

Article

# Evolution of Sustainability in American Forest Resource Management Planning in the Context of the American Forest Management Textbook

Thomas J. Straka

Clemson University, Department of Forestry and Natural Resources, Box 340317, SC 29634-0317, USA; E-Mail: tstraka@clemson.edu; Tel.: +1-864-656-4827; Fax: +1-864-656-3304

Received: 14 September 2009 / Accepted: 14 October 2009 / Published: 22 October 2009

---

**Abstract:** American forest resource management and planning goes back to the European roots of American Forestry. Timber management plans, documents based on forest regulation for timber production, were the foundation of American forestry. These types of management plans predominated until World War II. Multiple use forestry developed after World War II and issues like recreation, wildlife, water quality, and wilderness became more important. In the 1970's harvest scheduling became part of the planning process, allowing for optimization of multiple goals. By 2001 social, environmental, and economic goals were integrated into the timber production process. American forestry experienced distinct historical periods of resource planning, ranging from classic sustained yield timber production, to multiple use-sustained yield, to sustainable human-forest systems. This article traces the historical changes in forest management planning philosophy using the forest management textbooks of the time. These textbooks provide insight into the thought process of the forestry profession as changes in the concept of sustainability occurred.

**Keywords:** land use; forest sustainability; sustained yield; sustainable forest management

---

## 1. Introduction

Sustainability has always been part of American forest management, but the definition of sustainability and what was being sustained have changed dramatically over the past hundred years. Forest management developed from a system that produced a sustained annual timber yield to one that meets today's broader definition of sustainability that considers the multiple uses of the forest and the total environment, including ecological, social and economic factors. The forest management planning

process and the American forest management textbook can be used to illuminate the gradual transition to the broader modern definition of sustainability.

Management plans, called working plans in the early forestry literature, are as old as the European roots of American forestry. In European forestry, management plans were prescribed, stringent documents that were the center of forest management activities. The earliest American management plans focused on forest organization, regulation, and sustained annual yield [1]. The term forest regulation refers to methods to control the flow of timber from the forest. It is tied to sustained annual yield in that the regulated flow is usually on a perpetual basis and factors like area, timber volume, basal area, and growing stock are manipulated to produce the desired long-term sustained timber flow. What is now called a forest resource management plan would more aptly be called a timber management plan for at least the first half of American forestry history. Even today there are many forest management plans that have timber production as the sole objective.

In the early twentieth century Theodore Roosevelt and Gifford Pinchot (first Chief of the USDA Forest Service and founder of the Society of American Foresters) defined the purpose of American forestry using the utilitarian conservation philosophy [2] as “the greatest good for the greatest number for the longest time”. The multiple use policy that has been a framework for American forest management planning evolved from this language [3], but the original multiple use policy implicitly assumed timber primacy and sustained yield as co-foundations of the concept [4]. This “wise use” approach prevailed over preservation approaches proposed by other environmental leaders like John Muir, and Pinchot’s Conservation Movement laid the foundations of later multiple use approaches. The Inland Waterways Commission, appointed by Theodore Roosevelt in 1907, was charged, for example, with multipurpose river basin development [5].

Forest management textbooks are tangible evidence of then-current standards and philosophy in forestry. The transition of forest management plans from timber management plans to modern multiple use forest resource management plans can be traced from these textbooks. Forestry textbooks define the rationale, required components, and purposes of management plans. The temporal changes in these parameters illustrate changes in what foresters consider the foundations of the profession. This article utilizes these textbooks and related publications to trace American thought on forestry planning from the late eighteenth century to today.

One clue to what the professional norm on forest planning was at any time is the titles and content of the standard forestry textbooks. About one hundred years ago, the first textbooks had forest regulation in their titles; later the term changed to forest management as foresters were expected to consider broader aspects than pure sustained yield. But for at least the first fifty years of American forestry, forest regulation was the crux of forest management. What was the political and professional environment of this period and how is it reflected in the forest management textbooks?

## **2. Early Timber Management Planning**

Any discussion of forest resource management planning usually starts about the turn of the twentieth century. Most Americans then were familiar with the term forest devastation, as lumbering interests clearcut timber moving around the country from region to region. Timber famine or depletion was another concern; insufficient timber resources would cause timber demand to outstrip existing supplies,

resulting in unacceptable lumber and wood product prices. American forestry developed in this climate and adopted a European model of sustained yield. This was not sustainability in the modern sense, but regulated timber flow that led to timber self-sufficiency [6].

### *2.1. Federal Timber Management Planning*

The Secretary of the Interior in 1877 recommended two major federal forestry policies [7]: first, prevent the theft of timber from public lands and, second, preserving the public forests by “regulating the cutting and sale of timber on its lands as to secure the renewal of the forest by natural growth”. The first textbooks often had forest regulation, in their titles and by this they meant strictly controlling the flow of timber to maximize long-term timber production.

Gifford Pinchot [8], in setting the agenda for federal forestry, saw four purposes of forest management planning: First, protection from fire, overgrazing, and thieves. Second, strong and abundant reproduction. Third, “a regular supply of trees ripe for the ax”. Fourth, “growing space enough for every tree”. He did recognize that some forests, called protection forests, were needed to protect watersheds; otherwise, timber seemed to be the sole focus of any forestry planning.

At the same time Pinchot defined the concept of multiple use that would permeate federal forestry planning [9]; he saw “the forest and its relation to streams and inland navigation, to water power and flood control; to the soil and its erosion; to coal and oil and other minerals; to fish and game; and many other another possible use or waste of natural resources—these questions would not let him be”. Pinchot’s new policy, and a foundation of the new Forest Service, was “the use of natural resources for the greatest good of the greatest number for the longest time”.

Pinchot saw conservation as standing first for development, second for prevention of waste, and third for development and preservation that would benefit the many, not the few. He wrote the national forest management guidelines in his 1907 Use Book [10] and they stressed wise use, protection of biological productivity, and the welfare of local communities and workers. It was recognized forest uses would “sometimes conflict a little” and might have to be “made to fit with one another so that the machine would run smoothly as a whole” [5]. Federal forest management planning was dominated by timber production and other multiple-use benefits existed as fringe benefits [11]. This management philosophy prevailed on federal forestry lands for the next 55 years [5].

Federal forest policy from the beginning related primarily to public lands (national forests), but the policy also impacted private forest lands. Forest resources provided from public lands affect the demand for those from private lands and the public perception of forestry in general is greatly influenced by highly-visible federal forestry programs [12]. Private forest lands were often viewed as a problem and government planning was seen by many as the only way to protect future generations from forest devastation caused by the profit motive of lumbering interests [13]. Conservationists would champion “wise use” to ensure current and future generations would equitably benefit from the nation’s natural resources, but this concept had deficiencies both in terms of economic rationality and ethical design [14].

Marquis [15] noted several assumptions that were the foundation of early forest management planning. Silvicultural optimization would produce the highest values to society. European timber volume maximization techniques led to silvicultural practices that might prove economically unsound

and a mentality that all idle land must be planted to trees (lest waste occur). Sustained yield was seen as the cure of forest destruction, but the concept was clearly not the same concept that we call sustainability today [16]. Private forestry was generally seen as unprofitable, but public forestry produced sufficient social benefits to pay for its own costs [17].

The Capper Report [18] in 1920 revealed the forestry issues of the day in its title (mainly timber depletion and concentration of timber ownership). Federal regulation of forestry or public ownership of forests was seen as a possibility to attack timber depletion. Public ownership of forests was seen as necessary for multiple use forestry, as only public forests serve “other vital public interests, particularly recreation, the protection of water sources, and the conservation of wild life”. The Copeland Report [19] in 1933 provided early use of the concept of multiple use, or “multiple purpose management”. It was clear by 1920 that the federal government would not have a regulatory role in private forestry [20].

The earliest American forest management plans were prepared for private forest landowners by the Division of Forestry, or later the Bureau of Forestry, both under the United States Department of Agriculture, between 1898 and 1905 with the intent to interest landowners and the public in forest management [21]. These plans are the foundation for modern management plans. They were excellent in terms of technical content, format, and organization (today’s plans follow their model of a strong silvicultural foundation, detailed stand descriptions and management recommendations based on landowner objectives). However, they were rarely implemented (as they contained expensive recommendations for an unproven financial enterprise) and they served primarily a publicity purpose.

With the transfer of the Forest Service in 1905 to the Department of Agriculture came active management of the national forests. Management plan preparation shifted from private lands to national forest lands. Forest management planning is still a priority within the USDA Forest Service today.

## *2.2. Forestry Textbooks and Timber Management Planning*

Before forest management textbooks appeared, several forest regulation textbooks were produced. These were strictly concerned with managing forests to optimize the harvest of trees. An early textbook on forest planning recognized that “the working plan is not confined to such forests as are managed with the idea of sustained yield, but is equally adapted to the exploitation forest; i.e., forests which are to be logged within the next ten or twenty years” [22]. Three outlines of a management plan were discussed: Saxon, Prussian, and American. The difference between the Saxon and Prussian plans was the objectives; the Saxon model maximized timber production (forest rent) and the Prussian model maximized timber revenue (soil rent). Producing the most wood will not necessarily produce the maximum revenue. The American management plan was based on these European models. Another early textbook by Roth [23] centered on European-style forest regulation as a tool in working plan preparation and a second textbook by Woolsey [24] described how European regulation methods might best be applied to the American situation.

In 1919 the first American forest management textbook appeared, authored by Recknagel and Bentley [25]. It still had a foundation of forest regulation, but also covered forest mensuration, growth and yield, and forest valuation. However, even the second edition seven years later [26] made clear that

optimum timber production was the focus of the textbook and consequently the primary focus of forest planning.

Another early classic American forest management textbook by Chapman [27] stressed that these plans were timber management plans. “The general purpose of the management plan is to bring together in one document the guiding principles and measures for development and control of the business of timber production and yield for a given working circle. The ultimate objective of a management plan... is the regulation of yield”. This textbook gave a brief outline that followed most of the other early textbooks in terms of format. Table 1 presents a summary of Chapman’s general outline of a management plan. Another forest management textbook by Matthews [28] gave little attention to management plans. Emphasis was on forest regulation, forest business, and management planning for timber production. Management plans were seen as a need that would develop over time, especially on private lands. Early textbooks recognized that much of the broader multiple forest resources planning was taking place on the National Forests and USDA Forest Service publications were often cited as sources of textbook material on methods and principles of forest planning [29]. These USDA Forest Service publications were strictly timber-oriented.

**Table 1.** General outline of an early American forest management plan.

#### I. Foundation

1. Introduction
2. Land Description (location, boundary, topography, climate, soil).
3. Economic situation (markets, transportation, labor).
4. Forest description (silvics, stands, protection).
5. Tables (growth and yield, stock tables, stand tables).

#### II. Management Plan.

6. Management policy (objectives, markets, watershed protection, recreation use).
7. Silviculture
8. Regulation (rotation, cutting cycle, allowable cut, area and volume control).
9. Timber sales policy
10. Administration.
11. Fact-finding studies (silvicultural and growth studies).

#### III. Appendix

After fifty years of American forestry, little had changed in terms of management plans. Chapman, writing in 1950, noted that forest management was seen as “a continuing enterprise for producing wood crops”. Its aims were to ensure continuity of production of the forest crop and benefits in excess of cost of production. Forest management planning or “conversion to a continuous-production basis” consisted of five stages: (1) forest inventory or “the gathering of sufficient facts on the volume of timber,” (2) adoption of forest protection and silvicultural measures necessary for the perpetuation and renewal of the forest, (3) organization and development for future sustained yield (forest regulation), (4) forest organization (subdivision into compartments), and (5) organization of working groups within each management unit, with an objective of subsidiary sustained yields [30].

Forest management plans had broadened over the first fifty years of American forestry as multiple resources tended to be at least minimally addressed by 1950. The plans included more technical content (inventory, mensuration, and growth and yield); many recognized the business aspects of forest management; and a stronger silvicultural basis was common to the plans. Still, they tended to be timber management plans. If other issues or resources were addressed, usually it was in separate plan. As complexity increased, there might be separate timber, transportation, harvesting, wildlife, recreation, and protection plans; all for the same tract of land.

### **3. Multiple-Use Forest Resource Management Plans**

Post-World War II America developed a new attitude towards its natural resources. The country was more affluent, with an interstate highway system, and a population that now had much more leisure time. Recreation became important to many Americans. Economic growth and increased housing opportunities created lumber demand that impacted the nation's forests. Some forest management activities, especially clearcutting, were starting to draw public attention. Protection of wilderness areas became a major public issue. Timber production was no longer the most important objective on every forest, or at least many people started to feel that way.

#### *3.1. Federal Policy and Multiple-Use Management*

By the 1950s federal forest policy was centered on "intensive timber extraction" and devices to increase the allowable cut. Forest industry considered anything less than maximum allowable cut to be a failure to achieve sustained yield. The major timber situation report of the decade [31] made it clear that timber resources were the major concern in federal forest policy and multiple-use barely got a mention: "Much land in the national forests is primarily suitable for public ownership because of the multiple values involved, including the predominance of water and the growing importance of recreation". The USDA Forest Service was moving to address recreation, wildlife, and wilderness issues that developed over the 1950s [32], but belief in the "comfortable assumption that interest groups will balance each other in their struggles and produce policies of moderation" was eroding [3]. The USDA Forest Service had promised all users they could get what they wanted from the same acre of land and this was not possible [33].

By this time the forestry profession recognized the "group A" and "group B" foresters that Aldo Leopold described in Sand County Almanac [34]. Type A foresters grew trees in rows like cabbages and type B foresters managed a natural environment. Leopold envisioned foresters moving towards group B over time.

The Multiple-Use Sustained-Yield Act of 1960 marks the point where management of the National Forests was required to consider "all the various renewable surface resources of the combination that will meet the needs of the American people". Sustained yield now had to consider multiple outputs, not just timber, but also resources like recreation, fish and wildlife, forage, water quality, and wilderness. While the Act applied only to the National Forests, it helped lead to a general acceptance of multiple use forestry by other organizations.

Multiple use was still tied to sustained yield of the "various natural resources" and a clause in the act stated that it was "supplemental to and not in derogation" of the Organic Act of 1897 which clearly held

that timber and water were the primary uses [32]. The 1960 act was a turning point as it established multiple use as a statutory and professional foundation of forest management, but the public quickly realized it was not an effective piece of legislation [20].

The environmental movement developed over the 1960's and the clearcutting controversy stands out as a major issue of the decade. Major environmental legislation to come out of this turmoil was the National Environmental Policy Act of 1969, Endangered Species Act of 1973, National Forest Management Act of 1976, The Clean Air Acts of 1970 and 1977, The Federal Water Pollution Act of 1972, and the Clean Water Act of 1977, the Wilderness Act of 1964, the Wild and Scenic Rivers Act of 1968, and the National Trails System Act of 1968. Concern over water pollution from nonpoint sources led to adoption of "best management practices" by states, resulting in state forest practices laws. Gradually forest management plans were developing into multiple resource plans by necessity.

Still in 1966 the major forest management textbook [21] had a chapter entitled, "Timber Management Planning and Plans". The author notes that, "This book treats primarily timber production, but clear recognition is maintained that the central core of the forester's concern is management for all resources". The shift in focus from timber to broader resources was beginning, but really did not show up in the chapters of the textbook, but usually as a comment in the preface.

The clearcutting controversy climaxed with forest management practices on the Monongahela and Bitterroot National Forests in the mid-1960s. Public outcry resulted in Congress initiating reports on the forestry "problem". The most influential of these was the "Bolle Report" that discussed the Bitterroot National Forest [35]. It was extremely critical of forest management practices and claimed that neither multiple use nor sustained yield forestry existed on the forest [4]. Following the Bolle Report other issues, like below-cost timber sales, gained public interest [11,36]. In 1976 the National Forest Management Act (NFMA) became law and together with the earlier Multiple-Use Sustained-Yield Act formed the basis of a shift from single objective timber management with economic and environmental constraints to optimization of multiple objective functions with no forest value dominating. The NFMA dealt with sustained yield (non-declining even flow) and repealed the Organic Act [32]. This was a fundamental shift towards true multiple use forestry [20] with simultaneous optimization of both market-based products and non-market commodities to maximize "net public benefits".

Following the enactment of the NFMA the USDA Forest Service had to develop new regulations and regional guidelines. The law opened up avenues of legal challenge and litigation almost became part of the planning process [37] and the need for "a management process, not a legal process," that is, national forest planning had become a law and reversed the proper relationships in planning [38]; the plan should be a guide and the managers not become subservient to it. Even apparently simple issues like identifying the constituency affected by the management plan had to be resolved [39]. Behan [40] even illustrated how the inflexible linear programming used in planning could be replaced with ordinal judgment. Considerable political polarization developed [41] over the political process that held environmental protection to be a national interest and ignored "the viability of local economies, cultures, and social systems".

Behan [42] described the fundamental shift as a change in the paradigm of professional forestry. The problems identified in the Bolle Report had a basis in professional foresters "simply pursuing their traditional, orthodox paradigm of maximizing the sustained yield of commercial timber—a single

resource—attempting to avert a ‘timber famine’ in the future”. He saw a better paradigm using a systems approach where foresters’ actions were analyzed in terms of impacts not just on timber, but also wildlife, recreation, watershed, and grazing [42]. “The paradigm of professional forestry today is in fact undergoing a radical change, and the expectations of foresters’ social responsibilities are also altering substantially. ... The forestry profession is working out the details and techniques of ‘multi-resource forest management,’ in which the forest is seen as more than a tree plantation...”.

### 3.2. Forestry Textbooks and Multiple-Use Management

What were the textbooks saying in 1960? One major forest management textbook that came out that year [43] said, “While this book will not cover such related fields as wildlife, watershed, recreation, and grazing management, uses of the forest other than for timber production cannot be overlooked in considering the tasks for forest management. On many of our National Forests these play a more important role than does timber production. ... Looking into the future, it is quite likely that the great increase in our population and the development of more intensive forest practices, including mechanization, will result in multiple use of our forests to a greater degree”. Another management planning book acknowledged that owners might expect the following results from a management plan: timber production, grazing use, fish and game use, recreational use, and aesthetics. However, only timber production was discussed after this acknowledgement [44].

Even by the early 1980s timber management was still the theme of most forest management textbooks. Most made an effort to acknowledge other resources, but when the textbook shifted to problem solving, timber seemed to dominate the discussion. However, textbooks can also be ahead of their times. In the late 1960s the Society of American Foresters and the various forestry schools cosponsored the Forestry Curriculum Development Project that was about integrated forest management and the “whole forest”. It resulted in a new forest management textbook [45] that “spanned the array of renewable resources, addressed economic, political, social, personnel, and decision-making themes; and even spoke explicitly about the forest as a single system in a hierarchy of systems” [46]. The book on integrated forest management required integrated teaching and this “threatened the heritage and sanctity of the individual professor’s autonomous course” and the book was attacked for being insufficiently rigorous [46]. The established textbook using the sustained yield paradigm was safe from the integrated approach, at least for the time-being.

Soon after the integrated management textbook, a textbook tying classic timber management to modern linear programming and other quantitative approaches appeared [47]. It used the same concepts Pinchot used [46]: fully regulated forest, “maximum sustainable harvest,” and “sustainable equilibrium harvest”. The textbook made no apology for being single resource oriented. Other forest management textbooks only touched on resources other than timber [48].

In 1987 the first forest management textbook to clearly consider non-timber resources as part of the decision-making process was produced [49]. The preface to the textbook states that a change has occurred and multiple-use forestry was now an integral part of a forest management textbook:

“Our revision of Kenneth Davis’s “Forest Management: Regulation and Valuation,” second edition reflects three fundamental shifts in the tenets of forest management: (1) the new

dominance of economic and social goals as the determinants of forest management choices, (2) the necessity of private and, especially, public managers to consider all timber management decisions in the context of a larger, socially defined, multiple use management problem, and (3) the need to justify, based on quantitative analysis, that management recommendations, decisions, and plans satisfy owner constraints and are the best of the alternative choices. Technologically, it was our good fortune that the computer came along just in time to help us with the enormous amount of quantitative analysis needed to satisfy these shifts. But computers are also now an everyday part of our professional lives”.

Behan [46] called this a “marginal improvement” in forest management textbooks that did recognize “a forest is more than trees”. When he analyzed the textbook he found the “normal science” of classical forest regulation and not a “paradigmatic breakthrough”.

#### **4. A Fundamental Shift**

Behan [46] described the shift to a systems approach to forest management planning that was multiresource-based and about the same time the mathematical models available to planners advanced to meet the need. During the 1970s mathematical programming, in particular linear programming, began to enter the realm of forest management courses. All of the forest management textbooks of the 1980s were essentially applied linear programming textbooks. Some are developed from course notes of the late 1960s and 1970s where linear programming was introduced outside of the regular forest management textbooks [50], and some centered on broader natural resources issues [51]. Linear programming was a mathematical technique to maximize or minimize a linear objective function (usually to maximize timber output or profit or minimize costs of production). The advantage was that timber production goals could be maximized while conforming to non-timber constraints or non-timber goals could be maximized while timber production goals were being met.

Forest resource management planning was no longer limited to single goals. Quantitative methods existed to consider specific landowners’ objectives subject to specific constraints [52]. This meant the complexity of forest resource management planning could increase. Now timber production could be analyzed in the context of other resources, either as the primary objective, or as a secondary objective. Without the quantitative tools that became widely available after World War II and the modern computer, forest management planning would have had a much more difficult transition to multiple-use forestry.

The 1990s were marked by the USDA Forest Service’s commitment to develop an ecosystem approach to managing multiple uses on national forest lands [5]. Dale Robertson, then Chief of the Forest Service, described it as meaning [53] “that we must blend the needs of people and environmental values in such a way that national forests and grasslands represent diverse, healthy, productive, and sustainable ecosystems”.

By the turn of the century the standard forest management textbook [54] had social, environmental, and economic goals integrated into the timber production process and it recognized four viewpoints: (1) the classic sustained yield of commercial timber, (2) multiple use–sustained yield, (3) naturally functioning forest ecosystems, and (4) sustainable human–forest ecosystems. Adaptive management and

sustainability were major themes of the textbook. These illustrate the temporal transformation of forest management planning, from the classical sustained yield to the modern social, ecological, and economic parameters that define modern forest management. Something was always being sustained in forest management, over time that thing moved closer and closer to what we call forest sustainability today.

At the same time forest resource management planning was being impacted by major changes in federal funding for nonindustrial private forest management planning. The 1990 Farm Bill created the Forest Stewardship Program. Funding was through the USDA Forest Service to state forestry agencies. The goal was to encourage active multiple use forest management by nonindustrial private forest owners. The key mechanism was to be forest stewardship management plans that centered on explicit management objectives (at least a primary and secondary management objective). This program greatly impacted the teaching of forest resource management planning. The popularity of the Forest Stewardship Program made it a benchmark and its principles became incorporated into many management planning courses. Forest owners showed a strong preference to a multiple resource objectives-oriented planning process [55] and a favorable attitude towards the overall program [56]. An outline of a typical forest stewardship forest management plan is shown in Table 2 [57]. The Forest Land Enhancement Program replaced Forest Stewardship in the 2002 Farm Bill, but the objectives of the two programs are the same.

Since it was established in 1991, the Forest Stewardship Program has produced more than 260,000 multiple-resource management plans encompassing about 30 million acres of nonindustrial private forest land. These plans lay out the strategy for achieving multiple-resource forest management objectives and motivate landowners to be more active in planning and managing their forests [58]. Table 3 presents the components of a Forest Stewardship Plan [59]. These plans are one of the best examples of current operational forest resource management planning that stresses multiple-resources.

Forest Stewardship required different ways to view the planning process. Timber was always the main component of planning, as it so directly affected the other resources. More productive forests could supply both more timber and at the same time spare forestland for uses other than timber, like sequestering carbon, ecosystem services, or wildlife habitat [60,61]. Different ways to approach the public participation in the planning process were proposed, like collaborative learning [62]. Sustained yield is still a concept in American forestry, but today sustainability means more than that [63].

Sustainable forestry now relies on management strategies and technologies that interact with social and economic institutions to ensure the long-term viability of the forest [64]. Forest management textbooks were not quick to catch up with the full framework of the current broader definition of sustainability. The two current textbooks both stress optimization of output (though not necessarily timber production), linear programming, harvest scheduling, and forest planning that tends to be timber-based. However, both of these textbooks explicitly recognize the place of forest sustainability in the forest planning process and discuss its role in forest resource management [54,65].

**Table 2.** Generalized forest stewardship management plan.

- I. Management objective (Examples below, both primary and secondary required).
  1. Timber production
  2. Wildlife habitat
  3. Protection of soil and water
  4. Recreational opportunities
  5. Aesthetic values
  6. Range (grazing)
  7. Non-timber forest products
  8. Forest health
- II. Stand description and recommendation
  1. Location
  2. Tract history
  3. Past land use practices
  4. Wildlife habitat condition
  5. Stand-by stand description
    - a. General timber conditions
    - b. Wildlife habitat
    - c. Soil and water quality
    - d. Topography
  6. Recommendations
    - a. Management practices needed
    - b. General timber harvest recommendations
    - c. Wildlife habitat improvements necessary
    - d. Soil and water quality protection
    - e. Reforestation plans
- III. Management of related resources
  1. Relationship of pastures and hay fields to wildlife habitat
  2. Maintenance recommendations
- IV. Food Plots
- V. Threatened and endangered species
- VI. Soil and water resource recommendations
  1. Forest land erosion control system
  2. Maintenance recommendations
- VII. General recommendations
  1. Best management practices for wetlands
  2. Forest practices guidelines
  3. Smoke management guidelines (used in prescribed burning)
- VIII. Suggested management schedule
  1. Schedule of management activities
  2. Schedule of costs and revenues
  3. Schedule of timber and nontimber outputs
- IX. Maps and aerial photographs
- X. Organization providing local natural resources management assistance
- XI. Glossary

**Table 3.** Components of a Forest Stewardship plan.

1. Identify the Plan.
  - Identify the landowner and plan preparer.
  - Identify the property (location, acreage, tract data like known threatened or endangered species or soils information.
  - Include maps (location, boundaries, roads, covers type, etc.).
2. Present Management Objectives.
  - Landowner should prioritize property values: (i) aesthetics, (ii) recreation, (iii) timber production, (iv) fish and wildlife, (v) range, (vi) water, and (vii) soil.
  - Translate priorities into measurable management objectives.
  - Incorporate landowner's timeframe and financial expectations into objectives.
3. Describe Baseline Habitat Conditions.
  - Divide property into units, stands, tracts, or compartments as necessary for making management recommendations. Factors like cover type, size class, age stocking, origin, stand conditions, and site capacity create diverse conditions and require different management strategies.
  - Maps are necessary to describe the tract.
  - A cover type/stand description is necessary and all stewardship values should be described: (i) timber, (ii) wildlife habitat, (iii) fish, (iv) threatened and endangered species, (v) soils, (vi) water quality, (vii) recreation (viii) aesthetics, (ix) wetlands, (x) heritage resources, (xi) range, and (xii) forest health.
4. Present Management Recommendations
  - Describe strategy for achieving landowner objectives.
  - Recommendations should be at the stand or management unit level.
  - Include alternative management strategies.
  - Include an activity schedule/time line that outlines strategy implementation.
  - Communicate the plan to the landowner.
5. Include Supplemental Material.

Tradition slowly changes; economic optimization, forest valuation fundamentals, and regulation of some sort of product flow are in all the forest management textbooks discussed. The most recent of these textbooks includes chapters on forest and natural resource sustainability, forest certification, and carbon sequestration [65]. These forest management textbooks provide a clear overview of how forest sustainability is perceived, defined, and implemented by the forestry profession.

Current forest management textbooks have kept up with forest technology changes over time. Linear programming was the most important, but geographical and spatial models, advanced silvicultural techniques, planning models, simulation, and adaptive management are now expected to be in forest management textbooks. Ecological considerations now offer a framework for forest management; social and economic factors are part of that framework.

Today, forest resource management planning still often has a quantitative basis; especially for very large acreages that require linear programming for optimization. Timber production is still be important, but the value being optimized (maximized or minimized) could easily not be timber. Other values, like

wildlife and recreation, are just as common. Public pressure is requiring more and more private land to be managed with societal values providing guidance. Forest certification programs like the Sustainable Forestry Initiative (SFI) and the Forest Stewardship Council (FSC) now require this kind of management. Public land management is now integrated resource management [66], and this is the direction that most forest management planning is headed. The current forest management textbooks clearly reflect this.

The temporal trend in the use of sustainability concepts in American forest management textbooks is shown in Table 4. The transition that began in the 1960's gradually led to stronger and stronger recognition of what are now current forest sustainability concepts.

**Table 4.** Sustainability concepts summary in American forest management textbooks.

Author	Sustainability Concepts*						
	SY	CP	SY/MU	IM	EC	S/E/E	FS
Roth, 1914 [23]	X	X					
Recknagel <i>et al.</i> , 1919 [25]	X	X					
Woolsey, 1922 [24]	X	X					
Recknagel <i>et al.</i> , 1926 [26]	X	X					
Chapman, 1931 [27]	X	X					
Matthews, 1935 [28]	X	X					
Meyer <i>et al.</i> , 1961 [43]	X	X					
Davis, 1966 [21]	X	X	X				
Duerr <i>et al.</i> , 1979 [45]	X		X	X			
Clutter <i>et al.</i> , 1983 [47]	X	X					
Leuschner, 1984 [48]	X	X	X				
Davis <i>et al.</i> , 1987 [49]	X		X	X			
Davis <i>et al.</i> , 2001 [54]	X		X	X	X	X	
Bettinger <i>et al.</i> , [65]	X			X	X	X	X

\*Sustainability Concepts Abbreviations: SY = sustained yield (timber management emphasis); CP = strictly commodity production-oriented; SY/MU = sustained yield -multiple use (timber not necessarily dominant); IM = integrated forest resource management (multi-resource management); EC = ecological consideration; S/E/E = social/economic/ecological perspective; FS = forest sustainability, including resources, functions, society, and institutions.

## 5. Conclusions

American forest management textbooks clearly follow the transition in forest resource planning from a timber management emphasis to a multiple use/sustainability emphasis. The basic framework of what constitutes a forest management plan has remained unchanged, while the fundamental philosophy on the goals and objectives of why a plan is prepared has changed. Timber is still the dominate issue in forest planning; after all, it is what is manipulated to achieve most management objectives. For example, wildlife management fundamentally requires management of vegetation, so timber management often becomes the method of management. This is also why forest resource planning sometimes becomes

suspect. Some observers see management for wildlife, fire, or forest health sometimes used as a rationale to cut more timber.

For large industrial concerns and some small private landowners, timber management plans might still be the primary focus of forest planning. However, over time, more and more pure timber management plans are seen as unacceptable. Stewardship planning and sustainability are now hallmarks of good forest planning. Forest management textbooks plainly recognize this. At the least, the old multiple use concept is utilized by most forest landowners. The transition is still taking place, but there is little doubt that forest resource management plans now follow the pattern of Tables 2 and 3. As forest owners' social values continue to shift, so will the objectives of planning shift. Forestry textbooks have begun to recognize this dynamic nature of modern forest planning.

## References

1. Schlich, W. *A Manual of Forestry, Volume. III, Forest Management*; Bradbury, Agnew, & Co.: London, UK, 1895.
2. Dana, S.T.; Fairfax, S.K. *Forest and Range Policy: Its Development in the United States*, 2nd ed.; McGraw-Hill Book Company: New York, NY, USA, 1980.
3. McConnell, G. *Private Power and American Democracy*; Alfred A. Knopf: New York, NY, USA, 1966.
4. Behan, R.W. *Plundered Promise: Capitalism, Politics, and the Fate of the Federal Lands*; Island Press: Washington, DC, USA, 2001.
5. Fedkiw, J. *Managing Multiple Uses on National Forests, 1905–1995, a 90-Year Learning Experience and It Isn't Finished Yet*; USDA Forest Service Publication FS-628; United States Department of Agriculture: Washington, DC, USA, 1998.
6. Hays, S.P. *Conservation and the Gospel of Efficiency: The Progressive Conservation Movement, 1890–1929*; Atheneum: New York, NY, USA, 1969.
7. Schurz, C. *Annual Report of the Secretary of the Interior on the Operations of the Department for the Fiscal Year Ended June 30, 1877*; Government Printing Office: Washington, DC, USA, 1877.
8. Pinchot, G.A. *Primer on Forestry, Part II—Practical Forestry*; Government Printing Office: Washington, DC, USA, 1905.
9. Pinchot, G. *Breaking New Ground*; Harcourt, Brace and Company: New York, NY, USA, 1947.
10. Pinchot, G. *The Use of the National Forests*; Government Printing Office: Washington, DC, USA, 1907.
11. Dowdle, B. Below-cost timber sales: a macro view. *Western Wildlands* **1986**, *12*, 31-34.
12. Cubbage, F.W.; O'Laughlin, J.; Bullock, C.S., III. *Forest Resource Policy*; John Wiley & Sons: New York, NY, USA, 1993.
13. Dowdle, B. Public and private timber management: anatomy of a coexistence problem. *Western Wildlands* **1984**, *10*, 19-23.
14. Barnett, H.J.; Morse, C. *Scarcity and Growth: The Economics of Natural Resources Availability*; Johns Hopkins University Press: Baltimore, MD, USA, 1963.
15. Marquis, R.W. Bromides and folklore in forest economics. In Proceedings of Society of American Foresters National Meeting, Minneapolis, MN, USA, December 1947; pp. 76-81.

16. Weber, E.P. *Bringing Society Back In: Grassroots Ecosystem Management, Accountability, and Sustainable Communities*; The MIT Press: Cambridge, MA, USA, 2003.
17. Hays, S.P. *Beauty, Health, and Permanence: Environmental Politics in the United States, 1955–1985*; Cambridge University Press: Cambridge, UK, 1987.
18. USDA Forest Service. *Timber Depletion, Lumber Prices, Lumber Exports, and Concentration of Timber Ownership, Report on Senate Resolution 311, June 1, 1920*, 3rd ed. (Capper Report); Government Printing Office: Washington, DC, USA, 1928.
19. USDA Forest Service. *A National Plan for American Forestry, U.S. Senate Document No. 12, 73rd Congress, 1st Session, with Transmitted Letter from the Secretary of Agriculture (Copeland Report)*; Government Printing Office: Washington, DC, USA, 1933.
20. Sample, V.A.; Cheng, A.S. *Forest Conservation Policy: A Reference Book*; ABC-CLIO: Santa Barbara, CA, USA, 2004.
21. Davis, K.P. *Forest Management: Regulation and Valuation*, 2nd ed.; McGraw-Hill Book Company: New York, NY, USA, 1966.
22. Recknagel, A.B. *The Theory and Practice of Working Plans (Forest Operations)*; John Wiley & Sons: New York, NY, USA, 1913.
23. Roth, F. *Forest Regulation, or, the Preparation and Development of Forest Working Plans*; By Author: Ann Arbor, MI, USA, 1914.
24. Woolsey, T.S. *American Forest Regulation*; The Tuttle, Morehouse and Taylor Co.: New Haven, CT, USA, 1922.
25. Recknagel, A.B.; Bentley, J., Jr. *Forest Management*; John Wiley & Sons: New York, NY, USA, 1919.
26. Recknagel, A.B.; Bentley, J., Jr.; Guise, C.H. *Forest Management*, 2nd ed.; John Wiley & Sons: New York, NY, USA, 1926.
27. Chapman, H.H. *Forest Management*; J. B. Lyon Company: Albany, NY, USA, 1931.
28. Matthews, D.M. *Management of American Forests*; McGraw-Hill Book Company: New York, NY, USA, 1935.
29. Eldredge, I.F. *Management Plans with Special Reference to the National Forests*; USDA Forest Service Miscellaneous Publication Number 11; Government Printing Office: Washington, DC, USA, 1928.
30. Chapman, H.H. Forest Management. In *Fifty Years of Forestry in the United States*; Winters, R.K., Ed.; Society of American Foresters: Washington, DC, USA, 1950; pp. 78-91.
31. USDA Forest Service. *Timber Resources for America's Future*; Forest Service Report No. 14; Government Printing Office: Washington, DC, USA, 1958.
32. Hirt, P.W. *Conspiracy of Optimism: Management of the National Forests Since World War Two*; University of Nebraska Press: Lincoln, NE, USA, 1994.
33. Kemis, D. *This Sovereign Land: A New Visor for Governing the West*; Island Press: Washington, DC, USA, 2001.
34. Leopold, A. *A Sand County Almanac with Essays on Conservation from Round River*; Oxford University Press: New York, NY, USA, 1949.

35. Select Committee of the University of Montana. *A University View of the Forest Service, Senate Document No. 115, 91st Congress, 2nd Session (The Bolle Report)*; Congressional Record: Washington, DC, USA, 1970.
36. Behan, R.W. The economics and politics of public land management: a case of institutional lunacy (and a few modest prescriptions). *Western Wildlands* **1985**, *11*, 28-31.
37. McGuire, J.R. National forest planning: will it ever end? *Am. For.* **1994**, *91*, 10, 44-45.
38. Behan, R.W. National forest planning: will it ever end? *Am. For.* **1994**, *91*, 11, 50-53.
39. Behan, R.W. A plea for constituency-based management. *Am. For.* **1988**, *94*, 46-48.
40. Behan, R.W. Multiresource management and planning with EZ-IMPACT. *J. For.* **1994**, *92*, 32-36.
41. Carroll, M.S. *Community and the Northwestern Logger: Communities and Changes in the Era of the Spotted Owl*; Westview Press: Boulder, CO, USA, 1995.
42. Behan, R.W. The RPA/NFMA: Solution to a nonexistent problem. *J. For.* **1990**, *88*, 20-25.
43. Meyer, H.A.; Recknagel, A.B.; Stevenson, D.D.; Bartoo, R.A. *Forest Management*, 2nd ed.; Ronald Press Company: New York, NY, USA, 1961.
44. Patterson, A.E. *Techniques of Forest Management Plan Preparation*; By Author: Athens, GA, USA, 1960.
45. Duerr, W.A.; Teeguarden, D.E.; Christiansen, N.B.; Guttenberg, S. *Forest Resource Management: Decision-Making Principles and Cases*; W. B. Saunders Company: Philadelphia, PA, USA, 1979.
46. Behan, R.W. Multiresource forest management: a paradigmatic challenge to professional forestry. *J. For.* **1990**, *88*, 12-18.
47. Clutter, J.L.; Fortson, F.C.; Pienaar, L.V.; Brister, G.H.; Bailey, R.L. *Timber Management: A Quantitative Approach*; John Wiley & Sons: New York, NY, USA, 1983.
48. Leuschner, W.A. *Introduction to Forest Resource Management*; John Wiley & Sons: New York, NY, USA, 1984.
49. Davis, L.S.; Johnson, K.N. *Forest Management*, 3rd ed.; McGraw-Hill Book Company: New York, NY, USA, 1987.
50. Buongiorno, J.; Gilles, J.K. *Forest Management and Economics: A Primer in Quantitative Methods*; Macmillan Publishing Company: New York, NY, USA, 1987.
51. Dykstra, D.P. *Mathematical Programming for Natural Resource Management*; McGraw-Hill Book Company: New York, NY, USA, 1984.
52. Bowes, M.D.; Knutilla, J.V. *Multiple-Use Management: The Economics of Public Forestlands*; Resources for the Future: Washington, DC, USA, 1989.
53. USDA Forest Service. *Ecosystem Management: A National Framework*; United States Department of Agriculture: Washington, DC, USA, 1994.
54. Davis, L.S.; Johnson, K.N.; Bettinger, P.S.; Howard, T.E. *Forest Management: To Sustain Ecological, Economic, and Social Values*, 4th ed.; McGraw-Hill Book Company: New York, NY, USA, 2001.
55. Thrift, T.G.; Straka, T.J.; Marsinko, A.P.; Baumann, J.L. Forest resource management plans: importance of plan components to nonindustrial private forest landowners in South Carolina. *South. J. Appl. For.* **1997**, *21*, 164-167.

56. Melfi, F.M.; Straka, T.J.; Marsinko, A.P.; Baumann, J.L. Landowner attitudes toward South Carolina's Forest Stewardship Program. *South. J. Appl. For.* **1997**, *21*, 158-163.
57. Straka, T.J. Forest resource management plans: a landowner-oriented approach. *J. Nat. Resour. Life Sci. Educ.* **1993**, *22*, 111-115.
58. USDA Forest Service. Forest Stewardship Program. Available online: <http://www.fs.fed.us/spf/coop/programs/loa/fsp.shtml> (accessed September 7, 2009).
59. Russell, D.R., Jr.; Stein, S. *Planning for Forest Stewardship: A Desk Guide, USDA Forest Service Forest Stewardship Program*; Publication FS-733; United States Department of Agriculture: Washington, DC, USA, 2002.
60. Wernick, I.K.; Waggoner, P.E.; Ausubel, J.H. Searching for leverage to conserve forests: the industrial ecology of wood products in the United States. *J. Ind. Ecol.* **1998**, *1*, 125-145.
61. Wernick, I.K.; Waggoner, P.E.; Ausubel, J.H. The forester's lever: industrial ecology and wood products. *J. For.* **2000**, *98*, 8-14.
62. Daniels, S.E.; Walker, G.B. *Working through Environmental Conflict: The Collaborative Learning Approach*; Praeger: Westport, CT, USA, 2001.
63. Sample, V.A.; Anderson, S. *Common Goals for Sustainable Forest Management: Divergence and Reconvergence of American and European Forestry*; Forest History Society and Pinchot Institute for Conservation: Durham, NC, USA, 2008.
64. Floyd, D.W. *Forest Sustainability: The History, the Challenge, the Promise*; The Forest History Society: Durham, NC, USA, 2002.
65. Bettinger, P.; Boston, K.; Siry, J.P.; Grebner, D.L. *Forest Management and Planning*; Academic Press: Burlington, MA, USA, 2009.
66. Loomis, J.B. *Integrated Public Lands Management: Principles and Applications to National Forests, Parks, Wildlife Refuges, and BLM Lands*; Columbia University Press: New York, NY, USA, 1993.

© 2009 by the authors; licensee Molecular Diversity Preservation International, Basel, Switzerland. This article is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/3.0/>).