WHAT'S IN A WOODLOT MANAGEMENT PLAN?

A COMPARATIVE ANALYSIS OF REQUIREMENTS FOR PRIVATE WOODLOT MANAGEMENT PLANNING IN NOVA SCOTIA

Honours Thesis Research Project
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Abstract

The purpose of this honours thesis was to synthesize a set of management plan criteria for private woodlot owners in Nova Scotia through a review of the relevant literature. This literature included sources such as forest certification schemes, general forestry guidebooks, legal documents, and various other studies and journal articles. The results were compiled and organised in a template which displayed each woodlot management plan requirement found from each source and any pertinent information about the individual requirements. Several of the requirements were found to be in the majority of sources reviewed, including most of the forest certification schemes. A list of the most recommended woodlot management plan requirements is given based on compliance with the main forest certification schemes used in Nova Scotia: the Forest Stewardship Council (FSC) Maritime Standard (Forest Stewardship Council Canada 2008a), the Canadian Standards Association's (CSA) Z804 (Canadian Standards Association 2008), and the Sustainable Forestry Initiative's (SFI) standard (Sustainable Forestry Initiative 2008).

1- Introduction

1.1 Background

A large portion of forested land in the province of Nova Scotia—69 percent—is privately owned (Pannozzo & Colman 2008), which is much higher than the national percentage of 6 percent (National Round Table on the Environment and the Economy, 1997). Of the 69 percent, most is comprised of small woodlots of approximately 45 hectares each (National Round Table on the Environment and the Economy, 1997). The practice of

sustainable forestry is important in all forests worldwide, ecologically, economically and socially. Since so much of Nova Scotia's forests is managed by private owners, it is important that information on the sustainable management of woodlots is accessible to private woodlot owners and operators.

Sustainable management of Nova Scotia's forests is the key to the continuing success of the forest industry as well as the forest ecosystem as a whole. To manage a woodlot sustainably, it is important for the woodlot owner or operator to have a plan as to how to do this. The purpose of a management plan is to help the woodlot owner plot out the activities needed on the woodlot based on available resources, financial situation and what the owner wants in the end result (Private Woodlot Strategic Initiative [n.d.]). There is currently no widely accepted guide for private woodlot owners that draws together the various standards and templates for woodlot management planning and therefore these owners have limited information available to create their own plans without help from planning service providers. For this reason, it can be hard for private woodlot owners to know which of the many sets of woodlot planning standards would be best suited for their specific woodlot, and what would be required in the creation of a woodlot management plan.

Considering the importance of the forest industry in Nova Scotia and the sustainable management of private woodlots accounting for over half its forest area, it would be useful to create a set of criteria for woodlot owners identifying woodlot management plan requirements for private woodlots in the Acadian Forest Region of Nova Scotia. The

goal of this research is to conduct a comparative analysis of literature, including forest certification schemes, sustainable woodlot management standards and templates, government requirements, nongovernmental organisation publications, and other sources to develop a set of criteria for private woodlot owners in Nova Scotia to aid in the development and implementation of woodlot management plans. This study is worth pursuing because there does not yet appear to exist a set standard or guide for Nova Scotian private woodlot owners on what is required in a woodlot management plan.

1.2 Research Question & Objectives

The research question that this thesis has aimed to answer is: what are the necessary and recommended requirements for management plans for private Nova Scotia woodlots? The objective of this thesis was to create a generic guide for Nova Scotia woodlot owners and operators for the production of woodlot management plans specific to the Acadian Forest Region.

2- Literature Review

2.1 Introduction

The objective of this literature review was to examine the body of work on woodlot management planning and to situate this study within it. The scope of this literature review focuses on four main areas: resource management planning, sustainable forestry, private woodlot management, and forest certification schemes. These four were selected because they had the most relevance to the main objective of this thesis, as stated above.

This literature review demonstrates the necessity of management planning in sustainable forestry practices.

The literature review was conducted through a search of relevant databases and websites for peer-reviewed studies, government documents, publications from nongovernmental organizations, books and certification schemes. Some of the main databases used were Prowler, Novanet, JSTOR, Environmental Sciences and Pollution Management, and ScienceDirect, all of which are available through Dalhousie University Libraries. Search terms such as 'sustainable forestry', 'woodlot management' and 'forest certification' were used. Only English language material was considered for this literature review and there were no delimitations pertaining to years included.

2.2 Management Planning

Creating a management plan is an important first step to any venture, whether it be resource extraction, parks management, city planning, or even business planning. It is essential for any manager to consider and put down on paper plans for the future of the land, resource, business, etc. of which he/she is in charge. Ellis and Pekar (1980) note that "managers should recognize that planning is deciding in the present what to do in the future" (p. 22). An important thing to consider in any management plan is the expression of a clear commitment to the plan (Donnelly 1984). This can be seen in the use of the terms *shall*, *will*, or *must* in plan statements as opposed to *should* (Forest Stewardship Council Canada 2008; Halifax Regional Municipality 2006; Fogg 1994; Donnelly 1984). Plans are useful tools in mapping out the future of a project or enterprise. In the case of

forestry, a management plan should be based on a strategy promoting the sustainability and continuation of that forest.

Forests, being renewable resources, are theoretically able to provide us with a continuous supply of timber and other forest products if managed sustainably. Salim et al. (1999) state this nicely: "Forests are renewable, and should be capable of providing their services in perpetuity. But forest lands are finite, and whether the forests renew themselves or not depends upon how we affect their resilience" (pp. 80-81). The sustainable management of forest resources, as with any other natural resource, requires an understanding of many ecological and technical concepts as well as observational and experimental data. As Salim et al. (1999) point out: "Managing forests for sustainability must emerge from and within a broader approach to planning for and managing the overall landscape" (p. 82).

One of the concepts often mentioned in forest management is the notion of sustained yield, which is the idea that forest management can be planned to attain a continuous flow of forest products while maintaining the forest's ecological integrity (Nova Scotia Department of Lands and Forests et al. 1980). However, there is doubt concerning the effectiveness of this concept regarding sustainable forestry (Luckert and Williamson 2005). Luckert and Williamson (2005) point out that forest economists have criticised the use of sustained yield in forestry because of possibly high opportunity costs stemming from "deviations from revenue maximizing choices regarding land use, investment, and rotation length" (p. 360). Also, the practice of sustained yield does not necessarily ensure the preservation of ecosystem integrity, and in some instances can cause an

impoverishment in forest biodiversity (Luckert and Williamson 2005). The ecological integrity of a forest stand can be gauged using many indicators such as maintenance of natural forest processes, soil structure and fertility, forest wildlife abundance, water quality, and overall genetic health of forest species (Berger 2008).

Bunnell et al. (2009) advocate the use of adaptive management, which is a cyclical management process involving the continual assessment of management practices for the purposes of improving them. Conley and Moote (2001) describe adaptive management as emphasizing "an experimental, iterative approach to decisionmaking" (p. 12). The approach of adaptive management allows for more informed decision-making regarding management planning because it promotes the continual incorporation of new knowledge (World Bank 2008). An adaptive management approach has been taken in Ontario to assess forest management policies for provincial forests (Bell et al. 2008). Adaptive management has also been used for various other areas of natural resource management, including fisheries (Marttunen and Vehanen 2004). The use of adaptive management would be a sound approach for forestry in Nova Scotia considering the large uncertainties associated with planning forest-management activities many decades into the future.

2.3 Sustainable Forestry

Sustainable forestry is an essential facet of forest management planning and is mandatory for most forest certification schemes. It is an important issue for Canada because Canada has approximately ten percent of the world's forested land, amounting to over 400 million hectares (National Round Table on the Environment and the Economy 1997;

Standing Committee on Natural Resources et al. 2008). Over seven percent of Canada's productive woodland is privately owned (Standing Committee on Natural Resources et al. 2008). As mentioned above, the forest industry in Nova Scotia is in a unique situation from the rest of the country because most of the province's productive forest land—over 69 percent—is privately owned (Pannozzo and Colman 2008). The large proportion of privately owned woodland emphasizes the importance of private woodlot management planning because the bulk of Nova Scotia's forest resources are in the hands of private individuals, small groups or businesses.

There are eight major forest regions in Canada with a wide diversity of species compositions (Luckert and Salkie 1998). The Acadian Forest Region is dominant in much of Canada's Maritime provinces, including Nova Scotia (Mosseler et al. 2003). The Acadian Forest is characterised by mixed hardwood and softwood stands with 32 tree species in total (Simpson 2008). Red spruce is the dominant tree species in this forest type, with sugar and red maples, yellow birch, eastern hemlock and other species also being relatively common (Simpson 2008). Since forest regions have different species and other characteristics like climate, topography and geography, they need to be managed in different ways. A woodlot in the boreal forest of Canada and one in the Acadian forest are starkly different from each other, which is why management plans must be tailor-made to each forest region to be successful.

When managing a forest sustainably, it is important to consider methods of forest

regeneration and harvesting because these are key to successful forest growth and maintenance over time. Harvesting methods generally consist of removing mature trees in the stand—either some or all—to make room and open up gaps in the canopy for sunlight to allow for new tree growth (Nova Scotia Department of Lands and Forests et al. 1980). Conventional regeneration and harvesting methods can be classified into two categories: even-aged management and uneven-aged management (Tappeiner et al. 1997).

Even-aged management includes practices like clearcutting, and seed-tree and shelterwood methods (Tappeiner et al. 1997; Fujimori 2001). Clearcutting is the harvesting of all trees in a selected area at once (Nova Scotia Department of Lands and Forests et al. 1980). Seed-tree cuts consist of harvesting all but a few mature trees, which are left to provide seeds for the new stage of regeneration (Berger 2008). Shelterwood cuts remove most of the trees in an area but leave enough to provide a suitable overstory to protect regeneration from excess sun, wind and other natural factors (Nova Scotia Department of Lands and Forests et al. 1980; Berger 2008). These practices are called even-aged management because the trees that regenerate after harvesting are all relatively the same age.

Uneven-aged forest management consists of partial cutting methods like group or single-tree selection cutting (Tappeiner et al. 1997; Nova Scotia Department of Lands and Forests et al. 1980; Fujimori 2001). One single-tree selection method is to remove deformed or diseased trees in order to give the higher-quality wood more space to grow

(Amero and Johnson 2008; Berger 2008). This practice is used to improve the overall health of trees in a forest stand. Another method is to select the most successful and desirable trees in a stand and thin out the trees around them which will not improve in overall quality (Amero and Johnson 2008; Berger 2008). This practise is called crop-tree release because the harvester is essentially releasing the favoured trees from competition from other trees (Amero and Johnson 2008; Berger 2008). Group selection harvesting is similar to single-tree selection but a small group of trees is harvested instead of just one, allowing for gaps in the canopy to promote regeneration. These harvesting methods are part of uneven-aged management because they promote a multi-aged forest stand.

Selection must also take into account the species attributes of selected trees because different species have different life spans and competition tolerances. For example, in mixedwood Acadian forests, like those found in Nova Scotia, a mature fir tree should be harvested before a mature spruce or pine tree of similar age because it has a shorter life span and will therefore likely die before the other two (Nova Scotia Department of Lands and Forests et al. 1980). Selection techniques can also be used to restore mismanaged stands to their natural state by removing invasive tree species and reintroducing native species which had previously been removed due to high-grading harvesting practices (Berger 2008). High-grading is the continual selection of the trees of highest market value, which over time leads to a forest stand of only lower quality with less-desirable trees and tree species (Berger 2008). High-grading has negative effects on soil, stand structure, biological diversity in forests, stand height and mean tree diameter (Bravo and

Montero 2003). To avoid effects of high-grading, the harvester must be careful in the selection of trees for single-tree harvesting and have a well-thought-out harvesting plan.

There appears to be some disagreement in the literature concerning harvesting practices and snags. Snags are standing dead trees that provide habitat for other species and help maintain important ecological functions within the forest stand (Dickie 2005; Berger 2008). Most sources agree that snags are integral to the health of the forest and that at least a proportion should be left standing (Franklin et al. 1997; Dickie 2005; Berger 2008; N.S. Department of Natural Resources 2008). The retention of a certain proportion of snags and woody debris is also a requirement in many leading forest certification programs (Canadian Standards Association 2008; Forest Stewardship Council Canada 2008a, 2008b; Sustainable Forestry Initiative 2008). A guide published by the Government of Canada and the Canadian Forestry Service, however, advises foresters to cut down all standing snags before harvesting other trees due to safety reasons (Falardeau 1988). This discrepancy is likely due to the fact that this particular guide—*Successful Forestry: A Guide to Private Forest Management*—was written in 1988, when much of the timber harvesting was still being done by hand with chainsaws (Falardeau 1988), and also because snags were not considered as important.

2.4 Private Woodlot Management

Due to Nova Scotia's high rate of private forest ownership, it is just as important for private woodlot owners to have woodlot plans for their forest stands as it is for governments to develop plans for Crown land. Woodlot planning is an essential step

in sustainable woodlot management. The Private Woodlot Strategic Initiative (n.d.) states that a woodlot management plan is a statement that "articulates what [the woodlot owner's] personal interests may be, works carefully with [their] abilities and other resources, supports [their] financial objectives and helps [them] meet [their] goals" (p. 1). To be able to create a good management plan for a woodlot, the planner must know and understand the basic principles of sustainable forestry, including harvesting and regeneration methods. Management plans and goals must be supported by sound science and must be appropriate to the geographical and temporal characteristics of a woodlot (Vogt and Fanzeres 2000). The health and productivity of a woodlot is dependent on the specific harvesting methods and procedures used to maintain it. It is important to strike a balance between maintaining the ecological integrity of the forest and harvesting enough to meet economic and social needs (N.S. Department of Natural Resources 2008). A management plan is a guide to accomplishing this.

In creating a woodlot management plan, a private woodlot owner must consider several main factors. Included in these are their objectives for the woodlot, the potential of the woodlot, and which silvicultural practices would be best suited considering the first two factors (Falardeau 1988). The purpose of making a woodlot management plan is to map out where harvesting should be carried out, which harvesting methods should be used and what harvest yields should be, as well as planning logistics such as access road placement (Nova Scotia Department of Lands and Forests et al. 1980). A lot of preparation and analysis must go into creating an adequate plan. Woodlot management plans also need to be updated as the woodlot structure changes in order to remain relevant and useful for the

woodlot owner (Leuschner 1984; Private Woodlot Strategic Initiative [n.d.]). Due to the lack of a clear set of requirement criteria for woodlot management plans, most private woodlot owners must enlist the help of a qualified forester or consulting agency. The goal of this thesis is to create such a set of criteria.

2.5 Forest Certification

In the early 1990s, forest certification programs were beginning to be established to promote management for biological diversity and limit deforestation and forest degradation (Rametsteiner and Simula 2003). Salim et al. (1999) assert that even though forest product certification is relatively recent, it is already having a positive effect on the private forestry sector. According to the Forest Products Association of Canada (updated 2010), the total area in Canada certified under one or more of the Forest Stewardship Council (FSC), the Canadian Standards Association (CSA) and the Sustainable Forestry Initiative (SFI) at the end of 2009 was 148,947,963 hectares.

Since the scope of this thesis focuses on the management of private woodlots, this literature review has been limited to forest certification schemes addressing those specifically. The widely used certification schemes in Canada and the United States have facets of their standards devoted to small, private woodlot certification. Some examples are: a branch of the FSC's Maritime Standard called the Standard for Small and Low Intensity Forests (SLIMF) (Forest Stewardship Council Canada 2008b); the CSA's Z804 (Canadian Standards Association 2008); and the American Forest Foundation's (AFF) Standards of Sustainability for Forest Certification of Private Lands (American Forest

Foundation 2004).

A requirement of certification in all three of these schemes is the production of a woodlot management plan with outlines of management plan requirements. Some examples of these plan requirements include: management objectives, forest stand descriptions, maps, descriptions of planned silvicultural practices, and dedication to sustainable forestry practices (American Forest Foundation 2004; Canadian Standards Association 2008; Forest Stewardship Council Canada 2008a, 2008b). It is especially important that forest certification schemes include measures for safeguarding the environmental values of the forest (Tollefson et al. 2008). As one of this thesis' main objectives is to analyze literature concerning woodlot management plans for private woodlots, certifications schemes like these are highly relevant and represent one of the primary sources of plan requirement data.

3- Methods

3.1 Introduction

This chapter discusses the methods employed to conduct this project. These include the procedures used for data collection and analysis, as well as the delimitations and limitations of this study.

3.2 Procedures

Based on the literature, I compiled a master list of management plan requirements which were assessed for their relevance to private woodlots in Nova Scotia.

The focus of the study is a comparative analysis of private woodlot management standards and requirements, and a qualitative and inductive approach has been adopted. It was conducted through an *a posteriori* review and analysis of literature concerning the creation of woodlot management plans and sustainable forest management in general using an exploratory strategy. The literature was obtained from various sources, including forest certification schemes, generic forestry guidebooks, government documents, journal articles, publications from forestry associations and other nongovernmental organisations, and any other relevant sources discovered through the research process. Sources were found through the search of online journal and book databases (including Novanet, ScienceDirect, Web of Science, Environmental Science and Pollution Management, and Google Scholar), as well as government, university, organisation and association websites. Focus was put on literature relating directly to private woodlot management planning requirements for Nova Scotia's Acadian Forest Region but all literature found on forest management planning was considered. Key terms searched for included management planning, private woodlot management, woodlot management plan requirements, and FSC, SFI and AFF, and CSA-Z804 requirements. Sources were limited to the English language and there was no limitation on year, though preference was given to recent material.

3.3 Analysis

The literature obtained was systematically reviewed for information regarding the necessary requirements for woodlot management plans. For the purpose of analysis, the data were organised into a template to display the details of the requirements listed by

each source. Each requirement found was listed in the left column of the template under the heading of 'plan requirement' and details concerning that requirement were included underneath the appropriate headings for different literature sources. This format was selected because it clearly displays the master list of requirements found through the review of literature and includes relevant details about each requirement from different sources.

After the data were compiled and displayed, each requirement was reviewed for its usefulness in inclusion in woodlot management plans for private woodlot owners in Nova Scotia. The goal of this analysis was to synthesize a set of criteria for Nova Scotia woodlot owners and operators for the production of management plans specific to the Acadian forest. An analysis of these requirements determined which were necessary and recommended for our specific focus.

3.4 Delimitations

The study was limited to focus specifically on private woodlot management plan requirements in Nova Scotia's Acadian Forest Region because that is the region we were primarily interested in. Also, the literature reviewed was mostly limited to North American sources due to constraints of language and accessibility. However, the conclusions of this thesis contribute to the broader body of work on this topic and are generalizable to a degree.

3.5 Outputs

The output of the study is a compilation of plan contents recommended for private woodlots in Nova Scotia. These data are organised into a set of criteria that Nova Scotia private woodlot owners and operators can use in the production of woodlot management plans. The findings of this study will be shared with fellow Dalhousie students and professors in April of 2010 in the form of an oral presentation. Upon completion of this thesis, the possibility of publishing the results in a scientific journal will be explored. The thesis will be made available to interested forestry associations and other parties in Nova Scotia.

4- Results

4.1 Introduction

This section displays the results of the comparative analysis of woodlot management plan requirements for three main categories of sources: forest certification schemes, government documents, and general guidebooks/other sources. I identified a total of sixteen sources and organised them into these categories. They were then further sorted into subcategories within these categories (Table 1). From these sources, I extracted data concerning woodlot management plan requirements. A master list of requirements was created and organised into five categories: objectives, descriptive, practices, principles, and miscellaneous (Table 2). 'Objectives' included any requirement relating to the woodlot owner's and/or operator's future goals for the woodlot. Requirements listed under 'descriptive' were those that described the woodlot itself. 'Practices' included requirements dealing mostly with proposed silvicultural and harvesting methods, as well

as plans for monitoring and impact mitigation. 'Principles' was defined as something that drives the woodlot owner's and/or operator's decision-making and thinking. All other requirements were grouped into the 'miscellaneous' category. Each requirement was designated a number to identify it in the results tables.

Table 1. Sources analysed for management plan requirements.

Category	Source
Canadian Certification Schemes	FSC Maritime Standard
	FSC Maritime Standard SLIMF
	CSA-Z804
American Certification Schemes	AFF Standard 2004
	AFF Standard 2010-2015
	SFI Standard (Note that SFI uses the AFF Standard)
Other Certification Schemes	The Australian Forestry Standard
	The UK Woodland Assurance Standard
Government Documents	NS Department of Natural Resources 2008
	Nova Scotia Department of Lands and Forests et al. 1980
General Guidebooks	Leuschner 1984
	Simpson 2008
	Maser & Walter 2001
Other Sources	Dickie 2005
	Private Woodlot Strategic Initiative n.d.
	Federation of Nova Scotia Woodland Owners 2009 (Note that FNSWO uses CSA-Z804 Standards)

Table 2. Master list of management plan requirements.

Category	Requirement #	Requirement
Objectives	1	Statement of management objectives
	2	Consideration of carbon sequestration opportunities
	3	Consideration of management for multiple values
	4	Designation of parts of land for different levels of management intensity
	5	Economic expectations
Descriptive	6	Description of forest stand/woodlot
	7	Assessment of wildlife, including plans for identification and conservation/protection of rare, threatened and endangered species, and susceptible stands
	8	Map of woodlot
	9	Description of lands adjacent to woodlot
Practices	10	Description of silvicultural system and/or management system
	11	Plans for/description of forest monitoring activities
	12	Identification of environmental safeguards
	13	Description and/or justification of proposed harvesting techniques
Principles	14	Rationale for species selection and annual rate of harvest
	15	Commitment to sustainable forest management
	16	Respect for stakeholder input
Miscellaneous	17	Provisions for plan review and revision
	18	Public availability of plan summary
	19	Approval by author of plan and woodlot owner
	20	Type of ownership
	21	Other external factors (socio-economic factors, public policy, etc.)
	22	Identification of legal restrictions/requirements
	23	Identification of significant impacts of proposed activities

4.2 Forest Certification Schemes

I identified eight forest certification schemes for use in this analysis: three Canadian, three American, and two others for comparison (one from Australia and one from the United Kingdom). The data for these schemes have been organised into three groups accordingly. Several of the requirements for the certification schemes are identical as some standards conform to the same schemes. It should be noted that the SFI is linked with the American Tree Farm Association, which uses AFF standards. Others are similar because they are either different levels of the same certification scheme (as is the case with the FSC standards) or they are different editions of the same scheme (as with the AFF standards). The requirements identified in these six certification schemes were organised both into a master list of sources and requirements (Table 3) and in a series of smaller tables showing a more detailed examination of each of the three groups (Appendices A, B and C).

4.3 Government Documents

Two government documents were found pertaining to woodlot management planning. I was unable to find any specific legal documents governing the creation and use of woodlot management plans for private woodlot owners in Nova Scotia. The two sources found were *Nova Scotia's Code of Forest Practice: A Framework for the Implementation of Sustainable Forest Management* (NSDNR 2008) and *The Trees Around Us* (NS Department of Lands and Forests et al. 1980). These sources give rough guidelines concerning what should be included in a woodlot management plan in Nova Scotia but no definite requirements. The data obtained from these two sources were displayed both in short form in the master list (Table 3) and in a more detailed table (Appendix D).

4.4 General Guidebooks/Other Sources

I reviewed six other sources with respect to their information on woodlot management plan requirements, three of which I classified as general guidebooks and three as other sources. These sources consisted of guidebooks on sustainable forest management, management guides, and publications/documents from forestry associations. Though most of these sources did not explicitly state what is required in a private woodlot management plan in Nova Scotia, they give recommendations as to what should be included. The data from these sources were organised and displayed both in the master list (Table 3) and in two other tables (Appendices E and F) showing a more detailed account of the requirements found in the two groups.

Table 3. Master list of management plan requirements identified by each source.

Requirement #	Requirement	FSC Maritime Standard	FSC Maritime Standard SLIMF	CSA-Z804	AFF Standard 2004	AFF Standard 2010-2015	SFI Standard (Note that SFI uses the AFF Standard)	The Australian Forestry Standard	The UK Woodland Assurance Standard	NS Department of Natural Resources 2008	Nova Scotia Department of Lands and Forests et al. 1980	Leuschner 1984	Simpson 2008	Maser & Walter 2001	Dickie 2005	Private Woodlot Strategic Initiative n.d.	Federation of Nova Scotia Woodland Owners 2009 (Note that FNSWO uses CSA-Z804 Standards)
1	Statement of management objectives	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	Consideration of carbon sequestration opportunities	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No
3	Consideration of management for multiple values	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	Yes	No
4	Designation of parts of land for different levels of management intensity	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No
5	Economic expectations	No	No	No	No	No	No	No	No	No	No	Yes	No	No	No	Yes	No
6	Description of forest stand/woodlot	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7	Assessment of wildlife, including plans for identification and conservation/protection of rare, threatened and endangered species, and susceptible stands	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes
8	Map of woodlot	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No	Yes	No	Yes
9	Description of lands adjacent to woodlot	Yes	Yes	Yes	No	No	No	No	No	No	No	No	Yes	No	No	No	Yes
10	Description of silvicultural system and/or management system	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
11	Plans for/description of forest monitoring activities	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	No	No	Yes
12	Identification of environmental safeguards	Yes	Yes	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No
13	Description and/or justification of proposed harvesting techniques	Yes	Yes	No	No	No	No	Yes	Yes	No	Yes	No	Yes	No	No	No	No
14	Rationale for species selection and annual rate of harvest	Yes	Yes	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No
15	Commitment to sustainable forest management	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	No	No	No	No	No	Yes
16	Respect for stakeholder input	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No
17	Provisions for plan review and revision	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes
18	Public availability of plan summary	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No
19	Approval by author of plan and woodlot owner	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	No	Yes
20	Type of ownership	Yes	Yes	Yes	Yes	No	No	No	Yes	No	No	No	No	No	No	No	Yes
21	Other external factors (socio-economic factors, public policy, etc.)	No	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No
22	Identification of legal restrictions/requirements	No	No	No	No	No	No	Yes	No	No	No	Yes	No	No	No	No	No
23	Identification of significant impacts of proposed activities	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No

A further analysis was done to determine how many sources identified each of the management plant requirements (Table 4), and which of the sources did so (Appendix G).

Table 4. Table showing number of sources which identify each requirement.

Requirement #	Requirement	# of Certification Schemes	# of Government Documents	# of Guidebooks/Other Sources	Total
1	Statement of management objectives	8	2	6	16
2	Consideration of carbon sequestration opportunities	0	1	0	1
3	Consideration of management for multiple values	0	1	1	2
4	Designation of parts of land for different levels of management intensity	0	1	0	1
5	Economic expectations	0	0	2	2
6	Description of forest stand/woodlot	8	2	6	16
7	Assessment of wildlife, including plans for identification and conservation/protection of rare, threatened and endangered species, and susceptible stands	7	0	5	12
8	Map of woodlot	7	1	4	12
9	Description of lands adjacent to woodlot	3	0	2	5
10	Description of silvicultural system and/or management system	8	2	5	15
11	Plans for/description of forest monitoring activities	7	1	2	10
12	Identification of environmental safeguards	3	0	0	3
13	Description and/or justification of proposed harvesting techniques	4	1	1	6
14	Rationale for species selection and annual rate of harvest	3	0	0	3
15	Commitment to sustainable forest management	6	1	1	8
16	Respect for stakeholder input	1	0	0	1
17	Provisions for plan review and revision	6	2	3	11
18	Public availability of plan summary	2	0	0	2
19	Approval by author of plan and woodlot owner	3	0	1	4
20	Type of ownership	5	0	1	6
21	Other external factors (socio-economic factors, public policy, etc.)	0	0	1	1
22	Identification of legal restrictions/requirements	1	0	1	2
23	Identification of significant impacts of proposed activities	1	0	0	1

Analysis of the sources and woodlot management plan requirements showed that there is a core group of fifteen requirements (hereafter referred to as the 'Common Core of Requirements') that would satisfy all of the forest certification standards considered in this thesis that are currently in use in Nova Scotia: FSC, CSA, AFF and SFI (Table 5).

Table 5. The common core of management plan requirements which satisfy all of FSC, CSA, AFF and SFI standards.

Requirement #	Requirement
1	Statement of management objectives
6	Description of forest stand/woodlot
7	Assessment of wildlife, including plans for identification and conservation/protection of rare, threatened and endangered species, and susceptible stands
8	Map of woodlot
9	Description of lands adjacent to woodlot
10	Description of silvicultural system and/or management system
11	Plans for/description of forest monitoring activities
12	Identification of environmental safeguards
13	Description and/or justification of proposed harvesting techniques
14	Rationale for species selection and annual rate of harvest
15	Commitment to sustainable forest management
17	Provisions for plan review and revision
18	Public availability of plan summary
19	Approval by author of plan and woodlot owner
20	Type of ownership

5- Discussion

5.1 Introduction

Through analysis of the sources used, we can see that several woodlot management plan requirements are included in more than one source. We can take this to mean that these particular requirements have a high degree of significance in managing a forest sustainably. From the results, we can conclude that compliance with the Common Core of Requirements would satisfy all the major forest certification schemes currently in use in Nova Scotia: FSC Maritime Standard, FSC Maritime Standard SLIMF, CSA-Z804, SFI Standard and AFF Standard. It thus stands to reason that inclusion of these requirements by private woodlot owners in Nova Scotia would be a good start to any woodlot management plan. We can see from Table 5 that all of the requirements categorised under 'descriptive' and 'practices' are included in the Common Core of Requirements, as well as most of the 'principles' and just over half of those in the 'miscellaneous' category. This emphasises the relative importance of the former two categories in drawing up a suitable woodlot management plan. It is essential that the plan outline exactly what is in the woodlot in terms of stands, species, and age classes, as well as what methods the owner plans to use to manage and/or harvest it.

5.2 Brief Overview of the Common Core of Requirements

Requirement 1: Statement of management objectives

Management objectives are an essential part of any woodlot management plan and the inclusion of these objectives was a requirement for all the sources analysed. They are important because the plan must be structured around them. A management plan for one

owner's future goals may look very different from another's. Simpson (2008) noted that the owner's goals and objectives should be established before anything else in the management plan.

Requirement 6: Description of forest stand/woodlot

The woodlot description is also a necessary part of a good management plan. To be able to develop a schedule for harvesting and silvicultural practices, it is important to know what tree species are there, their density, height, age, and other information, as well as the location of different stands, forest types, wetlands, roads, and other features.

Requirement 7: Assessment of wildlife, including plans for identification and conservation/protection of rare, threatened and endangered species, and susceptible stands

This requirement, which was cited by seven of the eight forest certification schemes reviewed, is relatively self-explanatory. An assessment of the woodlot for ecologically sensitive habitats or species-at-risk will help the woodlot owner design management activities in a way that will have the smallest possible negative effect on these areas or species. Assessing the forest for susceptibility to forest fire, insect outbreak and disease can also help with mitigative planning.

Requirement 8: Map of woodlot

A woodlot map was an essentially component of twelve of the sixteen sources, required in all but one of the forest certification schemes. A map of the area allows the woodlot owner and/or operator to see where the different stands are within a forest as well as features like roads, streams, trails, and boundary lines. Up-to-date aerial photos are also useful to include in a management plan (Simpson 2008).

Requirement 9: Description of lands adjacent to woodlot

This is helpful to include when writing a woodlot management plan because the type of management system or silvicultural techniques one may decide to use might be influenced by what kind of lands surround one's woodlot. Simpson (2008) notes that the potential effects of adjacent land use (such as clearcuts, highways, mature forest stands, and farmland) should be considered in a management plan.

Requirement 10: Description of silvicultural system and/or management system

To certify a woodlot under one of the certification schemes available in Nova Scotia, it is important that a detailed description is given of the proposed management system. This system must meet the standards required by whichever scheme one is trying to become certified under. It is also useful in itself even if certification is not the goal because it guides the woodlot owner or manager in working out a schedule for future activities on the woodlot.

Requirement 11: Plans for/description of forest monitoring activities

Seven of the eight forest certification schemes analysed listed a description of monitoring activities as a requirement in a management plan. The monitoring of forest health and sustainability is a necessary step when it comes time for the plan to be revised and adapted. Monitoring is also important to discern whether the management system being used is the most appropriate for the specific woodlot and whether essential ecosystem functions are being disrupted.

Requirement 12: Identification of environmental safeguards

Even though only three of the sources cited a description of environmental safeguards as a requirement, it is a very useful device in the creation of a woodlot management plan. Environmental safeguards, informed by environmental assessments, allow the woodlot owner to consider the negative effects of various management activities and plan to prevent or at least mitigate these impacts.

Requirement 13: Description and/or justification of proposed harvesting techniques

Though included by less than half of the sources reviewed, a description of harvesting techniques is still valuable and is required by the majority of forest certification schemes used in Nova Scotia. Harvesting prescriptions and equipment used should be included under this requirement.

Requirement 14: Rationale for species selection and annual rate of harvest

Though this was only a requirement for the FSC standards and the Australian Forestry Standard, it is a useful tool for deciding how much timber should and will be removed annually and what species will be targeted. A good understanding of one's forest types and growth rates is needed to sufficiently determine this.

Requirement 15: Commitment to sustainable forest management

A commitment to sustainability is an important part of woodlot management planning, whether it involves certification or not, because the future of the woodlot relies on its sustainable management. Though only explicitly stated in half of the sources reviewed, the practice of sustainable management and harvest is what allows for a woodlot to provide materials and other values in the present as well as the future.

Requirement 17: Provisions for plan review and revision

The regular revision and adaptation of a management plan is vital for the improvement of the management/silvicultural system chosen. This is similar to the adaptive management approach described earlier and results in a cyclical pattern of planning which includes monitoring and revision as essential facets.

Requirement 18: Public availability of plan summary

Making a summary of the management plan available to the public is only a mandatory requirement for the two FSC standards that were reviewed. If one is not seeking certification under FSC, this requirement is neither useful nor necessary for the woodlot owner.

Requirement 19: Approval by author of plan and woodlot owner

Author and owner approval of the plan is only mandatory for certification under the FSC schemes and CSA-Z804. Since these are the two most common certification schemes used in Nova Scotia, there is a high probability that a private woodlot owner seeking certification would need to comply with this requirement.

Requirement 20: Type of Ownership

Though only explicitly stated in the management plan section of the 2004 AFF standard, type and proof of ownership of the woodlot being certified is also required by both FSC and CSA-Z804. If a woodlot owner is creating a management plan but does not plan on certifying the woodlot, this step is not required, but if he/she does want certification under FSC, CSA or AFF, it is mandatory.

5.3 Suggested Additional Requirements

Although not required by the main forest certification schemes in Nova Scotia, the remaining requirements identified are valuable additions to a private woodlot management plan. Many of them should be considered regardless as to whether they are required. All of these additional requirements offer some benefit to the management plan and the woodlot owner and I recommend that as many be included in a private woodlot management plan as is feasible for the woodlot owner and/or manager. In many cases, it is just a matter of time and resources as to whether they are in fact taken into consideration. Further contemplation of other objectives such as mentioned in requirements 2 (consideration of carbon sequestration opportunities) and 3 (consideration of management for multiple values) can open up more management and economic opportunities for the woodlot owner and help to identify other silvicultural options for the woodlot.

6- Conclusions & Recommendations

Several woodlot management plan requirements were common to the majority of sources I reviewed, and most were mandatory for the woodlot certification schemes most commonly used in Nova Scotia—the FSC Maritime Standard, CSA-Z804, AFF, and SFI (which follows AFF). If a woodlot owner or manager includes the Common Core of Requirements, as identified above, in a woodlot management plan, this should satisfy the plan requirements for all four of these certification schemes. Any of the additional requirements can also be included and I would recommend that they all be considered if possible because they will only increase the integrity and scope of the management plan.

As an analysis of the results showed that all the requirements classified in the 'descriptive' and 'practices' categories were included in the Common Core of Requirements, we can assume that these requirements are an essential part of any woodlot management plan. Requirements 1 (statement of management objectives) and 6 (description of forest stand/woodlot) are especially important as they were identified by all the sources. It is interesting that all of the additional requirements were only identified by one or two of the sources analysed, and that aside from the Australian Forestry Standard, the only sources that referenced them were government documents, general guidebooks, and other sources. This is likely due to the fact that these documents and the forest certification schemes were written in different ways and for a different group of people. Whereas general books are broad in subject matter and address many different issues, certification schemes are more narrow in purpose and are written specifically to apply to a particular set of standards.

The Australian Forestry Standard appears to be the outlier as even though it identifies many of the requirements listed in the Common Core of Requirements, it also has many of the additional ones as well, such as 16 (respect for stakeholder input), 22 (identification of legal restrictions/requirements), and 23 (identification of significant impacts of proposed activities). Perhaps this stems from differences between the Australian forest industry and that of Canada. If so, Canada should take a lesson from Australia and contemplate including some of these requirements in Canadian forestry standards in the future. It would also be advisable to consider more requirements in the 'objectives' category, as only one was included in the Common Core of Requirements.

Though the completion of a woodlot management plan will require the assistance of a certified forest practitioner, it is useful for the woodlot owner and/or manager to know the essential information that is required in the creation of a plan. This will make the process much more efficient and beneficial for both parties. This study provides a list and brief summary of the most important elements of a woodlot management plan for a privately owned woodlot in Nova Scotia and recommends that private woodlot owners seeking to create plans for their land become familiar with these components in order to facilitate this process.

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8- Literature Cited

American Forest Foundation. 2009. AFF 2010-2015 Standards of Sustainability for Forest Certification. 7 pp. Retrieved 12 March 2010 from <http://www.forestfoundation.org/pdfs/Final_Standards.pdf>

American Forest Foundation. 2004. AFF Standards of Sustainability for Forest Certification of Private Lands. 10 pp. Retrieved 30 October 2009 from: <http://www.forestfoundation.org/cff_standards.html>

Amero, Patricia and Flora Johnson. 2008. Growing High-Value Trees. Association for Sustainable Forestry, Truro, Nova Scotia. 6 pp. Retrieved 18 October 2009 from: <http://www.asforestry.com/PDFs/outreach/ UnevenAgedManagementInfo.pdf>

Australian Forestry Standard Technical Reference Committee of Australian Forestry Standard Limited. 2007. The Australian Forestry Standard. 88 pp. Retrieved 12 March 2010 from: <http://www.forestrystandard.org.au/files/Standards/4708.pdf>

Bell, F Wayne, Baker, James A., Bruemmer, George, Pineau, John & Stinson, Al. 2008. The Canadian Ecology Centre-Forestry Research Partnership: Implementing a research strategy based on an active adaptive management approach. The Forestry Chronicle 84(5): 666-677.

Berger, John J. 2008. Forests Forever: Their Ecology, Restoration, and Protection. University of Chicago Press, Chicago, U.S. 306 pp.

Bravo, Felipe & Montero, Gregorio. 2003. High-grading effects on Scots pine volume and basal area in pure stands in northern Spain. Annals of Forest Science 60(1): 11-18.

Bunnell, Fred L., Glen B. Dunsworth, David J. Huggard, and Laurie L. Kremsater. 2009. The Problem. Chapter 1 in "Forestry and biodiversity : Learning how to sustain biodiversity in managed forests" (Bunnell F.L. and G.B. Dunsworth, editors), pp. 5-16. UBC Press, Vancouver, BC.

Canadian Standards Association. 2008. Z804-08: Sustainable Forest Management for Woodlots and Other Small Area Forests. Canadian Standards Association, Mississauga, Ontario. 44 pp. Retrieved 18 October 2009 from: <http://www.csagroup.org/%5Crepository%5Cgroup%5CZ804-08EN.pdf>

Conley, Alex & Moote, Ann. 2001. Collaborative Conservation in Theory and Practice: A Literature Review. Udall Center Publications, Udall Center for Studies in Public Policy, University of Arizona, Tuscon, AZ. 34 pp. Retrieved 30 November 2009 from: <http://udall.jsdix.com/publications/sites/default/files/144_en.pdf>

Dickie, C. 2005. Best Management Practices: A Practical Guide for New Brunswick's Private Woodlots. Fundy Model Forest Network. 87 pp. Retrieved 18 October 2009 from: <http://fundymodelforest.net/cms/pdfs/publications/management/Management_2005_Dickie_best_management_practices_a_practical.pdf>

Donnelly, Robert M. 1984. Guidebook to Planning: Strategic Planning and Budgeting Basics for the Growing Firm. Van Nostrand Reinhold Publishing, New York. 130 pp.

Ellis, Darryl J. & Pekar, Peter P. Jr. 1980. Planning for Nonplanners: Planning Basics for Managers. Amacom, New York. 152 pp.

Falardeau, H. 1988. Successful Forestry : A Guide to Private Forest Management. Government of Canada, Canadian Forestry Service, Ottawa. 133 pp.

Federation of Nova Scotia Woodlot Owners. 2009. Small Private Woodlot Certification Program. 2 pp. Retrieved 18 October 2009 from: <http://www.fnswo.ca/testfnswo/July_Update_SPWCP_GeneralRequirements.pdf>

Fogg, C. Davis. 1994. Team-based Strategic Planning: A Complete Guide to Structuring, Facilitating, and Implementing the Process. Amacom, New York. 337 pp.

Forest Products Association of Canada. [Internet]. [updated 2010]. Certification Status - Canada & the Globe: Statistics. [cited 1 April 2010]. Retrieved from: <http://www.certificationcanada.org/english/status_intentions/status.php>

Forest Stewardship Council Canada. 2008a. Certification Standards for Best Forestry Practices in the Maritimes Region. 96 pp. Retrieved 18 October 2009 from: <http://www.fsccanada.org/docs/4362246B2B61578A.pdf>

Forest Stewardship Council Canada. 2008b. Certification Standards for Best Forestry Practices in the Maritimes Region: Standard for Small and Low Intensity Forests. 91 pp. Retrieved 30 October 2009 from: <http://www.fsccanada.org/docs/77F9A28B6FFB94A7.pdf>

Franklin, Jerry F., Dean Rae Berg, Dale A. Thornburgh and John C. Tappeiner. 1997. Alternative Silvicultural Approaches to Timber Harvesting: Variable Retention Harvest Systems. Chapter 7 in "Creating a Forestry for the 21st Century: The Science of Ecosystem Management" (Kathryn A. Kohm and Jerry F. Franklin, editors), pp. 111-139. Island Press, Washington, D.C.

Fujimori T. 2001. Ecological and Silvicultural Strategies for Sustainable Forest Management. 1st ed. Elsevier, New York. 398 pp.

Halifax Regional Municipality. 2006. Regional Municipal Planning Strategy. 176 pp. Retrieved 10 March 2010 from: <http://www.halifax.ca/regionalplanning/documents/Regional_MPS.pdf>

Leuschner, W.A. 1984. Introduction to Forest Resource Management. John Wiley & Sons, New York. 298 pp.

Luckert, M.K. and T. Williamson. 2005. Should sustained yield be part of sustainable forest management? Canadian Journal of Forest Research 35(2): 356-64.

Luckert, M. K. and F. J. Salkie. 1998. Forestry in Canada: Transitions and emerging policy issues. Canadian Public Policy 24(Special Supplement 2 on Forestry Issues in Canada): S1-S10.

Marttunen, Mika & Vehanen, Teppo. 2004. Toward adaptive management: the impacts of different management strategies on fish stocks and fisheries in a large regulated lake. Environmental Management 33(6): 840-854.

Maser, Chris & Smith, Walter. 2001. Forest Certification in Sustainable Development: Healing the Landscape. Lewis Publishers, Boca Raton, Florida. 235 pp.

Mosseler, A, J.A. Lynds, & J.E. Major. 2003. Old-growth forests of the Acadian Forest Region. Environmental Reviews 11(S1): 47-77.

National Round Table on the Environment and the Economy. 1997. State of the Debate on the Environment and the Economy: Private Woodlot Management in the Maritimes. Renouf Publishing Co. Ltd, Ottawa. 49 pp.

Nova Scotia Department of Lands and Forests, Nova Scotia Forest Practices Improvement Board, and Canada Department of Regional Economic Expansion. 1980. The Trees Around Us. Government of Canada, Province of Nova Scotia. 206 pp.

Nova Scotia Department of Natural Resources. 2008. Nova Scotia's Code of Forest Practice: A Framework for the Implementation of Sustainable Forest Management (working paper). 33 pp. Retrieved 18 October 2009 from: <http://www.gov.ns.ca/natr/forestry/reports/Code-of-Forest-Practice.pdf>

Pannozzo, Linda & Colman, Ronald. 2008. GPI Forest Headline Indicators for Nova Scotia. GPI Atlantic. 59 pp. Retrieved 18 November 2009 from: <http://www.gpiatlantic.org/pdf/forest/forestupdate.pdf>

Private Woodlot Strategic Initiative. [date unknown]. The Value of a Woodlot Management Plan. Natural Resources Canada. 2 pp. Retrieved 18 October 2009 from: <http://fundymodelforest.net/cms/pdfs/ValueofaManagementPlane.pdf>

Rametsteiner E. and M. Simula. 2003. Forest certification—an instrument to promote sustainable forest management? Journal of Environmental Management 67(1): 87-98.

Salim E, O. Ullsten, and World Commission on Forests and Sustainable Development. 1999. Our Forests, Our Future. Cambridge University Press, Cambridge, UK. 205 pp.

Simpson, Jamie. 2008. Restoring the Acadian Forest: A Guide to Forest Stewardship for Woodlot Owners in the Maritimes. Res Telluris, Kentville, NS. 155 pp.

Standing Committee on Natural Resources and Benoit L. 2008. Canada's forest industry : Recognizing the challenges and opportunities : Report of the standing committee on natural resources. Parliament, House of Commons, Ottawa. 74 pp.

Sustainable Forestry Initiative. 2004. Sustainable Forestry Initiative: 2005-2009 Standard. 27 pp. Retrieved 18 October 2009 from: <http://www.sfiprogram.org/files/pdf/sfi-standard-2005-2009-sept%2008%20update.pdf>

Tappeiner, John C., Denis Lavender, Jack Walstad, Robert O. Curtis, and Dean S. DeBell. 1997. Silvicultural Systems and Regeneration Methods: Current Practices and New Alternatives. Chapter 9 in "Creating a Forestry for the 21st Century: The Science of Ecosystem Management" (Kathryn A. Kohm and Jerry F. Franklin, editors), pp. 151-164. Island Press, Washington, D.C.

The UK Woodland Assurance Standard. 2006. The UK Woodland Assurance Standard: Second Edition. 60 pp. Retrieved 13 March 2010 from: <http://www.forestry.gov.uk/pdf/UKWASGUIDE.PDF/$FILE/UKWASGUIDE.PDF>

Tollefson, C., D. Haley and F. P. Gale. 2008. Setting the Standard : Certification, Governance and the Forest Stewardship Council. UBC Press, Vancouver. 404 pp.

Vogt, Kristiina A. and Anna Fanzeres. 2000. Definitions and Current Values Integrated into Certification Protocols. Chapter 3 in "Forest Certification: Roots, Issues, Challenges, and Benefits" (Vogt, Kristiina A., Bruce C. Larson, John C. Gordon, Daniel J. Vogt and Anna Fanzeres), pp. 55-108. CRC Press, Boca Raton, Florida, U.S.

World Bank. 2008. Forests Sourcebook : Practical Guidance for Sustaining Forests in Development Cooperation. World Bank, Washington, DC. 369 pp.

9- Appendices

Appendix A. Management plan requirement details for the Canadian certification schemes.

Requirement #	Requirement	FSC Maritime Standard	FSC Maritime Standard SLIMF	CSA-Z804
1	Statement of management objectives	Yes	Yes	Yes
2	Consideration of carbon sequestration opportunities	No	No	No
3	Consideration of management for multiple values	No	No	No
4	Designation of parts of land for different levels of management intensity	No	No	No
5	Economic expectations	No	No	No
6	Description of forest stand/woodlot	Yes, including forest resource, environmental limitations, land use and ownership status, socio-economic conditions, and a profile of adjacent lands.	Yes, including forest resource, environmental limitations, land use and ownership status, socio-economic conditions, and a profile of adjacent lands.	Yes, including woodlot size and location as well as a description of individual stands within the woodlot (including age and condition).
7	Assessment of wildlife, including plans for identification and conservation/protection of rare, threatened and endangered species, and susceptible stands	Yes	Yes	Yes, including identification of susceptible stands (to fire, insects and/or disease) and proposed treatments. Also including information on sites requiring conservation or protection and a species-at-risk recovery plan for the woodlot.
8	Map of woodlot	Yes, including protected areas, planned management activities and land ownership.	Yes, including protected areas, planned management activities and land ownership.	Yes
9	Description of lands adjacent to woodlot	Yes	Yes	Yes
10	Description of silvicultural system and/or management system	Yes, based on ecology of specific forest stand other information about stand.	Yes, based on ecology of specific forest stand other information about stand.	Yes, including a schedule of proposed management activities.
11	Plans for/description of forest monitoring activities	Yes, especially monitoring of forest growth and dynamics.	Yes, especially monitoring of forest growth and dynamics.	Yes
12	Identification of environmental safeguards	Yes, based on environmental assessments.	Yes, based on environmental assessments.	No
13	Description and/or justification of proposed harvesting techniques	Yes, including both proposed harvesting techniques and equipment used.	Yes, including both proposed harvesting techniques and equipment used.	No
14	Rationale for species selection and annual rate of harvest	Yes	Yes	No
15	Commitment to sustainable forest management	Yes	Yes	Yes
16	Respect for stakeholder input	No	No	No
17	Provisions for plan review and revision	Yes, in order to incorporate new results from monitoring and/or new scientific and technical information.	Yes, in order to incorporate new results from monitoring and/or new scientific and technical information.	Yes
18	Public availability of plan summary	Yes	Yes	No
19	Approval by author of plan and woodlot owner	Yes	Yes	Yes
20	Type of ownership	Yes	Yes	Yes
21	Other external factors (socio-economic factors, public policy, etc.)	No	No	No
22	Identification of legal restrictions/requirements	No	No	No
23	Identification of significant impacts of proposed activities	No	No	No

Appendix B. Management plan requirement details for American certification schemes.

Requirement #	Requirement	AFF Standard 2004	AFF Standard 2010-2015	SFI Standard (Note that SFI uses the AFF Standard)
1	Statement of management objectives	Yes	Yes, including a description of desired forest condition.	Yes, including a description of desired forest condition.
2	Consideration of carbon sequestration opportunities	No	No	No
3	Consideration of management for multiple values	No	No	No
4	Designation of parts of land for different levels of management intensity	No	No	No
5	Economic expectations	No	No	No
6	Description of forest stand/woodlot	Yes, including stands and conditions as well as special sites and wildlife.	Yes	Yes
7	Assessment of wildlife, including plans for identification and conservation/protection of rare, threatened and endangered species, and susceptible stands	Yes	Yes	Yes
8	Map of woodlot	Yes	Yes	Yes
9	Description of lands adjacent to woodlot	No	No	No
10	Description of silvicultural system and/or management system	Yes	Yes	Yes
11	Plans for/description of forest monitoring activities	No	Yes	Yes
12	Identification of environmental safeguards	No	No	No
13	Description and/or justification of proposed harvesting techniques	No	No	No
14	Rationale for species selection and annual rate of harvest	No	No	No
15	Commitment to sustainable forest management	Yes	Yes	Yes
16	Respect for stakeholder input	No	No	No
17	Provisions for plan review and revision	Yes	Yes	Yes
18	Public availability of plan summary	No	No	No
19	Approval by author of plan and woodlot owner	No	No	No
20	Type of ownership	Yes	No	No
21	Other external factors (socio-economic factors, public policy, etc.)	No	No	No
22	Identification of legal restrictions/requirements	No	No	No
23	Identification of significant impacts of proposed activities	No	No	No

Appendix C. Management plan requirement details for the other certification schemes analysed.

Requirement #	Requirement	The Australian Forestry Standard	The UK Woodland Assurance Standard
1	Statement of management objectives	Yes	Yes, including a prioritisation of objectives.
2	Consideration of carbon sequestration opportunities	No	No
3	Consideration of management for multiple values	No	No
4	Designation of parts of land for different levels of management intensity	No	No
5	Economic expectations	No	No
6	Description of forest stand/woodlot	Yes	Yes
7	Assessment of wildlife, including plans for identification and conservation/protection of rare, threatened and endangered species, and susceptible stands	No	Yes, including appropriate treatment plans for sensitive/special areas.
8	Map of woodlot	No	Yes
9	Description of lands adjacent to woodlot	No	No
10	Description of silvicultural system and/or management system	Yes	Yes, describing the first 5 years in detail.
11	Plans for/description of forest monitoring activities	Yes	Yes
12	Identification of environmental safeguards	Yes, with reference to operating conditions and activity controls.	No
13	Description and/or justification of proposed harvesting techniques	Yes, including rationale for specific silvicultural treatments.	Yes, including plans for the next 20 years for activities (felling, regeneration, etc.).
14	Rationale for species selection and annual rate of harvest	Yes	No
15	Commitment to sustainable forest management	No	No
16	Respect for stakeholder input	Yes, stakeholder input should also be encouraged.	No
17	Provisions for plan review and revision	No	No
18	Public availability of plan summary	No	No
19	Approval by author of plan and woodlot owner	No	No
20	Type of ownership	No	Yes
21	Other external factors (socio-economic factors, public policy, etc.)	No	No
22	Identification of legal restrictions/requirements	Yes, including any other external requirements restricting the forest manager.	No
23	Identification of significant impacts of proposed activities	Yes, taking into account impacts of entire proposed management activities.	No

Appendix D. Management plan requirement details suggested by the NS Department of Natural Resources (2008) in *Nova Scotia's Code of Forest Practice: A Framework for the Implementation of Sustainable Forest Management* and by Nova Scotia Department of Lands and Forests et al. (1980) in *The Trees Around Us*.

Requirement #	Requirement	NS Department of Natural Resources 2008	Nova Scotia Department of Lands and Forests et al. 1980
1	Statement of management objectives	Yes	Yes
2	Consideration of carbon sequestration opportunities	Yes	No
3	Consideration of management for multiple values	Yes, examples being timber extraction, recreation, aesthetics, conservation of wildlife habitat, etc.	No
4	Designation of parts of land for different levels of management intensity	Yes, including natural state, extensive, and/or intensive management (Crown land only)	No
5	Economic expectations	No	No
6	Description of forest stand/woodlot	Yes	Yes, including inventory of woodlot (species, stand age, volume, condition, etc.).
7	Assessment of wildlife, including plans for identification and conservation/protection of rare, threatened and endangered species, and susceptible stands	No	No
8	Map of woodlot	No	Yes, including all different stands in the woodlot.
9	Description of lands adjacent to woodlot	No	No
10	Description of silvicultural system and/or management system	Yes	Yes, including harvesting plans, roads, boundaries, fire ponds, and silvicultural treatments.
11	Plans for/description of forest monitoring activities	Yes	No
12	Identification of environmental safeguards	No	No
13	Description and/or justification of proposed harvesting techniques	No	Yes, including year by year treatment plan.
14	Rationale for species selection and annual rate of harvest	No	No
15	Commitment to sustainable forest management	Yes, though requirement is very vague.	No
16	Respect for stakeholder input	No	No
17	Provisions for plan review and revision	Yes	Yes
18	Public availability of plan summary	No	No
19	Approval by author of plan and woodlot owner	No	No
20	Type of ownership	No	No
21	Other external factors (socio-economic factors, public policy, etc.)	No	No
22	Identification of legal restrictions/requirements	No	No
23	Identification of significant impacts of proposed activities	No	No

Appendix E. Management plan requirement details suggested in the general guidebooks analysed.

Requirement #	Requirement	Leuschner 1984	Simpson 2008	Maser & Walter 2001
1	Statement of management objectives	Yes	Yes; objectives should be established before anything else in the plan.	Yes
2	Consideration of carbon sequestration opportunities	No	No	No
3	Consideration of management for multiple values	No	No	No
4	Designation of parts of land for different levels of management intensity	No	No	No
5	Economic expectations	Yes, including demand (for timber products, recreation, hunting, etc.) and supply (of natural capital, labour and materials).	No	No
6	Description of forest stand/woodlot	Yes	Yes, including property identification number, location of roads and trails, boundary lines, specific features of the land, condition and composition of woodlot, etc.	Yes, including growth and yield data, timber volume, wildlife habitat, wildlife and fish population health, volume and distribution of down woody debris and snags, etc.
7	Assessment of wildlife, including plans for identification and conservation/protection of rare, threatened and endangered species, and susceptible stands	Yes, including protection plans from fire, disease and insects.	Yes	Yes
8	Map of woodlot	Yes, including roads, tree cover types and subdivisions and compartments in woodlot.	Yes, showing different stands in woodlot, roads and trails, wetlands, waterways, etc. Aerial photographs can also be included.	No
9	Description of lands adjacent to woodlot	No	Yes, including surrounding land uses (highways, clearcuts, farmland, etc.)	No
10	Description of silvicultural system and/or management system	Yes	Yes, including a time-frame of proposed activities.	No
11	Plans for/description of forest monitoring activities	No	No	Yes
12	Identification of environmental safeguards	No	No	No
13	Description and/or justification of proposed harvesting techniques	No	Yes	No
14	Rationale for species selection and annual rate of harvest	No	No	No
15	Commitment to sustainable forest management	No	No	No
16	Respect for stakeholder input	No	No	No
17	Provisions for plan review and revision	Yes	No	No
18	Public availability of plan summary	No	No	No
19	Approval by author of plan and woodlot owner	No	No	No
20	Type of ownership	No	No	No
21	Other external factors (socio-economic factors, public policy, etc.)	Yes	No	No
22	Identification of legal restrictions/requirements	Yes	No	No
23	Identification of significant impacts of proposed activities	No	No	No

Appendix F. Management plan requirement details suggested in the other sources analysed.

Requirement #	Requirement	Dickie 2005	Private Woodlot Strategic Initiative n.d.	Federation of Nova Scotia Woodland Owners 2009 (Note that FNSWO uses CSA-Z804 Standards)
1	Statement of management objectives	Yes	Yes	Yes
2	Consideration of carbon sequestration opportunities	No	No	No
3	Consideration of management for multiple values	No	Yes, depending on owner's objectives for woodlot.	No
4	Designation of parts of land for different levels of management intensity	No	No	No
5	Economic expectations	No	Yes, including expected revenues.	No
6	Description of forest stand/woodlot	Yes, including timber quality, wildlife habitat and other stand information.	Yes, including tree species and volume, stream locations, soil types, habitat, etc.	Yes, including woodlot size and location as well as a description of individual stands within the woodlot (including age and condition).
7	Assessment of wildlife, including plans for identification and conservation/protection of rare, threatened and endangered species, and susceptible stands	Yes	No	Yes, including identification of susceptible stands (to fire, insects and/or disease) and proposed treatments. Also including information on sites requiring conservation or protection and a species-at-risk recovery plan for the woodlot.
8	Map of woodlot	Yes	No	Yes
9	Description of lands adjacent to woodlot	No	No	Yes
10	Description of silvicultural system and/or management system	Yes	Yes	Yes, including a schedule of proposed management activities.
11	Plans for/description of forest monitoring activities	No	No	Yes
12	Identification of environmental safeguards	No	No	No
13	Description and/or justification of proposed harvesting techniques	No	No	No
14	Rationale for species selection and annual rate of harvest	No	No	No
15	Commitment to sustainable forest management	No	No	Yes
16	Respect for stakeholder input	No	No	No
17	Provisions for plan review and revision	No	Yes	Yes
18	Public availability of plan summary	No	No	No
19	Approval by author of plan and woodlot owner	No	No	Yes
20	Type of ownership	No	No	Yes
21	Other external factors (socio-economic factors, public policy, etc.)	No	No	No
22	Identification of legal restrictions/requirements	No	No	No
23	Identification of significant impacts of proposed activities	No	No	No

Appendix G. Table showing sources which include each requirement.

Requirement #	Requirement	Certification Schemes	Government Documents	Guidebooks/Other Sources
1	Statement of management objectives	FSC Maritime Standard; FSC Maritime Standard SLIMF; CSA-Z804; AFF Standard 2004; AFF Standard 2010-2015; SFI Standard; The Australian Forestry Standard; The UK Woodland Assurance Standard	NS Department of Natural Resources 2008; NS Department of Lands and Forests et al. 1980	Dickie 2005; Private Woodlot Strategic Initiative; Leuschner 1984; Simpson 2008; Maser & Walter 2001; Federation of Nova Scotia Woodlot Owners
2	Consideration of carbon sequestration opportunities		NS Department of Natural Resources 2008	
3	Consideration of management for multiple values		NS Department of Natural Resources 2008	Private Woodlot Strategic Initiative
4	Designation of parts of land for different levels of management intensity		NS Department of Natural Resources 2008	
5	Economic expectations			Private Woodlot Strategic Initiative; Leuschner 1984
6	Description of forest stand/woodlot	FSC Maritime Standard; FSC Maritime Standard SLIMF; CSA-Z804; AFF Standard 2004; AFF Standard 2010-2015; SFI Standard; The Australian Forestry Standard; The UK Woodland Assurance Standard	NS Department of Natural Resources 2008; NS Department of Lands and Forests et al. 1980	Dickie 2005; Private Woodlot Strategic Initiative; Leuschner 1984; Simpson 2008; Maser & Walter 2001; Federation of Nova Scotia Woodlot Owners
7	Assessment of wildlife, including plans for identification and conservation/protection of rare, threatened and endangered species, and susceptible stands	FSC Maritime Standard; FSC Maritime Standard SLIMF; CSA-Z804; AFF Standard 2004; AFF Standard 2010-2015; SFI Standard; The UK Woodland Assurance Standard		Dickie 2005; Leuschner 1984; Simpson 2008; Maser & Walter 2001; Federation of Nova Scotia Woodlot Owners
8	Map of woodlot	FSC Maritime Standard; FSC Maritime Standard SLIMF; CSA-Z804; AFF Standard 2004; AFF Standard 2010-2015; SFI Standard; The UK Woodland Assurance Standard	NS Department of Lands and Forests et al. 1980	Dickie 2005; Leuschner 1984; Simpson 2008; Federation of Nova Scotia Woodlot Owners
9	Description of lands adjacent to woodlot	FSC Maritime Standard; FSC Maritime Standard SLIMF; CSA-Z804		Simpson 2008; Federation of Nova Scotia Woodlot Owners
10	Description of silvicultural system and/or management system	FSC Maritime Standard; FSC Maritime Standard SLIMF; CSA-Z804; AFF Standard 2004; AFF Standard 2010-2015; SFI Standard; The Australian Forestry Standard; The UK Woodland Assurance Standard	NS Department of Natural Resources 2008; NS Department of Lands and Forests et al. 1980	Dickie 2005; Private Woodlot Strategic Initiative; Leuschner 1984; Simpson 2008; Federation of Nova Scotia Woodlot Owners
11	Plans for/description of forest monitoring activities	FSC Maritime Standard; FSC Maritime Standard SLIMF; CSA-Z804; AFF Standard 2010-2015; SFI Standard; The Australian Forestry Standard; The UK Woodland Assurance Standard	NS Department of Natural Resources 2008	Maser & Walter 2001; Federation of Nova Scotia Woodlot Owners
12	Identification of environmental safeguards	FSC Maritime Standard; FSC Maritime Standard SLIMF; The Australian Forestry Standard		
13	Description and/or justification of proposed harvesting techniques	FSC Maritime Standard; FSC Maritime Standard SLIMF; The Australian Forestry Standard; The UK Woodland Assurance Standard	NS Department of Lands and Forests et al. 1980	Simpson 2008
14	Rationale for species selection and annual rate of harvest	FSC Maritime Standard; FSC Maritime Standard SLIMF; The Australian Forestry Standard		
15	Commitment to sustainable forest management	FSC Maritime Standard; FSC Maritime Standard SLIMF; CSA-Z804; AFF Standard 2004; AFF Standard 2010-2015; SFI Standard	NS Department of Natural Resources 2008	Federation of Nova Scotia Woodlot Owners

Requirement #	Requirement	Certification Schemes	Government Documents	Guidebooks/Other Sources
16	Respect for stakeholder input	The Australian Forestry Standard		
17	Provisions for plan review and revision	FSC Maritime Standard; FSC Maritime Standard SLIMF; CSA-Z804; AFF Standard 2004; AFF Standard 2010-2015; SFI Standard	NS Department of Natural Resources 2008; NS Department of Lands and Forests et al. 1980	Private Woodlot Strategic Initiative; Leuschner 1984; Federation of Nova Scotia Woodlot Owners
18	Public availability of plan summary	FSC Maritime Standard; FSC Maritime Standard SLIMF		
19	Approval by author of plan and woodlot owner	FSC Maritime Standard; FSC Maritime Standard SLIMF; CSA-Z804		Federation of Nova Scotia Woodlot Owners
20	Type of ownership	FSC Maritime Standard; FSC Maritime Standard SLIMF; CSA-Z804; AFF Standard 2004; The UK Woodland Assurance Standard		Federation of Nova Scotia Woodlot Owners
21	Other external factors (socio-economic factors, public policy, etc.)			Leuschner 1984
22	Identification of legal restrictions/requirements	The Australian Forestry Standard		Leuschner 1984
23	Identification of significant impacts of proposed activities	The Australian Forestry Standard		