An Evaluation of the Native Plant Communities Management Guide for Mesic and Dry-Mesic White-Red Pine in Northern Minnesota

Chad W. Skally and Charles R. Blinn

March 11, 2002

Staff Paper Series No. 156

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Abstract

A guide was developed to provide management information on native plant communities, specifically mesic and dry-mesic white-red pine in Northern Minnesota. This guide was reviewed by many professional foresters (planners, field personnel, and researchers). A survey was mailed to 110 people involved in forest planning and management in Minnesota to evaluate how well the concepts in the guide were understood and how feasible it would be to implement the recommendations. The return rate for the survey was 52%. The overall understanding of the native plant community concepts presented within the guide was relatively high. However, the feasibility to implement the landscape and site-level recommendations presented was only "somewhat". Many impediments to implementation were identified. Some of the most referenced included: lack of time, lack of money, and lack of professional staff. After a review of the surveys, the management guide was revised to address specific comments provided by survey respondents. Additional references to available classification keys were added along with discussion on impediments in the management recommendations. Overall, the guide was successful in communicating native plant community information to the diversity of people involved in forest management. There is likely a need for similar guides, and more audience-specific guides and training in the future.

Introduction

In the 1980s, 90s and the new millennium there has been an increased amount of literature relating to native plant communities. What is the reception of this new knowledge with people who work in forest resource management in Minnesota? How well do they understand the concepts and how feasible are those concepts to implement in a field-setting? What are impediments to managing using native plant community concepts?

All these questions were examined in a survey mailed to people who work with forest management in Minnesota. The survey was based on a document that synthesized different concepts relating to mesic and dry-mesic white-red pine native plant communities in Northern Minnesota (Appendix A). The intent of the document was to increase peoples' understanding of these plant communities by summarizing information that referenced concepts presented in other literature.

The management guide begins by briefly describing a native plant community and in detail defines the mesic and dry-mesic pine plant community. There is discussion of different natural disturbances that affect these plant communities. Also, landscape and site-level management recommendations are given. The paper ends with two scenarios to help illustrate the different ideas presented. This guide was developed from a literature review and was revised using comments received from numerous forestry researchers and professionals during the revision development process.

After the management guide was drafted, the survey was mailed and the results compiled. The survey looked at: 1) the overall understanding of respondents to the different sections in the guide, 2) their ability to implement the strategies was examined, 3) impediments to using the strategies in the guide, and 4) their overall feeling on the format of the management guide. After a review of the responses, the management guide was revised to address specific comments provided by survey respondents. The next sections present information about how the data was collected, results, and conclusions.

Methods

A management guide, "Native Plant Communities Management Guide Mesic and Dry-Mesic White-Red Pine in Northern Minnesota", was developed to serve as a tool to assist people who deal with forest management relating to native plant communities (Appendix A). This guide was developed from a literature review and included input from several forest planners, researchers, and field personnel during a formal review process. The review was conducted by mailing a copy of the draft guide to 11 researchers, field managers, and planners to check accuracy of the information presented in the draft guide. Reviewer comments were used to revise the guide.

A survey was created to address the readers' understandability of the guide and the ability to implement the recommendations presented (Appendix B). The survey was approved through the University of Minnesota Institutional Review Board: Human Subjects Committee (code 0110E11121). The survey was sent to 110 people who participate in forest resource

management in Minnesota. The management guide was included with each mailed survey. Each respondent was asked to read the guide before filling out the survey.

Participants in the Minnesota Forest Resources Council Landscape Program Northeast and North Central regions were mailed the survey and guide. At the time of the mailing there were 92 participants in this program ranging from private forest owners, County land managers, US Forest Service planners, State Department of Natural Resources wildlife and forestry planners, industrial foresters, and forest resource stakeholder group representatives (wildlife, recreation, environmental, forest industry). Due to the limited number of field personnel in this group, additional surveys and guides were distributed to 18 Federal (3), State (3), County (6), and forest industry field foresters (6).

The survey was designed to collect information on a variety of aspects of native plant community management (Appendix B). Demographic information was collected including how long the respondent had been involved in forestry, what their personal status and title was, and if they had participated in workshops on sustainability and landscape management. The first question asked about their understanding of the different topics within the management guide. Their ability to implement the landscape and site-level recommendations was assessed in the second question, including listing impediments. The third question asked about how well the respondent felt that the material was presented. Lastly, their overall use of the information in the guide was evaluated.

All of the survey questions had space available for comments. After reviewing the comment sections, minor revisions were made to the document to make it more readable. An additional section was also added to the management guide to address the landscape and site-level impediments to implementation that were evaluated in the second question of the survey.

There were three phases in sending out the survey and soliciting replies. Initially the survey and guide were emailed to everyone. Two weeks later they were surface mailed to non-respondents. A self-addressed stamped envelope was enclosed for returning the survey. Lastly, the week of the survey deadline, a reminder was emailed out to all remaining non-respondents. This is a modification of the Dillman method.[1]

Results

The overall return rate for the survey was 52 percent (57 returned out of 110 mailed). The majority of surveys were entirely filled out. Appendix C has a tabular summary of the data collected from the surveys.

[1] Dillman, D.A. 1978. Mail and telephone surveys: The total design method. John Wiley & Sons, Inc., New York. 325 p.

Demographics

Respondents self selected which personal description suited them and the number of years of forestry experience they had. Responses were received from all four personal description groups: field forester (21), forest planner (11), nonindustrial private forest owner (5), other - forest recreational user, general citizen, etc. (20). The average years of forestry experience was 15.0 years with a standard deviation (SD) of 12.4. The maximum was 48 years and the minimum was 0 years (Figure 1).

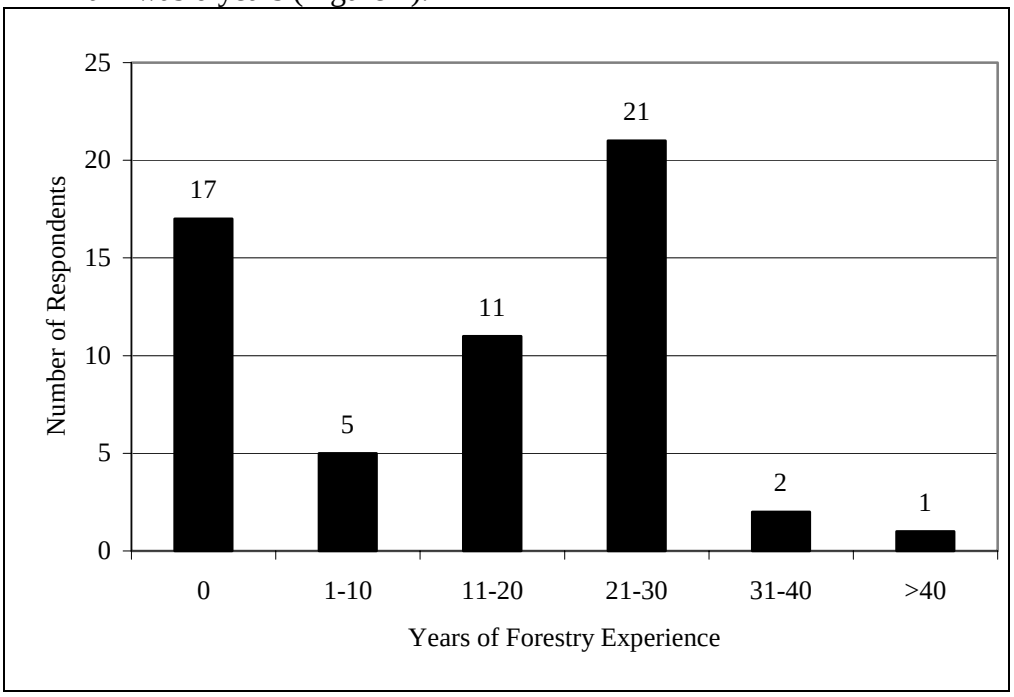


Figure 1. Summary of years of forestry experience reported by survey respondents (n=57).

A majority of the respondents participated in at least three of the activity groups listed (workshops on forest sustainability, workshops on landscape management, Forest Resource Council regional landscape planning committees, and multi-ownership forest management cooperatives) during the past three years (Figure 2). The average was 2.7 groups with a SD of 1.2.

When comparing the respondents' personal description and the number of activity groups in which they participated during the last three years, all types of respondents had participated in relatively high numbers of activities (Figure 3). Forest planners were most likely to participate in all four activity groups, while field foresters and "other" respondents generally participated in three activity groups. Nonindustrial private forest owners generally participated in either three or four activity groups.

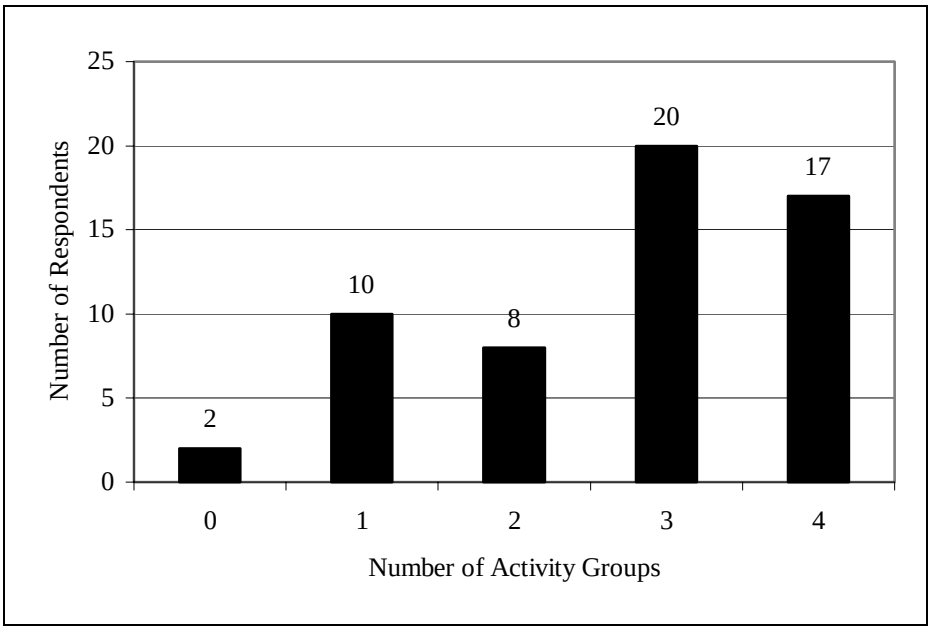
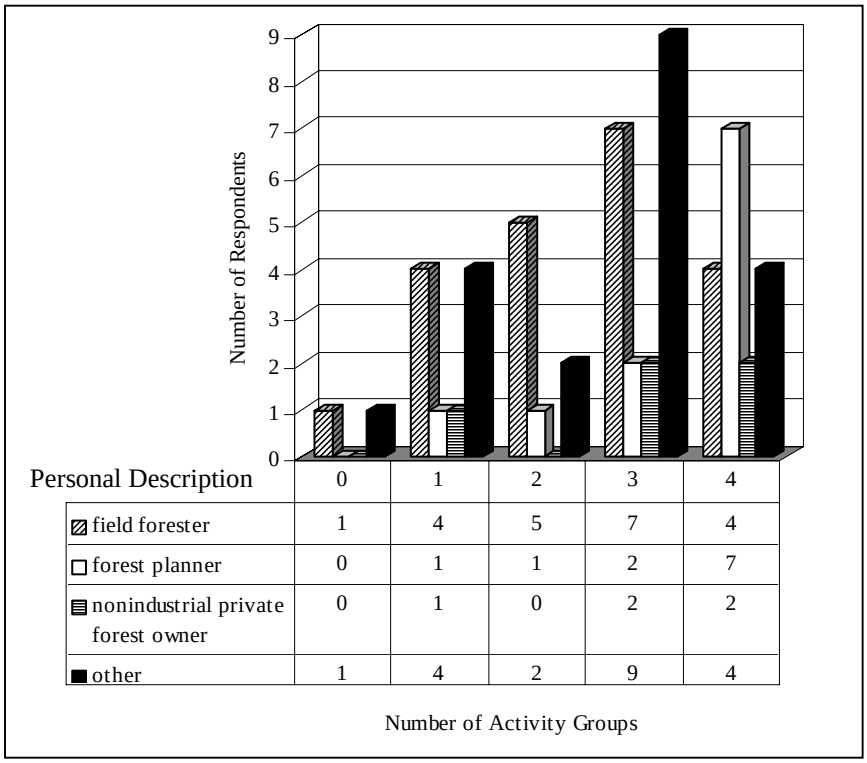


Figure 2. Summary of number of activity groups in which respondents participated during the past three years (n=57).



Personal Description	0	1	2	3	4
field forester	1	4	5	7	4
forest planner	0	1	1	2	7
nonindustrial private forest owner	0	1	0	2	2
other	1	4	2	9	4

Figure 3. Summary of relationship between personal description and number of activity groups in which respondents participated during the past three years (n=57).

Understanding

Understanding of each concept presented in the management guide was rated between medium to high (Table 1). One noticeable difference in the data is a slightly lower reported average level of understanding of the mesic and dry-mesic white-red pine plant community and the site-level management recommendations. The average level of understanding of all respondents across all concepts is 2.1 with a SD of 0.9.

Table 1. Summary of responses concerning the level of understanding about the concepts presented within the various sections of the management guide (Level of Understanding: 1 = High, 3 = Medium, 5 = Low).

Concepts	Level of Understanding					*Reponses (n)*	*Average*
	1	*2*	*3*	*4*	*5*		
What is a Native Plant Community?	21	22	9	3	2	57	2.00
Mesic and Dry-mesic White-red Pine Native Plant Community Description	18	22	7	9	1	57	2.18
Landscape Management Strategies	19	22	10	4	1	56	2.04
Site-level Management Recommendations	20	18	9	8	1	56	2.14
Practical Examples	16	25	10	3	1	55	2.05

When comparing the level of understanding by personal description, the overall trend is skewed towards a high level of understanding for all descriptions except the nonindustrial private forest owner category (Table 2). That category may show a lower level of understanding due to reduced levels of education and training focused on the concepts presented in the management guide. However, since there are only five responses from this group, it is difficult to draw more specific conclusions.

Table 2. Summary of responses concerning the average level of understanding by the various personal descriptions for all the concepts presented within the management guide (percent is listed in "()").

Average rating of understanding for all concepts	Personal Description			
	field forester	forest planner	Nonindustrial private forest owner	Other
1-1.9 (High)	15 (71)	4 (36)	2 (40)	10 (50)
2-2.9	4 (19)	7 (64)	2 (40)	2 (10)
3-3.9 (Medium)	1 (5)	0	1 (20)	6 (30)
4-4.9	1 (5)	0	0	2 (10)
5 (Low)	0	0	0	0

Implementation

The second survey question assessed the feasibility of the respondents to implement the landscape and site-level management recommendations presented within the management guide. There were 11 surveys with no answers in this section; seven of which came from the Other personal description category. In general, the landscape and site-level parts of the question received similar responses with a median of 3 and slightly skewed towards little feasibility (Figure 4). When looking at the average of the responses, the site-level recommendations are

slightly more feasible to implement than the landscape strategies (averages of 3.2 and 3.3, respectively).

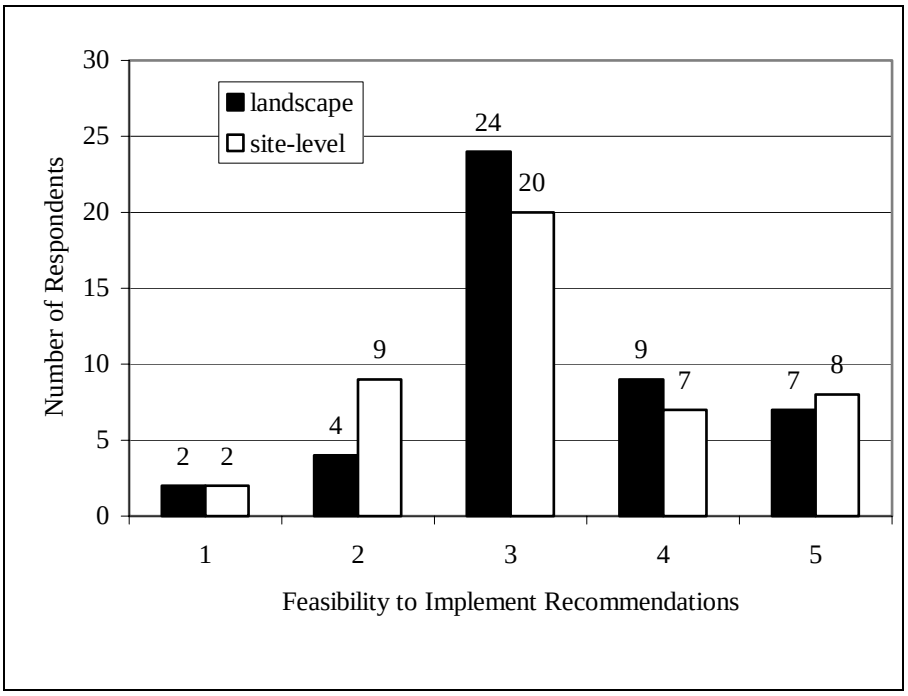


Figure 4. Summary of responses concerning the feasibility to implement the landscape and site-level management recommendations presented in the management guide (1=high, 3=somewhat, 5=little) (n=46).

Respondents could also identify one or more constraints that they felt might impact the implementation of the landscape and site-level strategies. Numerous people did not respond to this part of the questions. Of the items listed, lack of money, lack of time, and lack of professional staff were the three most frequently cited constraints for both landscape and site-level recommendations responses (Table 3). Also inability to coordinate externally was a high constraint in the landscape strategies. Some of the other answers included "no ability", "economic", and "wildlife".

Presentation

The third question addressed the overall presentation of the management guide. It was rated on a scale of 1 to 5, 1 being a "great presentation", 3 an "average presentation", and 5 a "poor presentation". Two respondents did not answer this question. When looking at all the responses, the average rating was 2.2 (SD 0.7) (Figure 5). Written remarks on the presentation were also provided in many of the comment areas within the survey. These comments varied greatly from “good explanation” to “tough to read”. Many comments were vague and some provided specific editorial ideas. These ideas were reviewed and, to the extent possible, incorporated into the final version of the management guide. There were many comments highlighting impediments to the management strategies. These were used with the comments in questions two and three to assist in adding the additional section on impediments.

Table 3. Summary of constraints that might limit the ability of respondents to implement landscape and site-level recommendations presented within the management guide. Respondents could select more than one constraint.

Constraints	Number of Responses for Landscape Recommendations (n=42)	Number of Responses for Site-Level Recommendations (n=40)
Lack of Money	16	15
Lack of Time	14	15
Lack of Professional Staff	12	11
Inability to Coordinate (externally)	12	6
Lack of Data	7	9
Lack of Proper Equipment	7	8
Other - No Ability / Understanding / Experience	8	6
Other	7	7
Inability to Coordinate (internally)	5	4
Other - Wildlife	4	5
Lack of Administrative Staff	4	2
Other - Economic	3	3

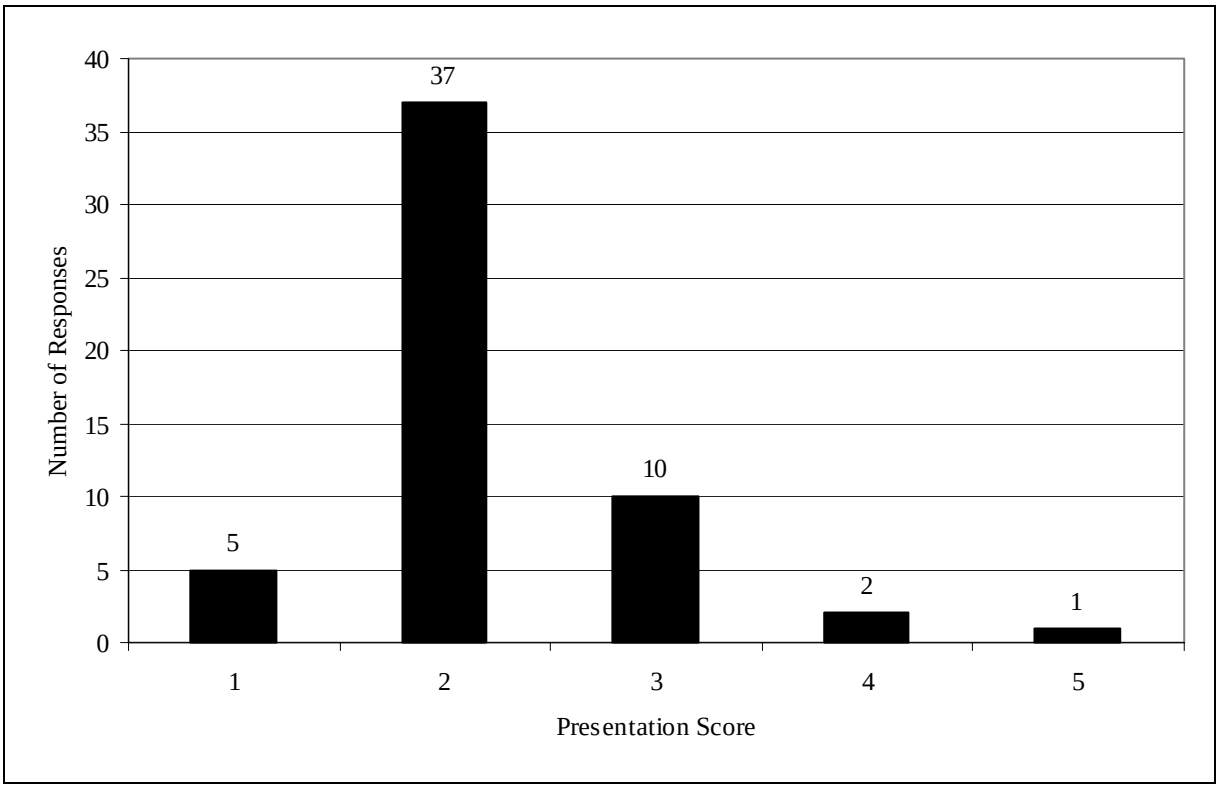


Figure 5. Summary of responses concerning the level of presentation of the material contained in the management guide (1 = great presentation, 3 = average presentation, 5 = poor presentation) (n = 55).

Applicability

The last question looked at the overall ability of respondents to use this guide. The question was rated using a scale of 1 "will be used / referenced frequently", 3 "used occasionally", and 5 "will not be utilized". Eleven people did not answer this question; eight of which came from the Other personal category. Of those respondents that did answer the question, the average was 2.8 (SD 1.2) (Figure 6).

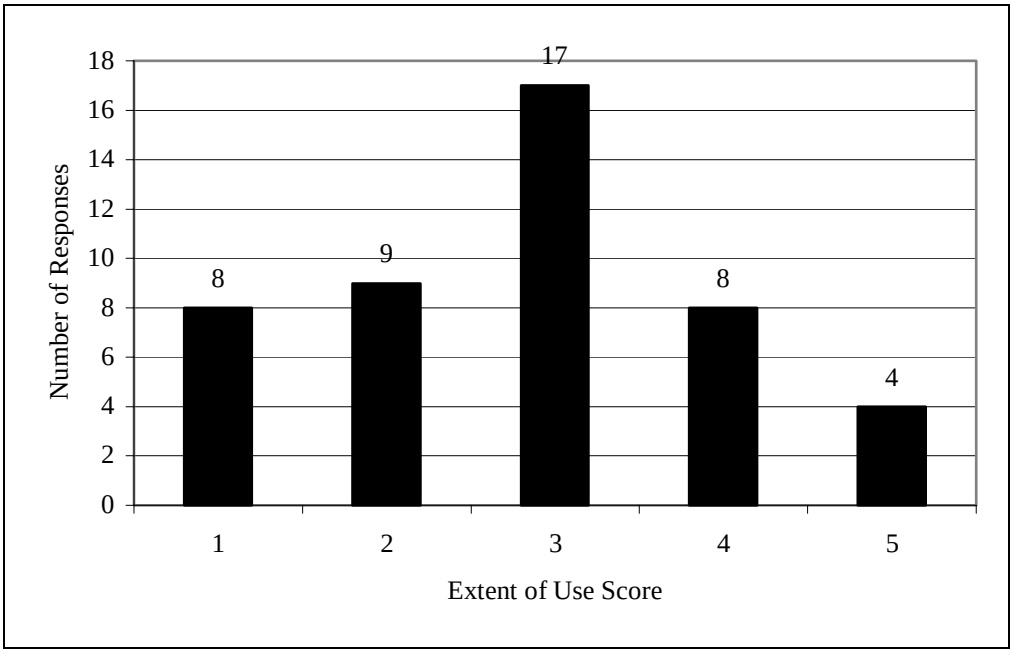


Figure 6. Summary of responses concerning the extent to which the management strategies will be applied (1 = will be used / referenced frequently, 3 = used occasionally, 5 = will not be utilized) (n = 46).

Many of the miscellaneous comments provided at the end of the survey described various constraints. One thing that was mentioned several times by non-industrial private forestland owners and the Other personal category respondents was the difficulty to use the strategies and recommendations. This relates to many factors, not only a lower-level of understanding of the concepts (Table 2), but also a smaller land area to work with, and the possibility of the land being sold. Also, wildlife and economic constraints were mentioned here. These comments, along with information from the listing of impediments in the implementation question, were used to add an additional section to the management guide. The section was added at the end of the landscape and site-level recommendation section to address the impediments identified in the survey.

Discussion

The survey questions focused on four general topics. The first was the general understanding of the concepts presented in the guide. The survey showed that most people who are involved with natural resource management have a good understanding of native plant communities and the landscape and site-level recommendations presented in the guide. This indicates that respondents have become familiar with native plant community concepts. Sources of that information might come from college coursework, articles and literature on these topics, continuing education, and specialized training provided within various agencies.

Secondly, the ability to use the guide and implement the strategies and recommendations was examined. In both these questions, the response fell right in the middle, with not a lot of commitment, but not a lot of resentment either. This shows that even though people understand the ideas, they do not know how well they can be implemented in the field.

Thirdly, the respondents selected impediments to the recommendations. The major impediments for both landscape and site-level recommendations were lack of resources (time, money, and trained professional staff). Many of the impediments the respondents listed could link to their ability to implement the landscape and site-level recommendations of mimicking natural disturbances to promote native plant communities. There are two ways to mimic natural disturbances. One is through creating the natural disturbance (i.e., prescribed burning). The other is to emulate the disturbance (i.e., silvicultural methods). Creating natural disturbances requires many resources to first create and then to control the disturbance. Some of the respondents specifically mention this while others most likely account for it in their listing of the top three impediments selected. It is important to note that silvicultural methods can also be used to mimic natural disturbances, and that these methods may not require the same amount of resources as creating natural disturbances.

The last topic was the presentation of the material in the guide. Overall, it appears that the format of the guide was well-accepted. Many editorial comments were provided from the respondents and were utilized in editing the final version of the management guide. Since the management guide was intended to be for an audience that did not have a science degree, it most likely was readable by both the professional and non-professional respondents. This is shown in Table 1 with an average understanding for each concept above Medium, towards High.

So the question becomes: given these perceived impediments, how likely will native plant community landscape and site-level recommendations presented in the management guide be implemented? Since the main impediments come back to resource constraints, it will take some time to see what the true economic costs and returns are from managing land based on native plant community concepts. Since the material in the management guide was well-understood overall, it is likely these ideas will be incorporated into various forest management activities throughout the state where feasilbe. Some organizations have begun to incorporate native plant community concepts in their management plans and reports including the Chippewa National Forest, Minnesota Department of Natural Resources, Minnesota Forest Resources Council, Superior National Forest, The Nature Conservancy, and UPM - Blandin. The extent to which the impediments actually prohibit these types of recommendations will become better known over time.

Conclusion

This research provided insight into the level of understanding of native plant community concepts by forest managers, forest planners, and citizens involved with landscape-level forest management. It has also identified some of the impediments to using landscape and site-level strategies for managing native plant communities.

The understanding of these concepts is pretty good. This does not necessarily mean that there is not a need for more education in this area. But it does show that the education provided to these audiences has been sufficient to build a base-level of knowledge.

There are some important obstacles that can impede the implementation of landscape and site-level strategies relating to native plant communities. Some of the impediments include lack of time, money, and professional staff. Addressing this lack of resources may be difficult for organizations faced with both budgetary problems and lack of available staff to accomplish the various other tasks (i.e., it becomes a matter of setting priorities).

The material in the management guide was presented as something new to forest management, which may be why many people were not sure of its feasibility. New strategies can fit into our current systems by slowly integrating the ideas over time. This slow integration has begun to occur through educational programming and by finding potential areas in management plans where native plant community components can be enhanced.

The purpose of bringing together different concepts into one guide was successful. In reviewing the comments, a few missing pieces were identified by the respondents. One missing piece was the need to reference the importance of meeting landowner objectives when implementing the strategies in the management guide. Another piece that can be useful is incorporating plant community field classification keys. After reviewing the surveys, the management guide was revised. Additional references to available classification keys were added. Also discussion on the importance of landowner objectives was added. Lastly, an additional section was added that discussed the impediments to site and landscape-level management within native plant communities.

Overall the guide was well-accepted. One problem encountered from the respondents and reviewers was the uncertainty of the “audience” for the guide. Was it for the general public, or foresters? The audience was “people involved in forest management”. In order to write to this audience, the overall language was less technical. Because of this, some respondents said the guide was too vague, while others said it had too much detail. There is a need for management guides to clearly define their audiences. If potential audiences have different backgrounds, it may be necessary to provide multiple levels of a guide. In all, the guide was successful in providing native plant community information to this broad ranging audience. There is likely a need for similar guides with more audience-specific language.

Appendix A: Native Plant Community Management Guide for Mesic and Dry-Mesic White-Red Pine in Northern Minnesota

Native Plant Communities Management Guide for Mesic and Dry-Mesic White-Red Pine in Northern Minnesota

Native Plant Communities Management Guide for Mesic and Dry-Mesic White-Red Pine in Northern Minnesota

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St.Paul, MN

May 13, 2001
Revised January 13, 2002

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Section 1

Background

"I want to manage for more white and red pine." "I want to manage in a way that is similar to natural ecological processes." This document is a guide to help a person understand and achieve these objectives. The first section gives a general discussion on native plant communities and the white-red pine native plant community types. The second section provides general management strategies for maintaining and/or recreating these community types in appropriate areas. Next, two forest management scenerios are provided that highlight the information presented in the previous sections. Finally, specific literature is referenced that can be utilized to explore these topics in more detail. This general management guide is meant to provide insight into managing white-red pine communities. It does not provide details on methods for replicating fire disturbance, planting, seeding, timber removal, etc. Instead, it is a tool that can be used with other resources to assist foresters and planners in understanding and managing Northern Minnesota's forests on a landscape and site-level scale.

What is a Native Plant Community?

A native plant community consists of two parts. The term "community" implies interaction of species. As stated by Helms (1998) it is "an assemblage of plants and animals living together and occupying a given area". This is a continuous interaction that occurs over time. "Native" represents a time period, usually prior to European settlement where the plant community appeared to be in a continuous cycle of specific interactions. Often many non-organic (abiotic) elements (soil, climate, geomorphology) affect the cycle of interactions that form a specific plant community. The naming of distinct native plant communities frequently relates to abiotic characteristics like soil moisture (mesic i.e. wet vs. dry) and the species that tend to dominate during the later successional stages of the community (white pine, jack pine, maple, etc.).

So what is a native plant community? It is not a stand of white pine trees. It is a stand of white pine trees that prefer certain climates, soils, landforms, and natural disturbances and contain specific micro and macro organisms that may not occur in other places. It could also be a forest currently containing no white pine, which has the potential for white pine to be present in the future, perhaps in 50 to 100 years. In both cases forbs, grasses, and shrubs that also favor these conditions would be present. In order to know what a native plant community is you must look at a forest from the forest floor to the canopy and see what plants interact with each other given the different abiotic (soil, climate,

disturbances), and biotic (plants, animals, invertebrates) features in that area (MNDNR, 1999).

Traditionally the term native plant communities is used to describe the current condition of an area (Frelich, 1999). In this paper I use the term to describe both what is currently on a site and what the potential is for a site.

Mesic and Dry-Mesic White-Red Pine Native Plant Community Description

Stand and Site Characteristics

In Minnesota, white-red pine native plant communities are located in northern part of the state. There have been two research projects that have mapped out the potential distribution of plant communities in northern Minnesota, one focusing in the northern superior uplands (White and Host, 2000) and the other in the drift and lake plains ecological section (Shadis and Almendinger, 1999). Figure 1 highlights the areas in these sections where mesic and dry-mesic pine native plant communities have the potential to exist.

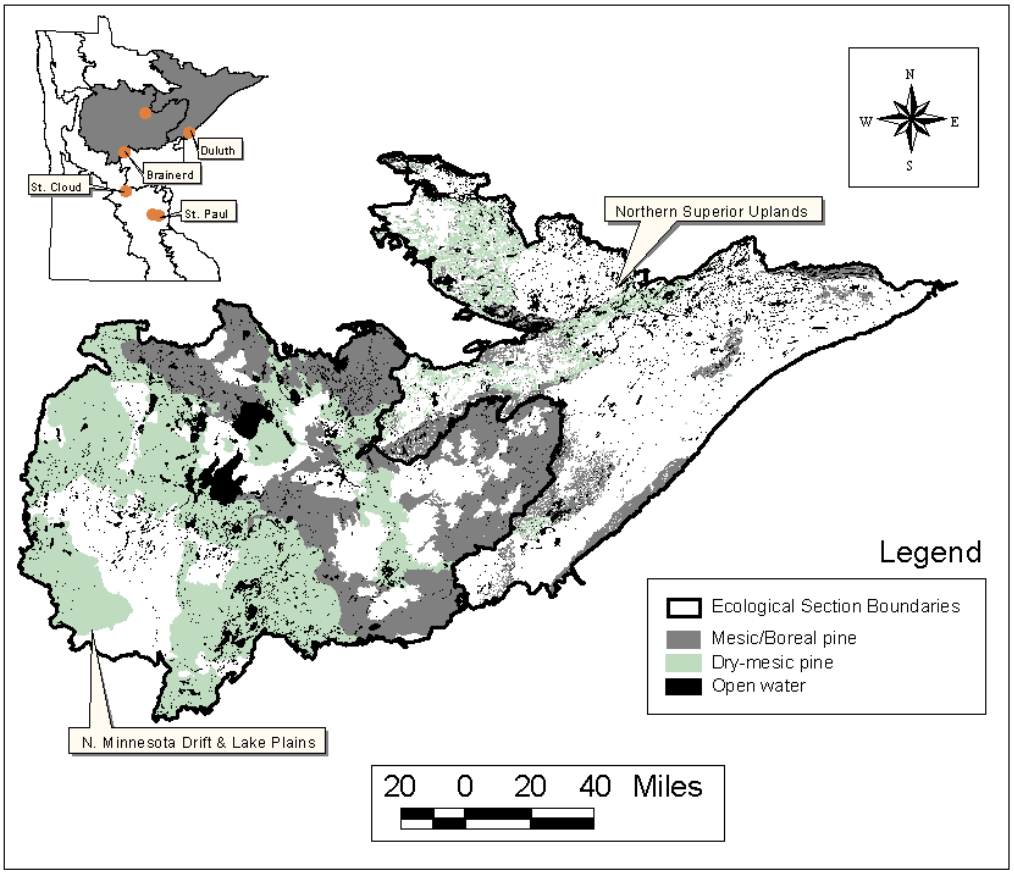

Figure 1. Potential locations of mesic/boreal and dry-mesic pine native plant communities for the northern superior uplands (White and Host, 2000) and the drift and lake plains (Shadis and Almendinger, 1999) ecological sections.

These pine plant communities can contain many associated tree species including: paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), white spruce(*Picea glauca*), balsam fir (*Abies balsamea*), red pine (*Pinus rubrum*), and white pine (*Pinus strobus*) (Frelich, 1999). There are also many forbs and shrub species found in these site including: beaked hazel (*Corylus cornuta*), rose twisted-stalk (*Strepopus* roseus), thimbleberry (*Rubus parviflorus*), and fly honeysuckle (*Lonicera Canadensis*) (Lee, 2000). They develop on moist to somewhat dry soils, and white-red pines dominate the stands in later successional stages. Often red pine will grow more abundantly on well-drained sandy/loamy soils and white pine more abundantly on silty/loamy moist soils (Burns and Honkala, 1990). During the seedling development stage white pine is more successful in shady areas than red pine. After this stage both species grow more productively with increased light. Historically (prior to European settlement) these stands developed after major fires and were maintained by low-intensity surface fires (Frelich, 1992).

The basic successional path of this native plant community begins after a stand destroying fire or wind disturbance when birch and other shade-intolerant hardwood species start to grow. After about 20 to 40 years white-red seedliongs become established from scattered mature trees that provided a seed source after the disturbance. Between 40 and 100 years after the disturbance, the pines start to dominate, and spruce and fir may develop in the understory (Frelich, 1992). Red pines may live as long as 400 years, white pine as long as 500. At several times during this successional path, surface fires occur that reduce the competing hardwood, spruce/fir, and shrub species, thus helping increase pine growth. Also many hardwood species are short-lived and shade-intolerant so they die-off quickly as the pines dominate after 100 years. Major disturbances like fire or wind may destroy a majority of the trees every 100-500 years in a stand and the cycle reinitiates (Figure 2).

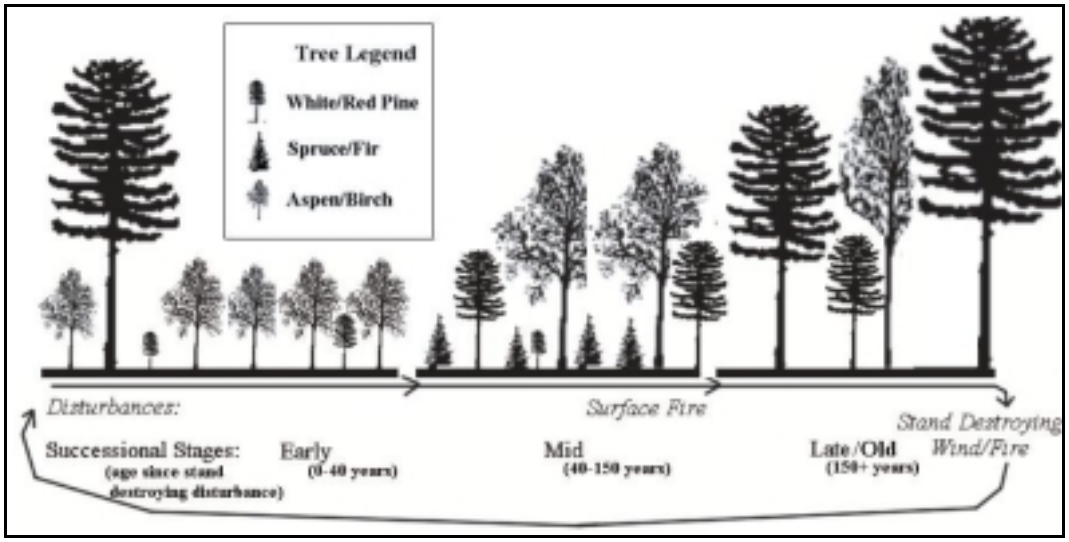

Figure 2. Stand development of the white-red pine native plant community types based on natural disturbances.

It is important to note that Figure 2 highlights the succession of this plant community when disturbances occur at their natural rate. If fire is removed from the community, or human caused disturbances take place the succession of this community would change. One example is removing fire and harvesting would cause the late/old succession to succeed to spruce and fir as the pine died out. Also at any point harvesting could take place that could set the succession back to the early stage. And at anytime planting could take place that might change the composition of the plant community. The focus of this guide is only on the natural sequence of succession stages as depicted in Figure 2.

Sizes, Rotations, and Intensities of Natural Disturbances

Many natural disturbances occur in Northern Minnesota that affect the structure of all the forests, including the white-red pine plant communities. Specific abiotic disturbances are fire and wind. The following text and tables briefly describe these disturbances.

First, the size of forests affected by disturbances varies primarily based on the type of disturbance (Table 1). Some disturbances are very intense, like stand destroying fires, and some are not intense like surface fires that only harm younger plants or winds that form small gaps (cause select trees to blowdown). Disturbances often occur at very different sizes depending on long- and short-term atmospheric conditions like drought or cold fronts.

Table 1. General sizes of disturbances that affect natural communities, in Northern Minnesota (acres).

Disturbance	Range of sizes per occurrence
Stand destroying fire[A]	60 – 400,000
Surface fire[A]	20 – 1,000
Stand destroying wind[B]	20 – 50,000
Gap forming wind[C]	0.001 – 0.07

Sources: [A] Heinselman, 1973; [B] Canham and Loucks, 1984; [C] Webb, 1989

Also, these natural disturbances affect forests at different frequencies (Table 2). The majority of the forest developed with major disturbances taking place every 150 to 300 years. But even less intense disturbances, like surface fires and minor windstorms, helped create openings for species to grow in this plant community.

Table 2. General frequency between various disturbances that affect natural communities in Northern Minnesota (years).

Disturbance	Frequency in years between occurrences (at the same location)
Stand destroying fire[A]	150-300
Surface fire[A]	40
Stand destroying wind[B]	1000-2000
Gap forming wind[C]	>2000

Sources: [A] Heinselman, 1973; [B] Canham and Loucks, 1984; [C] Webb, 1989

Table 3 is an example of looking at the frequency of disturbances compared to different management unit sizes (total area managed). It shows there is a range of acres that can be managed each year. If a manager has 50,000 acres that they would like to manage for white-red pine, they would mimic stand destroying fire disturbances on 167-333 acres per year. They would mimic surface fire on about 1,250 acres. In total, management would occur on at least 2,934 acres. How the acres are located (spatially) should be influenced on the current conditions of the land (see Site-Level Management Recommendations section). Also these acres should be located based on the characteristics of the natural disturbances being replicated. Mimicking stand destroying fire might occur on larger tracts of land, while mimicking surface fires may occur on smaller areas.

Table 3. Yearly acres to treat based on natural disturbance and management unit sizes (acres).

Disturbance	Entire management unit size for white-red pine				
	50,000	25,000	10,000	5,000	1,000
Stand destroying fire	167-333	84-167	33 – 67	17-33	3-7
Surface fire	1,250	625	250	125	25
Stand destroying wind	25-50	13-25	5-10	2.5-5	0.5-1
Gap forming wind	25	13	5	2.5	0.5
Total acres to treat	1,467-1,658	734-829	293-332	147-165.5	29-33.5

Disturbances also have various intensities (Table 4). Intensity directly affects what parts of the forest are affected by the disturbance. A stand leveling fire destroys everything from regeneration, to the understory and the overstory. Wind mainly affects the overstory, with some damage to the understory and regeneration. A surface fire will usually destroy regeneration, some of the understory, and very little of the overstory. Lastly, less severe winds (gap forming) tend to impact only select older trees.

Table 4. General intensity of disturbances that affect natural communities in Northern Minnesota (acres).

Disturbance	Intensity	Description of areas affected
Stand destroying fire	High	all vegetation layers, variable
Surface fire	Medium	younger and understory vegetation layers
Stand destroying wind	High	overstory vegetation layers
Gap forming wind	Low	Select older vegetation layers, and shallow soil areas, variable

These tables highlight key information about natural disturbance that occur in Northern Minnesota. This information is useful is setting up strategies to manage a forest based on emulating some of these disturbances.

Section 2

Management Strategies

The following landscape and site-level strategies are for landowners that would like to increase the amount of native communities on suitable sites. Examples of this objective are: "I want to manage for more white and red pine," or "I want to manage in a way that is similar to natural ecological processes." Other objectives that can be reached include increasing wildlife habitat and earning money from the land through timber harvesting. Although, in the end of this section many impediments to doing this type of management are presented that should be considered. These management strategies may not be suitable for every landowner and should only be part of a larger management plan for an area.

Landscape Management Strategies

There are several strategies for management based on natural disturbances.

- **Mimic natural disturbances that you can control.** Most fires can be controlled (created, slowed down, and eventually stopped) and thus fire is a good disturbance to replicate. Since wind cannot be controlled it is better to salvage and mimic fire after wind events occur. Basically, be knowledgeable of what natural disturbances you are emulating. Consider the effects of the type, size, intensity, and frequency (previous section) of the disturbance, to the land you are managing. Adjust your disturbance to fit what you are trying to mimic. Specifically learn the methods to do prescribed burning, thinning, harvesting, and other silvicultural operations on the land to mimic natural disturbances.
- **Have flexible management plans.** If you plan on replicating a fire disturbance once a year and a major wind event happens, adjust your management plan to salvage timber from the wind event and reduce, or eliminate, management that would have occurred to replicate fire. Another example is if you want to replicate fire disturbance, but there are several dry years. In this case, wait to conduct prescribed burning until an appropriate time when the fire can be controlled. You will end up burning more when the fire is finally established, but often natural disturbances occur sporadically like this in nature.
- **Apply management treatments to larger tracts of continuous land.** This is economically and biologically beneficial. Economically, there would be less roads to build, less distance to travel, and fewer entries needed. Native plant communities are considered to contain a diverse and large amount of

biodiversity (variety and abundance of living organisms), and have developed from major disturbances greater than the current 10 to 20 acre size of managed stands. To accomplish this, coordination across multiple ownerships may be necessary and public acceptance must be developed.

- **Be patient.** Managing for white-red pine plant community types doesn't mean there is going to be a lot more white-red pine in Minnesota over the next 5, 10, or even 20 years. What it means is that in the future there will be a higher probability of these plant communities existing as they did in the past. But this future may not occur for at least 50 to 150 years.

Site-Level Management Recommendations

These recommendations are only for sites suitable for sites for mesic and dry-mesic pine plant communities. There are field keys that can help determine if a site is suitable (Almendinger and Hanson, 1998; Kotar and Burger, 2000). The key below provides management recommendations based on the current condition of the area being managed. The lettered and numbered items represent different possible conditions of the forest. The italics items are management recommendations for each condition. After the key a descriptions for each management recommendation is provided. These recommendations came from detailed descriptions in the management literature listed in the references section (Burns and Honkala, 1990; Johnson, 1995; Logan, and Fletcher, 1997; MNDNR, 1996; Zastrow, 1992). Only sites suited (proper soil, climate, and landowner objectives) for white-red pine plant communities should be managed as such. Trying to establish these communities on inappropriate sites will at most be minimally successful.

Management recommendation key

The stand:

a) contains species found in white-red pine native communities (Figure 2)
   1. Early succession species and contains pine regeneration (0-40 years since a major disturbance)
      Leave alone
   2. Mid succession species or does not contain pine regeneration (40-150 years)
      Emulate low intensity fire
   3. Late-succession species (150-200 years)
      Emulate major fire (thinning / shelterwood silviculture)
   4. Old-succession species (200 + years)
      Emulate major fire (shelterwood/seed tree silviculture)

b) does not contain species found in white-red pine native plant communities
   Emulate major fire, plant or seed

Management descriptions

Emulate Low Intensity Fire – First you should emulate a fire that kills the fire intolerant tree species by removing the majority of the overstory hardwoods, spruce, and fir species using selective logging. Leave pines for future forest structure and as a seed source. Complete site preparation that reduces competition for the regenerating pines (low intensity burn, raking, disking, or chemical spraying). If pines are not present on the site,

then do some *planting or seeding* to establish them. This management can be repeated several times within a stand over the 150-300 years before a major fire event is emulated.

Emulate major fire – Remove the majority of all tree species in the overstory and understory. If the stand contains late succession pine species, leave groups (at least 2-3 trees per group) of these for seeding, shelter, and to provide future old succession structure (thinning / shelterwood silviculture). If the stand is in the old stage, remove most trees but leave select trees to provide shade, seeds, and future snags for the site (shelterwood / seed tree silviculture). Create a high intensity prescribed burn that removes most of the remaining seedlings and understory after harvesting (note that many special considerations need to be made when creating high intensity burns that will not be discussed here). This method is similar to clearcutting, but it is important to leave groups of older pine trees in the stand to increase not only seeding and regeneration, but also other biological effects like decomposition into snags and overstory connectivity for use by wildlife species. If no pines are on the site, then some *planting or seeding* may need to be completed.

Planting or seeding – Do this after harvest and control burn activities have been completed. Depending on the size of area being managed, site conditions, and budget, pines seeds can be spread around or seedlings planted to establish the pine component back into the plant community. It is important to consider site-level characteristics (soil moisture, amount of shade, slope, seed sources, blister rust zones, wildlife browsing, etc.) of the stand when planting and seeding pine species. Also utilizing seed from similar nearby sites or from the same seed zone can increase the success of the seedlings (Anderson, 2000).

Landscape and site-level management impediments

There are several impediments to white-red pine plant community management that need to be considered. The following impediments were identified by survey reviewers who evaluated this guide. The top three impediments relate to concerns about having available the necessary resources (i.e., money, time, and professional staff) to implement these strategies. Related to the concern about availability of adequate resources, one respondent indicated that it is difficult to expand programs due to other budget needs, combined with increased responsibilities of field personnel (e.g., implement forest management guidelines, attend more training, meet day-to-day demands with reduced staffing).

The main reason resources are a major impediment is because it is not simple for a forest manger or forest management agency to quickly change how they manage forests. Changing management practices not only involves a shift in philosophy, but also requires additional education and training. For large landowners, upper-level management must first strongly advocate the need for a shift in philosophy before on-the-ground field managers will alter their approaches. For small non-industrial private landowners adjusting management styles is simpler, but to reach landscape objectives more resources and time may be needed to establish and maintain forest cooperatives. All landowner groups will need additional training before they can feel comfortable implementing these new approaches.

Other impediments which were written in by respondents were lack of ability / understanding / experience, and wildlife concerns. Some respondents noted specific concerns about deer and blister rust associated with expanded white pine management. Prescribed burns or other management approaches that mimic fire were also listed. Many times, it is difficult for landowners to do prescribed burns although coordination with neighboring landowners can make this more feasible. Applying other strategies that mimic fires like disking, raking, and harvesting, may be more feasible for many landowners.

The other concern was wildlife. Recommendations should promote native wildlife, which may decrease habitat for non-native species. Also, some organisms can negatively affect attempts to reintroduce native plant species. Deer can be a problem when attempting to regenerate pine because they tend to eat the buds off of the saplings. Bud capping (stapling a piece of paper around the terminal bud) can reduce the risk of deer killing saplings. Blister rust is a fungus that can kill white pine. Pruning white pine and planting seeds and saplings from white pine that have not been affected by blister rust can reduce the risk of this fungus. But, bud capping and pruning require additional resources. As these recommendations are attempted by different organizations, their feasibility will be tested.

Section 3

Practical Examples

There are some new and old ideas in this guide, but why manage a forest based on a native plant community? To answer this lets look at the definition of forest management. As defined by Helms (1998):

> *The practical application of biological, physical, quantitative, managerial, economic, social, and policy principles to the regeneration, management, utilization, and conservation of forest to meet specific goals and objectives while maintaining the productivity of the forest.*

Native plant community concepts are directly developed from biological and physical principles of the forest and thus are very useful in maintaining forests. Also, our society has shown an interest in these ideas, which provides social principles for managing native plant communities. The previous text was meant to provide several strategies and methods to replicate disturbance regimes

The next two fictional scenarios go through examples of how management could increase white-red pine native plant community types. These scenarios highlight some of the information presented in the previous sections. These scenarios are by no means complete illustrations but are only meant to get the reader thinking about the concepts.

Scenario 1 – Site-level management

The Minnesota Department of Natural Resources begins managing some of its northern forests in a manner that, to the degree possible, replicates natural disturbances. Since white-red pines are not very abundant on their land, the DNR locates 20,000 acres where these communities have the potential to exist (Figure 1), and does an inventory of those areas on what is currently there (Table 5). They find that there are 15,000 acres where white-red pine is a component of the stand, and another 5,000 acres where white-red pine is not a component.

Table 5. Management acres for scenario 1.

Status of area	Current acres	Rotation age	Yearly management acres
Early succession white-red pine present	10,000	40-60	200
Mid succession white-red pine present	4,000	200	20
Late succession white-red pine present	1,000	200	5
Old succession white-red pine present	0	0	0
Total areas with white-red pine	**15,000**	**67**	**225**
Total areas lacking white-red pine	**5,000**	**60**	**83**

Given the information from the "Sizes, Rotations, and Intensities of Natural Disturbances" and "Recommendations for white-red pine native plant community management stands" sections, they decide to go with the following site level management strategies:

- Use a rotation age between 40 and 60 for the hardwood species in early successional stands. When these stands are harvested, only remove the hardwood species, leaving most pine and spruce/fir. After harvesting, low intensity prescribed burning, or another form of site preparation should be done to remove brush.
- Pines in mid, late and old successional stands should be managed on a 200 year rotation. When pine stands are greater then 40 to 60 years, harvesting followed by low intensity prescribed burning or other site preparation should be done to reduce brush, hardwoods, and spruce/fir components. Burning may need to be repeated to keep brush out. Also periodic thinning may be done on the site every 7 to 15 years to reduce competition for regeneration. When the pines reach their rotation age, shelterwood harvesting will be completed. After harvesting, high intensity prescribed burning should be done in the stand and with the slash, removing the majority of the understory. After 10 to 20 years, some of the overstory pine may be removed, making sure to leave some for additional seed production, shelter, and other forest amenities (wildlife, recreation, biodiversity).
- In areas where white-red pine does not exist, a rotation age around 60 years should be used on the current tree species. Some tree clumps may be left to provide shelter and some shed for pine regeneration. After the harvest is completed, high intensity prescribed burning or other site preparation should be done in the stand to prepare the site by reducing the slash and removing the majority of the remaining understory. Seeding and planting of white-red pine should be done after the burning, within 2 years.
- If at any time a natural wind or fire event affects any part of this management area, salvage harvesting should be implemented. Prescribed burning should follow the harvesting and if needed planting. This area replaces harvesting in other areas that would of occurred if the natural event had not existed.

Scenario 2 – Landscape level management

A cooperative management plan is developed by the DNR, Forest Service (FS), and some county land departments. This plan covers portions of Northeastern Minnesota and one part is to increase white-red pine in appropriate areas. After compiling forest inventory data across ownerships, 90,000 acres are identified where management could focus on increasing the amount of white-red pine. Of these 90,000 acres, 75,000 contain some white-red pine, while 15,000 acres do not contain white-red pine (Table 6).

Table 6. Management acres for scenario 2.

Status of area	Current acres	Rotation age	Yearly management acres
Early succession white-red pine present	35,000	60	583
Mid succession white-red pine present	28,000	150	187
Late succession white-red pine present	2,000	150	13
Old succession white-red pine present	10,000	150	67
Total areas white-red pine present	**75,000**	**88**	**850**
Total areas lacking white-red pine	**15,000**	**60**	**250**

The plan developed included some overall recommendations and goals. It did not include silvicultural prescriptions for every acre.

- When possible, apply silvicultural management to areas larger than 50 acres.
- Use longer rotation ages, greater than 150 years, for the pine species.
- Use shorter rotation ages with hardwood species (around 40 to 60 years) on pine sites.
- Plant and seed pines (after burning) in areas with little to no pine species.
- When possible increase the amount of prescribed burning to increase regeneration of pine species through competition reduction. Can use other forms of site preparation if needed.
- Increase white-red pine acres and/or trees by 10% in the next 100 years.
- Assist in the coordination of these efforts with all levels of government and private landowners.

These management recommendations could then be used to guide the individual agencies in developing their specific management plans affecting their land and neighboring lands (see Scenario 1).

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Appendix B: Copy of Cover Letter and Survey

November 20, 2001

Dear MFRC Landscape Participant,

I am sending this memo, survey, and document in the mail to help people who were not able to print or view the document that I emailed. I have received some responses, but many people have still not responded. Please take 20 minutes to assist me in this project I am doing through the University of Minnesota. Here again is the information I provided in the memo I emailed out:

> In the past 10 years a lot of research has been conducted to show how Minnesota's forests were formed. Much of this research looked at historical data to see how disturbances influenced Minnesota's ecosystems. This information on natural disturbances can assist in managing our forests. The document I created attempts to explain this research on native plant communities and historic disturbance regimes for the white and red pine communities in Northern Minnesota. It also gives some management recommendations for emulating natural disturbances.
>
> The enclosed survey is meant to help me determine how well you understand the concepts in the document and to evaluate whether the management guidelines could occur in Northern Minnesota. Please read the enclosed management guide before completing the survey. The information you provide will not only assist in editing the guide but also in developing future guides on related subjects. This information can provide a useful tool to assist us in sustaining Minnesota's forests. All responses will be kept confidential; names of respondents will not be provided in the results.
>
> Thank you for taking time to read through the guide and answer the questions in the survey. Please return the survey by December 31, 2001 via fax (651-296-5954), email (chad.skally@dnr.state.mn.us), or mail (500 Lafayette Rd. Box 44, St.Paul, MN 55155). If you have any questions or comments feel free to contact me at 651-296-0757.

Thanks again for your help.

Sincerely,

Chad Skally

Enc. Survey, and Native Plant Communities Management Guide for Mesic and Dry-Mesic White-Red Pine in Northern Minnesota

Survey Respondent Information

Name:

Position:

Years of professional forestry experience:

Do you consider yourself a (please circle the description that is most appropriate):

A. **Field Forester**
B. **Forest Planner**
C. **Private Forest Owner**
D. **Other (forest recreational user, general citizen, etc.) Please Specify**

_____

Which of the following have you participated in during the last 3 years (please circle all that apply)?

A. **Workshops on forest sustainability**
B. **Workshops on landscape management**
C. **Forest Resource Council regional landscape planning committees**
D. **Multi-ownership forest management cooperatives (Resource Management Partnership *ReMaP*, Association of Land Commissioners *MACLC*, local woodland cooperative, etc.)**

Phone Number:

Email:

Please return the completed survey by December 31, 2001 to Chad Skally via:

Fax: **651-296-5954**
Email: **chad.skally@dnr.state.mn.us**
Mail: **500 Lafayette Rd. Box 44**
St.Paul, MN 55155

Survey

Please read the management guide before answering the following questions.

1. **What is your level of understanding about the concepts presented in each of the following management guide sections? (Use the comments areas to indicate specific ideas you have about the understandability of the concepts that were presented in each section.)**

1 = high-level of understanding 3 = medium-level 5 = low-level

a) **What is a native plant community?** 1 2 3 4 5

Comments:

b) **Mesic and Dry-Mesic White-Red pine native plant community description**
1 2 3 4 5

Comments:

c) **Landscape management strategies** 1 2 3 4 5

Comments:

d) **Site-level management recommendations** 1 2 3 4 5

Comments:

e) **Practical examples** 1 2 3 4 5

Comments:

2. How feasible is it for you to implement the landscape and site-level management strategies presented within the guide? (Please circle all constraints that limit your ability to apply these strategies.)

1 = highly feasible 3 = somewhat feasible 5 = little feasibility

a) **Landscape management strategies** 1 2 3 4 5

Constraints:

A. Lack of Time

B. Lack of Money

C. Lack of Professional Staff

D. Lack of Administrative Staff

E. Inability to Coordinate (internally)

F. Inability to Coordinate (externally)

G. Lack of Data

H. Lack of Proper Equipment

I. Other (Please Specify): _____

J. Other (Please Specify): _____

b) **Site-level management recommendations** 1 2 3 4 5

Constraints:

A. Lack of Time

B. Lack of Money

C. Lack of Professional Staff

D. Lack of Administrative Staff

E. Inability to Coordinate (internally)

F. Inability to Coordinate (externally)

G. Lack of Data

H. Lack of Proper Equipment

I. Other (Please Specify): _____

J. Other (Please Specify): _____

3. How well was the material in the document presented?

1 = great presentation 3 = average presentation 5 = poor presentation

1 2 3 4 5

Comments:

4. To what extent will you apply these strategies? (List any other final thoughts in the comments section.)

1 = will be used / referenced frequently 3 = used occasionally 5 = will not be utilized

1 2 3 4 5

Comments:

Please return the completed survey by December 31, 2001 to Chad Skally via:

Fax: 651-296-5954
Email: chad.skally@dnr.state.mn.us
Mail: 500 Lafayette Rd. Box 44
St.Paul, MN 55155

Appendix C: Summary of Survey Responses

Question Numbers / Titles																		
Forestry (Yrs)	*Job Type*	*job #*	*Workshop #*	*Workshop Types*	*1a*	*1b*	*1c*	*1d*	*1e*	*2a*	*2a #*	*2a Types*	*2a Type other*	*2b*	*2b #*	*2b Types*	*2b Type other*	*3*	*4*
14	A	1	1	B	2	3	2	3	2	5	5	ABCDH		5	5	ABCDH		2	3
31	A	1	3	ABC	1	1	1	1	1	0	3	ABF		0	5	ABFGI	deer	2	3
28	A	1	1	A	1	1	1	2	2	5	6	ABCFGI	fiber production	5	6	ABCFGI	fiber production	2	4
22	A	1	2	AB	3	4	3	4	3	3	1	I	fiber production	3	1	I	fiber production	5	3
14	A	1	0		2	4	0	0	0	4	1	B		4	1	B		3	0
25	A	1	3	ABC	1	2	1	1	2	2	2	FG		2	1	G		2	1
13	A	1	3	ABD	2	2	2	2	2	3	3	ABF		3	2	AB		3	3
27	A	1	1	A	1	2	2	1	1	4	4	CEHI	no ability to burn	3	2	HI	no ability to burn	2	4
23	A	1	2	AC	1	1	1	1	1	3	6	BDEFHJ	deer	3	6	BDEFHJ	deer	1	1
30	A	1	3	ABCD	1	1	1	1	1	2	4	BCEF		2	4	BCEF		2	1
30	A	1	2	AB	2	1	1	3	1	4	2	BG		4	2	BG		2	3
16	A	1	2	AB	2	2	1	1	1	3	4	ACEF		2	2	AE		2	1
25	A	1	2	AB	1	1	1	1	1	0	3	ABC		0	3	ABC		2	3
23	A	1	4	ABCD	1	1	1	2	2	3	1	F		3	1	F		2	3
48	A	1	1	C	2	2	3	3	3	4				3				2	0
6	A	1	4	ABCD	2	3	3	2	3	3	1	A		2				2	3
28	A	1	3	ABC	2	2	2	2	1	2	1	B		3				2	3
21	A	1	3	ABC	3	2	2	1	1	4	5	ABCDI	lack of policy and priority	5	4	ABCD		4	4
9	A	1	4	ABCD	1	1	1	1	1	1				1				3	0
30	A	1	3	ABC	4	4	4	4	4	3	1	B		3	1	B		3	3
27	A	1	4	ABCD	2	2	2	1	2	3	2	CH		3	2	CH		2	2
26	B	2	1	B	2	2	2	2	3	3	3	ACD		3	2	AC		2	2
12	B	2	4	ABCD	2	4	2	4	2	3	2	CG		4	5	ACFHI	public acceptance	3	3
20	B	2	3	ABC	2	2	4	3	3	3	4	BGI	risk of fire	3	3	BGI	risk of fire	3	4
27	B	2	4	ABCD	3	2	2	2	2	0				0				2	2
28	B	2	4	ABCD	1	1	1	1	1	1				1				2	2

Forestry (Yrs)	*Job Type*	*job #*	*Workshop #*	*Workshop Types*	*1a*	*1b*	*1c*	*1d*	*1e*	*2a*	*2a #*	*2a Types*	*2a Type other*	*2b*	*2b #*	*2b Types*	*2b Type other*	*3*	*4*
18	B	2	4	ABCD	1	2	2	2	2	3	1	G		3	1	G		2	3
17	B	2	4	ABCD	2	2	2	2	2	4	3	ABH		4	3	ABH		2	3
13	B	2	2	CD	4	1	3	3	2	0				0				2	4
20	B	2	4	ABCD	1	1	1	1	1	5	1	I	no new info	5	1	I	no new info	3	5
1	B	2	3	ABC	2	2	3	2	2	3	1	I	lack of experience	3	3	AGI	lack of experience	2	4
32	B	2	4	ABCD	1	2	2	2	2	2				2				2	2
0	C	3	3	ABC	2	3	2	2	0	4	3	ABJ	deer	4	3	ABJ	deer	2	3
0	C	3	3	ABC	1	1	1	1	1	4	3	GIJ	opinion, wildlife good	4	3	GIJ	opinion, wildlife good	2	3
0	C	3	4	ABCD	3	3	2	2	2	3	2	IJ	lack of interest, sell ideas	3	2	IJ	lack of interest, sell ideas	2	2
0	C	3	1	C	3	3	3	3	3	3	1	A		3	1	A		2	1
22	C	3	4	ABCD	2	2	2	2	2	4	2	IJ	economics, wildlfe	4	2	IJ	economics, wildlfe	2	4
0	D	4	3	ABD	3	3	4	4	4	0	1	I	no ability	0	1	I	no ability	2	0
0	D	4	3	ABC	2	2	2	2	2	0				0				3	0
0	D	4	3	ABC	2	4	4	4	2	0				0				0	0
26	D	4	3	ABC	4	4	2	3	3	3				3				4	3
0	D	4	0		3	2	3	4	3	5	1	I	no ability	5	1	I	no ability	2	5
0	D	4	3	ABC	1	1	2	2	2	3	2	AF		2	1	A		2	1
12	D	4	4	ABCD	2	2	2	1	2	3	1	AI	lack of understanding	2	1	A		1	3
0	D	4	1	C	5	4	5	5	5	0				0				3	0
0	D	4	3	ABC	2	4	3	4	4	5	1	I	no ability	5	1	I	no ability	2	5
4	D	4	4	ABCD	2	2	2	1	2	5	1	I	no ability	5	1	I	no ability	2	0
23	D	4	2	AB	1	2	1	1	2	3				3				0	0
24	D	4	3	ABC	1	1	1	2	2	3	1	I	lack of understanding	2	1	I	no ability to burn	3	2
0	D	4	1	C	3	3	3	3	3	3	3	CFH		2	2	CH		1	1
28	D	4	3	ABC	1	1	1	1	1	3	5	CEFIJ	lack of policy and priority	3	4	CEFI	lack of priority	2	1
0	D	4	4	ABCD	1	1	1	1	1	5	1	I	no ability	5	1	I	no ability	2	5
0	D	4	3	ABC	1	1	1	1	1	0				0				2	0
0	D	4	1	D	5	5	3	4	3	3				3				2	4
10	D	4	4	ABCD	1	1	2	2	2	3	4	BFHI	objectives	3	4	BCGH		1	2
0	D	4	2	AC	3	4	2	3	2	0				0				2	0
0	D	4	1	C	2	2	1	1	2	0				0				1	2