.

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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 inter-mountain 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

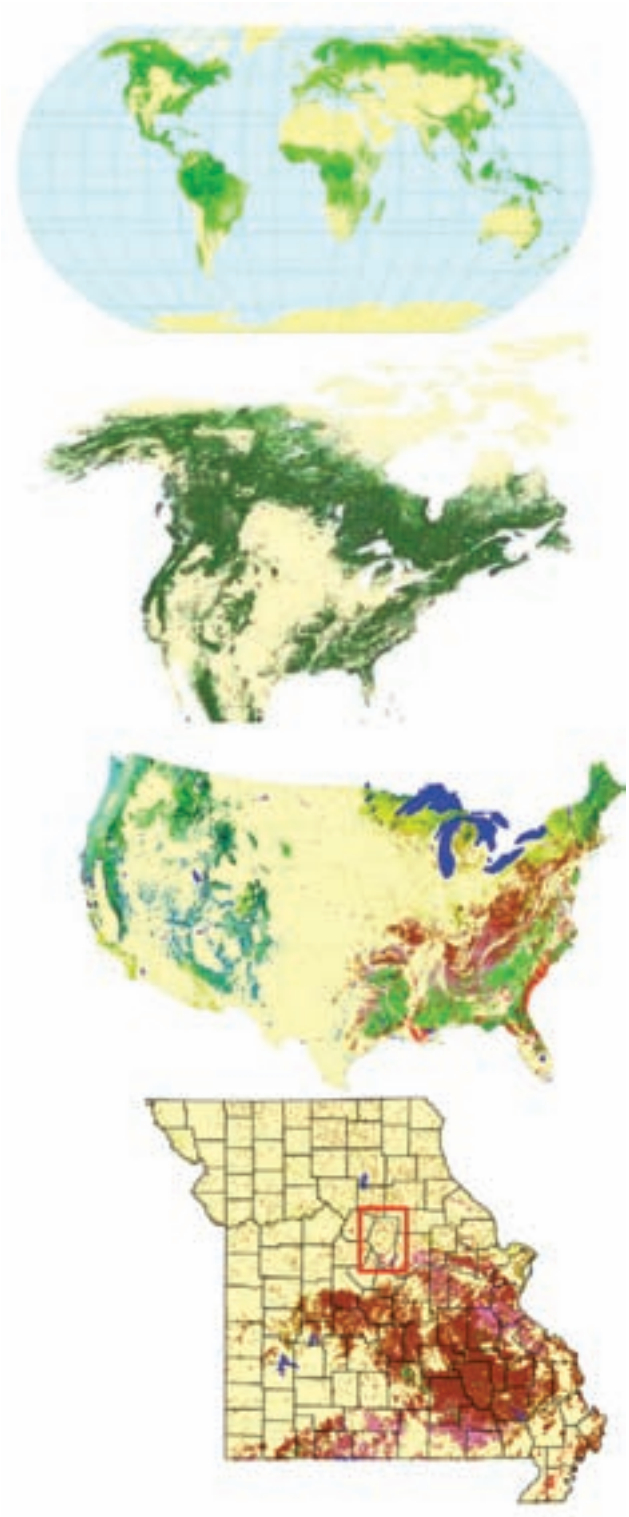

Figure 1. U.S. forest resources in a global context. Dark shades indicate forest land. The land mass of the Earth is about one-third forested, North America is about one-third forested, the United States is about one-third forested, and Missouri is one-third forested. Sources: World map; Food and Agriculture 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).

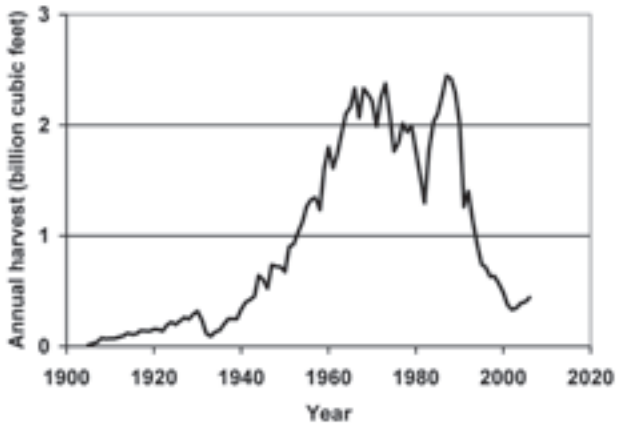

Figure 2. National Forest timber harvest 1905 to 2006. Conversion to cubic feet based on 5.2 board feet per cubic foot. Harvest peaked in 1987 at 2.4 billion cubic feet (12.7 billion board feet). In 2006, harvest was 0.4 billion cubic feet (2.3 billion board feet). Data from USDA Forest Service (2007b).

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.

ACKNOWLEDGEMENTS

These analyses rely on data collected and published through the U.S. Forest Service's Forest Inventory and Analysis program. Over the past decade, advances in internet delivery of FIA information have provided easy access to FIA data and new tools for summary and analysis. Callie Jo Schweitzer and an anonymous reviewer provided helpful comments on an earlier version of this manuscript.

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