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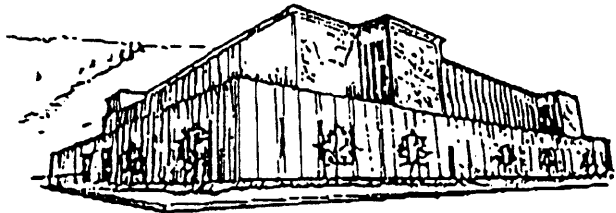
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Patrick W. Daigle

Date:

Aug 17 / 94

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A SYSTEMATIC GUIDE FOR FOREST LAND MANAGEMENT PLANNING
FOR PRIVATE LANDOWNERS

by

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Presented in partial fulfilment of the requirements
for the degree of
Master of Science (Forestry)
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1992

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Assistance for private landowners has often been biased toward timber management, rather than a balanced, multiple resource perspective. In order to make professional assistance relevant to the multiple resource goals of the landowner, a broader planning process has to be developed.

This thesis develops a step-by-step multiple-resource planning process that would help guide private consultants and public agencies in providing effective assistance to private forest landowners.

First, a planning methodology is described. This method is then demonstrated in two different planning approaches. Then, the strengths of the two approaches are combined in a planning method that identifies the steps that a natural resource professional and landowner could follow while working together to develop a forest management plan. The steps in the planning process provide a sequential guide to consider stand management treatments that address the needs of the landowner.

The results should be useful in helping private forest landowners make sound land management decisions.

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Patience is the great teacher. Though I appreciate her, I sometimes wonder if I am able to learn from her.

Bob Pfister, the twinkle in your eye -- I like it, may it always be there. In just the right moment, it saves the moment. As the Chair of my graduate committee, I thank you for your insights, patience, support, and encouragement with this project. Thanks also to David Jackson, Alan McQuillan, and Thomas Power for serving on my graduate committee and for the direction you provided.

I appreciate the insights that Bob Logan provided in regard to adult learning modes. Gary Ellingson was cooperative with respect to the Montana Forest Stewardship Cooperative initiative in Forest Stewardship for private landowners.

Roland Barger, I wish I could have finished this before you passed away. Your professional demeanour and personal kindness provided inspiration during my academic and professional work in Montana. Thank you.

During formal educational sessions at the University of Montana and while working two seasons for the United States Forest Service, I came to appreciate how fortunate I was to be able to become a technology transfer linkage from the Pacific Northwest USA to British Columbia. Though I have many people to thank for their contributions to my education, Steve Slaughter, a District Silviculturist on the Lolo National Forest, deserves special recognition. Thank you Steve; may you continue to have positive influences on forest practices in British Columbia.

I have deep gratitude for the on-going support and patience of my wife Jane during this multi-year entry into a new career.

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CHAPTER 1

STEWARDSHIP OF NON-INDUSTRIAL PRIVATE FOREST LANDS: THE PROBLEM AND PREVIOUS APPROACHES

The purpose of this study is to develop a planning process which helps non-industrial private forest (NIPF) landowners manage their holdings for a broad array of goals and uses.

1.1 The problem

Many NIPF landowners would like to understand how to achieve an array of objectives for their land. Private landowners often have extensive practical experience which can help them implement plans on their forested holdings, but they do not usually have the professional skills or information necessary to evaluate a wide range of alternatives. To develop a comprehensive management plan for their forested land, professional assistance is needed.

Highly technical information about forests tends to be the purview of professionals, who have been trained to view forest processes over periods of time that range from decades to centuries. Lay landowners generally have a limited understanding of long-term forest development.

To add to the dilemma, the landowner who wishes to consider, enhance, or protect a range of resource values has difficulty obtaining balanced professional advice from foresters and public agencies. Traditional forest assistance programs have focused on timber management, rather than on a diversity of forest resources. Foresters (consultants, and agency, and timber company employees) are frequently the only natural resource professionals providing advice and have often had too much influence in setting objectives for the private land. When the owners multi-faceted objectives have not been adequately addressed, they may reject or ignore the advice of professional natural resource managers.

1.2 Literature review

This section begins with a synopsis of how professional advice can benefit private landowners in the management of their timber resources. Then, studies of public agency attempts to make forest assistance available to private landowners are presented. Available educational resources such as forest resource curricula, books, and decision-aids are reviewed. Finally, existing literature is evaluated as it pertains to the purpose of this study.

The value of professional assistance. Jackson (1988) found interesting results while examining the effectiveness of the Montana Division of Forestry Private Forestry Assistance program through which free forestry advice is

available to NIPF landowners. Comparing the timber sales of landowners using the professional advice to timber sales where the owner was unassisted, Jackson demonstrated that assisted landowners received more money for their timber, retained residual crops that grow more quickly, and protected nonmarket values such as water quality. Professionally-assisted landowners incorporated prudent forest harvesting practices (judicious road and skidtrail design and location, protection of residual trees, and hazard reduction) more consistently and with greater success than did forestland owners who did not use professional advice.

McCurdy and Budelsky (1989) came to similar conclusions with a study of Illinois state-forester assisted timber sales compared to unassisted sales on NIPF landholdings. Cabbage (1983) obtained similar results in a Georgia study.

These studies highlight the timber value benefits associated with using professional help to design timber sales. In addition, they demonstrate that valuable professional advice can be imparted to other forest resources such as water, soils, and the forests remaining after a timber sale.

Landowner interest in forest resource education. Though researchers document that private landowners are interested in receiving information on forest management, they also indicate problems with past attempts to transfer forest

management information from government agencies and consultants to landowners (Baumgartner 1980; Force, Lee, and Folk 1987; Force and Lee 1987, 1991; Bliss and Martin 1990). Often, financial assistance or educational programs designed for private landowners (by government agencies or private companies) are too heavily timber-oriented. Private owner motivations and objectives are often diverse, and include concern for wildlife, homesite, grazing, and aesthetics (Baumgartner 1980; Kurtz et al 1984; Young and Reichenbach 1987; Force and Lee 1987; Force, Lee, and Folk 1988; Bliss and Martin 1989; Blatner, Baumgartner, and Quackenbush 1991).

Landowner comments elicited by qualitative research methods (Kingsley et al. 1988) reveal a strong sense of stewardship on the part of some NIPF owners. Force and Lee (1991) emphasize that, generally, commodity uses are neither a high priority benefit nor a reason why NIPF landholders own their land. Further, an approach to land management that clearly incorporates the needs and concerns of the NIPF owners will be more favourably received by landowners (Kurtz and Lewis 1981; Kurtz et al. 1984; Young and Reichenbach 1987; Blatner, Baumgartner, and Quackenbush 1991).

Currently available forest resource education. Minkler (1974) presents useful ecological concepts in his text Woodland Ecology and calls on private forest owners

(primarily in the eastern USA) to actively practice long-term conservation. In The Woodland Steward, Fazio (1985) provides practical ideas for management of small private forest lands (mainly in the western USA). Though these texts foster landowner awareness and understanding of woodland ecology and tutor forestland owners in a systematic manner, neither book provides a step-by-step guide to forest stewardship. These texts are basically "read-at-home" general educational materials for private forest owners.

Forest resource educators, with the aid of The Woodland Owner Curriculum (Oregon State University Extension Service 1986), can design educational programs for landowners or other groups. The complete Woodland Owner Curriculum is an intricate and skeletal inter-relationship of hierarchies for resource educators experienced in developing curricula for woodland owners. The compiler of this material states that because of its complex appearance, the Woodland Owner Curriculum may not be suitable for use with untrained NIPF landowners.

The Woodland Workbook (Oregon State University Extension Service 1990), consists of a series of booklets designed to improve small woodland owners' understanding of forest management; two of these extension circulars deal with management planning. A two-page pamphlet introducing management planning concepts for forested stands on private

ownerships is produced and distributed by the University of Idaho Cooperative Extension Service (Handley and Larson 1982). These Oregon and Idaho extension booklets deal with management planning; however, they do not provide a simple way to analyze stand management treatments and the planning process is not presented in an explicit step-by-step manner. Reid, Collins and Associates (1988) produced a handbook, *Managing Your Woodland*, to provide non-foresters with forest management information which would enable NIPF owners to manage woodland property. Although this handbook considers other forest resource values, it emphasizes management for timber production.

Bliss and Martin (1990) summarize difficulties landowners face while attempting to gain multiple-resource information from a variety of public agencies. Agencies operate independently, focus on narrow concerns, and present a variety of "programs, requirements, procedures, and personalities".

Forest management decision-aids. Weetman et al. (1990) developed a decision-aid to assist public land managers seeking alternatives to clearcutting practices in forest stands in northern British Columbia. This type of decision tree (a step-by-step framework utilizing inventory details about specific stand attributes such as structure, basal area, and residual tree acceptability) is suitable for situations in which timber production is a favoured

management objective. Weetman et al. (1990) caution qualified silviculturists to employ experience, local knowledge, and professional judgement when using this decision-aid formulated for northern British Columbia forest stands. This stand management procedure is too complicated for use with lay landowners.

Bloomfield (1974) describes a procedure for constructing a decision-tree to assist US Forest Service planners to analyze financial and forest policy problems. This decision-aid requires the user to assign objective (known) and subjective (best-estimate) probabilities and expected monetary values to management treatments. Useful for sequential decision-making problems, the decision-tree graphic can reveal necessary decision points, potential alternatives, estimated outcome (payoff or loss), and enables planners to gain a greater understanding of the situation. This complex decision aid is unsuitable for private landowners.

In order to promote an ecological approach to woodlot forestry, Courtin et al. (1989) proposed two flow charts to describe and organize distinct forest stands and accomplish effective multiple-use management on holdings in British Columbia. Though these flow charts have been developed for use on small-scale holdings, the organizational process requires substantial professional level inventory skills in

order to address woodlot ecological and operational considerations and management goals.

Not all decision-aids need be intricate. While not specifically referring to forest management issues, Yourdon (1989), reasons that we can create models or simple facsimiles of elaborate systems (such as flow charts) so that the complexities can be read and understood by users without a lot of training. Models, by focusing on important system features, enable the user to visualize what it is that he or she wants.

Kurtz and Lewis (1981), Kurtz et al. (1984), and Young and Reichenbach (1987) encourage public agencies to influence, persuade, or induce private landowners to manage their forested lands for timber production. They emphasize marketing certain values (with a timber commodity bias) or changing the attitudes and beliefs of landowners rather than assisting the owners to meet a full range of objectives.

In an effort to encourage NIPF landowners to manage woodlands for timber, Kurtz and Lewis (1981) assembled a flow chart linking landowner motives, objectives, and management constraints to understand the purposes behind timber owner harvesting decisions. Understanding the landowner decision-making process can help public agencies provide assistance programs that might encourage private

landowners to actively manage their forests for timber production.

A later article (Kurtz et al. 1984) integrates internal factors (such as landowner motivations and objectives) with external factors (such as education, technical assistance, and market conditions) to demonstrate how these components may influence landowners' management decisions.

Kurtz and Lewis (1981) and Kurtz et al. (1984) feel that by considering owners' concerns, resource professionals can effectively motivate private forest landowners through one-on-one contact. Direct contact, on the forested landholding, provides an opportunity to influence owner attitudes about land management practices.

In contrast, a survey of Washington NIPF owners (Blatner et al. 1991) found that forty-one percent of the respondents felt that public agency assistance should be designed to satisfy landowner objectives. Twenty-four percent felt that agency programs should focus on enhancing timber production while thirty-six percent had no opinion.

Public foresters can find themselves in a difficult position when they represent timber-oriented agencies while consulting with NIPF owners whose desires for land management are amenity based (Blatner et al. 1991).

Summary of literature. Private landowners want (and can benefit from) education offered by natural resource professionals. However, since most extended professional

advice has focused on timber sales, the problem of addressing a broad range of landowner objectives has not been fully explored.

Most of the literature raises the question of whether agency assistance is designed to:

- 1) help landowners formulate and carry out their personal desires; or,
- 2) cajole, convince, or coerce the landowner to carry out some public policy.

Several cited professional journal articles and the landowner workbooks emphasize timber management. However, private landowners often have management objectives that assign timber production a less dominant role.

The works of Courtin et al. (1989), Oregon State University Extension Service (1986), and Weetman et al. (1990) contain sequential frameworks to help clarify complex decision-making processes. These frameworks are developed for agency use and are almost universally applied to forest stands or stand types. Though these publications use step-by-step techniques and are useful for professionals, private landowners require simpler methods for getting started on developing management plans.

Kurtz and Lewis (1981) and Kurtz et al. (1984) use connected concepts to indicate relatively simple relationships (or flow) among ideas. These connected concepts enhance understanding, but do not provide

practical procedures for interaction of professional and landowner in cooperative development of a forest management plan. Still, Yourdon (1989) considers flow charts to be a clear and efficient way to transmit information about a process to a lay audience.

In summary, the above publications have valid points to consider and provide alternative ways to reach out to private forest landowners. However, the literature does not reveal a simple approach which assists landowners to consider and select treatment options designed to achieve their multiple resource objectives. This study proposes a solution to this problem.

1.3 Montana Forest Stewardship Cooperative

At the time of this study, the Montana Forest Stewardship Cooperative (MFSC) was developing methods of extending forest stewardship information to private landowners in Montana. Details and methods of the MFSC are an evolving process. The MFSC decided to concentrate its limited resources on providing workshops where landowners learn to create a stewardship plan for their land. The MFSC wanted to help private forest owners:

- 1) develop management goals;
 - 2) understand and evaluate land management alternatives which will assist landowners to attain those goals;
- and,

- 3) obtain information and help to implement landowner choices. (MFSC 1990)

1.4 Land units commonly used in forest planning

In order to simplify organization of the forest planning process, it often helps to segment the subject landholding into units. In this study, two types of land segmentation are illustrated: management units and stand units. Since comparison of these two types of land units comprises a significant portion of this study, these two terms will be capitalized (Management Units and Stand Units).

Planning using Management Units. The term "Management Unit", as defined in the text Forest Management (Davis and Johnson 1981) is:

A geographically contiguous parcel of land containing one or more stand types and usually defined by watershed, ownership, or administrative boundaries for the purposes of locating and implementing prescriptions. A management unit is usually larger than a stand and typically contains many stand types and individual stands.

To assist landowners in developing a stewardship plan, MFSC workshop leaders encouraged participants to segment their landholding into Management Units. The definition of a Management Unit, as used in the MFSC Stewardship Workshop, is rather flexible:

...Management Units may have some of the following elements in common.

- Type of vegetation
- Physical characteristics
- Constrained areas
- Management convenience
- Common resource objectives (MFSC 1992).

During the MFSC workshop, landowners segmented their land according to owner-chosen criteria. Usually, Management Unit boundaries were chosen on the basis of management convenience and/or common resource objectives. Near the conclusion of the workshop, some owners adjusted Management Unit boundaries based on their new understandings about vegetation, physical characteristics, and constraints (Logan 1993).

Until about 1983, Champion International (a large timber company with extensive private industrial forested land in western Montana until sold to Plum Creek Timber Company in late 1993) segmented their holdings into Management Units. At that time, Champion used Management Units mainly because of management convenience and common resource objectives. Not only were Management Units convenient for tax purposes, they also enabled Champion to segment their land into areas with a common tree size class which made harvesting and milling more efficient. (Saunders 1993)

About 1983, Champion changed its manner of segmenting its lands. Champion now manages its lands by grouping pieces of land exhibiting similar long-term potential. This method of stratifying land into Management Units is based on site-related attributes such as aspect, slope, habitat type, soils, and geologic similarity. In some situations, Champion Management Unit boundaries are modified by

management considerations or constraints such as road access and harvesting method. (Saunders 1993)

Planning using Stand Units. Silviculture (including multiple-resource silviculture), inventory, and vegetation descriptions are traditionally based on stands. Ford-Robertson (1983) defines a "stand" as:

A community, particularly of trees..., possessing sufficient uniformity as regards composition, constitution, age, spatial arrangement, or condition, as to be distinguishable from adjacent communities, so forming a silvicultural or management entity.

Courtin et al. (1989) modify this meaning by adding that the definition implies uniformity of site. In this study, areas of forested land segmented as stands are referred to as Stand Units.

Since the 1960's, the stand has been the dominant unit used for inventory (hence "stand exams"). Growth and yield models, analysis models, and silvicultural prescriptions are all based on stands. The forestry profession has adopted the stand as a fundamental unit for analysis, silvicultural prescriptions, and management actions.

O'Hara (1992) cites the stand as the basic unit of multiple-resource silviculture; stands are the units of forest land on which professionals prescribe silvicultural (vegetation manipulation) treatments. The stand is also a basic unit for describing landscape patterns to evaluate biological diversity and wildlife habitat relationships.

Planning using both Management Units and Stand Units.

Courtin et al. (1989) use both stands and administrative units referred to as "Compartments" to assist with private woodlot planning and operations; these compartments are similar in definition to Management Units.

Crookston and Stage (1991) also use a combination of Management Units and Stand Units to demonstrate the usefulness of the Parallel Processing Extension of the Prognosis Model. These authors reason that:

Stands are good for inventories, but they are almost never managed as units. Foresters create management units (often these are harvest units) by combining parts of stands into a land area that is treated in a coordinated way. The silvicultural prescriptions may vary in different parts of the management unit. (Crookston and Stage 1991)

The preceding paragraphs defined and provided examples of use of both Management Units and Stand Units in forest planning. This study will use a comparative framework in order to gain an appreciation of the relative strengths and weaknesses of these two methods of segmenting a landholding. The research methods are described in the next chapter.

CHAPTER 2

STUDY OBJECTIVE AND RESEARCH APPROACH

The literature review revealed that natural resource professionals have not had a simple set of procedures that focus on landowner needs and integrate private landowner and professional perspectives in collaborative development of a management plan for NIPF land.

2.1 Objective

The objective of this study is to develop a systematic planning process that promotes private landowner and consultant collaboration in creating stewardship management plans. The product will be developed in the form of a step-by-step guide that can be used for a wide variety of forest conditions, objectives, and forms of landowner/consultant interaction.

The systematic process will explicitly define and illustrate planning procedures that will:

- 1) Enhance communication between natural resource professionals and private landowners;
- 2) Clearly address landowner interests;
- 3) Lead to consideration of a full range of forest resources on the landholding;

- 4) Provide a framework for evaluation of management options; and,
- 5) Help assure selection of treatment alternatives that will achieve landowner goals.

2.2 Research approach

This study compares a process used in two planning approaches, each using a different method for segmenting the private landholding. One planning approach uses Management Units designated by the landowner (as used in the MFSC landowner workshops). The other planning approach uses Stand Units designated by a consultant (conventional approach).

The methods used to accomplish the objective of this study were:

- 1) Develop a first-draft step-by-step planning process for use with NIPF landowners. The planning process is designed to expose landowners to the expertise of natural resource professionals in a simple incremental manner such that the landowner can understand the diversity and management potentials of their specific landholding.
- 2) Construct a hypothetical forested landholding called "Mock Ranch" for purposes of demonstrating two different planning approaches on the same area of land.

- 3) Illustrate the step-by-step planning process as used in the MFSC workshop program where Management Units are designated by the landowner.
- 4) Illustrate a conventional step-by-step planning process where Stand Units would be designated by a consultant.
- 5) Compare and discuss the strengths and weaknesses of the two stratification approaches relative to the objective of this study.
- 6) Incorporate knowledge gained during the study to present an explicit step-by-step planning process that will assist private landowners in creating a management plan for their forested land that incorporates professional advice in appropriate balance with landowner objectives.

CHAPTER 3

DEVELOPING A STEP-BY-STEP PLANNING PROCESS

This chapter begins by describing a step-by-step planning process developed for a private landowner. Then, two step-by-step planning processes are demonstrated; a hypothetical landholding called Mock Ranch is used to illustrate the two planning approaches. In the first demonstration, Mock Ranch is stratified into Management Units. In the second instance, Mock Ranch is stratified into Stand Units. Illustrating NIPF planning in these two ways provides an opportunity to examine and compare the strengths and weaknesses of each method of segmenting the ownership. The strengths of both approaches are combined to produce a recommended process in Chapter 4.

3.1 The initial model

The initial "model" of a step-by-step planning process was based on review of the literature, professional education, and experience to that date. It was developed in a conventional "strong consultant" role format. In fact, it was developed as part of an unsuccessful bid for a consulting contract on the Handley Ranch in the Rock Creek drainage east of Missoula, Montana (see Figure 1).

Nevertheless, it represented my first approximation of how a natural resource consultant could provide professional service in helping an absentee landowner meet their objectives. (Coincidentally, this "one-on-one" approach was described in the MFSC charter plan as one of the two alternative methods used to develop Stewardship Plans (MFSC 1990).

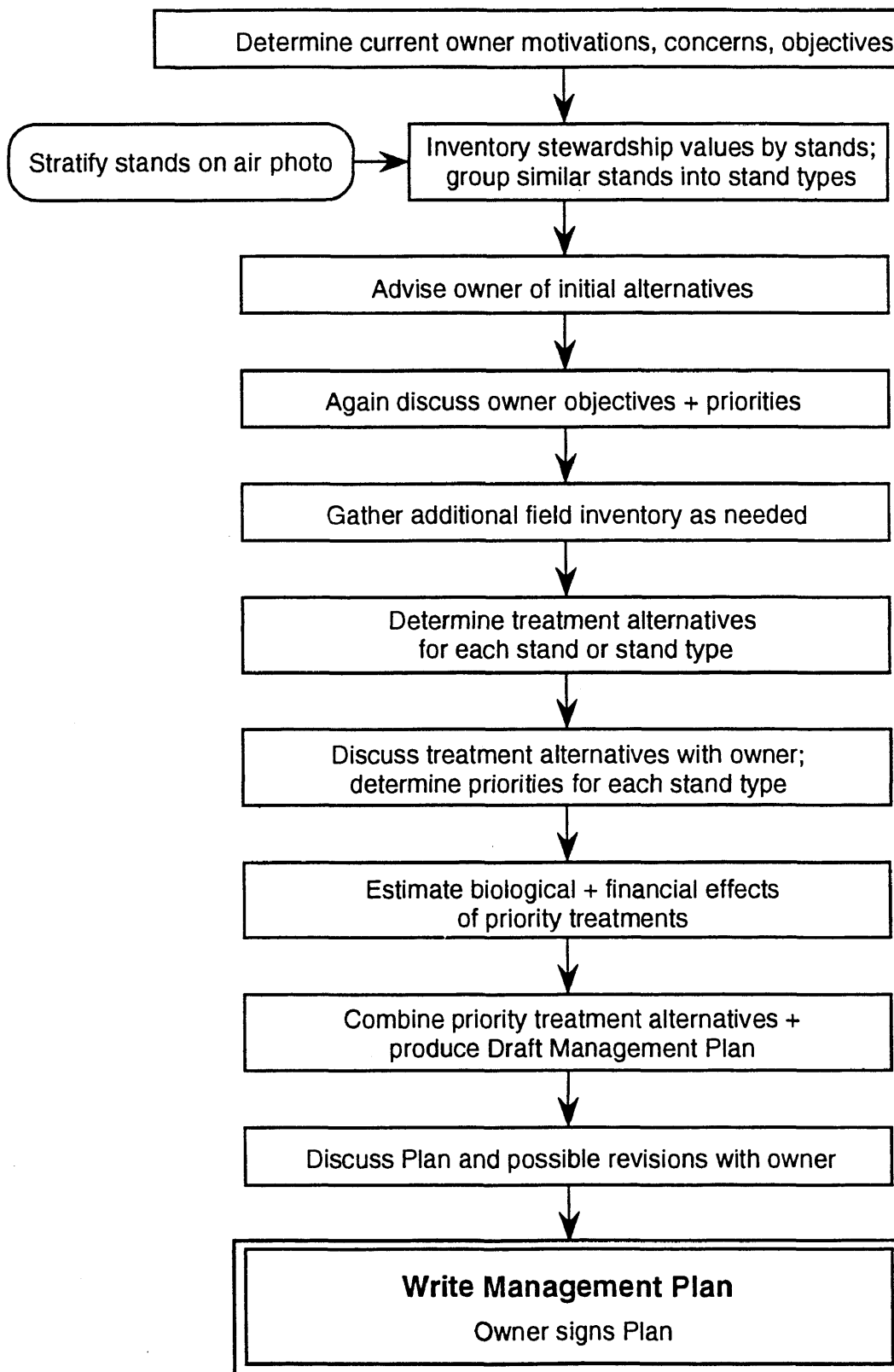


Figure 1 Proposed methodology to develop a long-term management plan for the Handley Ranch, Rock Creek, east of Missoula, Montana.

3.2 A planning process based on Management Units

While I was working on this study, the MFSC was initiating a new landowner education program designed to empower landowners to write their own stewardship management plans with natural resource consultants playing (primarily) an educational role. I attended classes as an observer and interviewed leaders of the program to document the educational sequence they were using. The MFSC workshop did not provide an explicit step-by-step planning process. In order to examine the MFSC planning approach, I used MFSC workshop materials to draft an explicit set of sequential steps used during the pilot Landowner Workshop. (To ensure that the steps accurately summarized the stages of the MFSC planning process, I solicited and incorporated the comments of Stewardship Director Bob Logan, Stewardship Coordinator Gary Ellingson, and Montana Department of State Lands Stewardship Manager Eric Norris (1992).) The MFSC workshop planning steps are characterized and illustrated for a demonstration area.

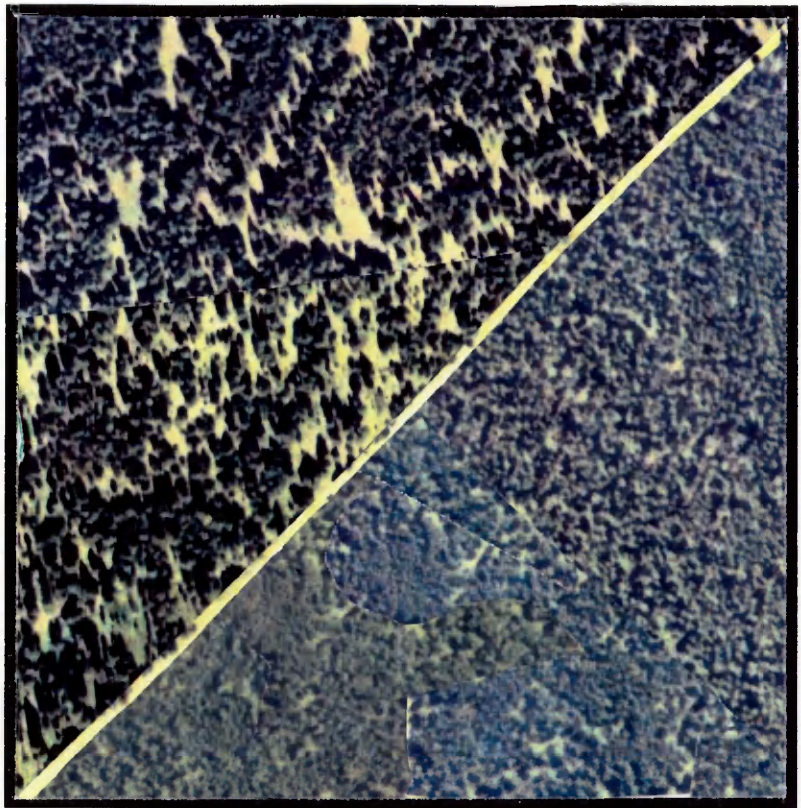
In order to demonstrate both the Management Unit and Stand Unit approaches to planning, I created a fictitious landholding called Mock Ranch. The forested areas comprising Mock Ranch are actual stands located on Lubrecht Experimental Forest where multiple-resource stand management treatment alternatives are being studied and demonstrated. The rest of the information about Mock Ranch

is fabricated. Since the Lubrecht stands are not contiguous, a photographic composite was prepared from aerial photographs; a base map was also drafted (Figure 2). Appendix A contains summarized inventory data about the Lubrecht forested land comprising Mock Ranch.

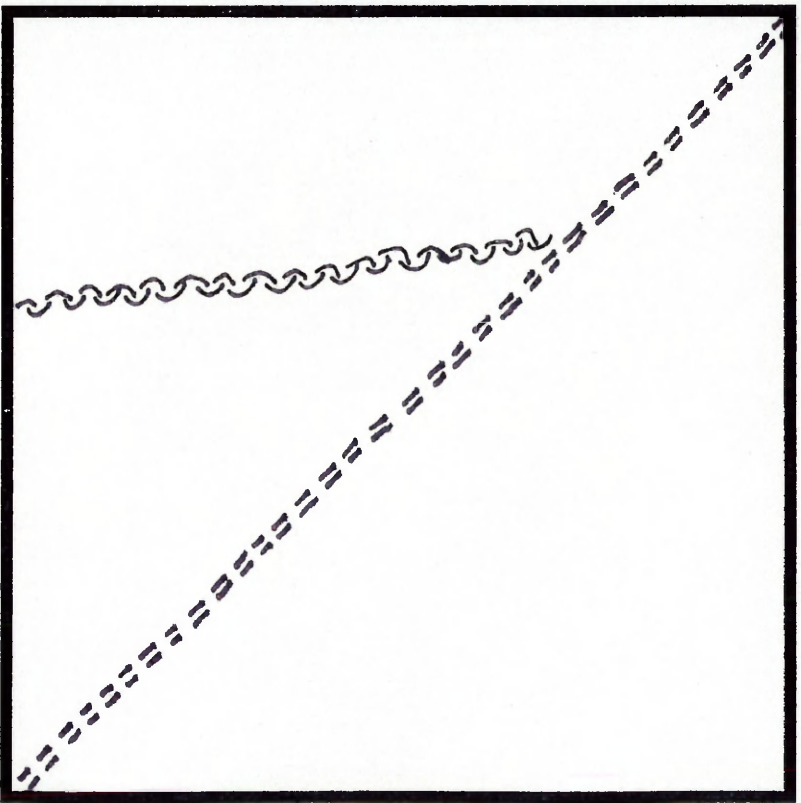
The following steps summarize the MFSC workshop sequence.

STEP 1 Describe the land.

The landowner provides a legal description and a brief narrative about the land. The forest resource professional provides a topographic map and an aerial photograph(s) of the property.



A



B



1:15,840 Scale

=== Road
~ ~ ~ Ridge

Figure 2 A) Aerial photograph composite of Mock Ranch;
B) Mock Ranch basemap

STEP 2 State landowner goals for the ownership.

The owner develops a written statement of preliminary goals for the landholding. The written statement of preliminary goals documents for both the consultant and the landowner the nature of landowner interests. At this point, the goals will reflect initial owner attitudes, motivations, and personal factors. During the planning process, the landowner has opportunities to revise the preliminary statement of goals.

For Mock Ranch, the owner and consultant begin by creating a written statement of owner goals. During MFSC Workshops, a list of landowner goals was provided in a classroom exercise. This list of goals has been assumed for the Mock Ranch demonstration because it refers to a broad array of forest resources:

- 1) Avoid or reduce losses of trees to insects/disease;
- 2) Improve tree growth rates;
- 3) Produce periodic income from timber sale;
- 4) Maintain visual quality of all stands;
- 5) Maintain current levels of grazing;
- 6) Improve grazing distribution across the ownership;
- 7) Maintain or improve white-tail deer and elk habitat and use;
- 8) Maintain a wide variety of resident wildlife; and,
- 9) Protect soil and water resources on the ownership (MFSC 1991).

STEP 3 Describe Management Units; collect and summarize inventory data.

Because forested lands often have significant ecological variation, and in order to help an owner reach specific

goals, a landowner may find it convenient to break the holding into Management Units. Lines separating the Management Units are to be determined by the landowner for planning purposes. Since an inventory will likely be conducted in each Management Unit, a few large Management Units for the landholding (rather than more numerous small ones) may make inventory data collection easier.

The preliminary statement of owner goals (Step 2) reveals what goals the landowner deems important for the whole property. However, the statement of goals does not specify where on the property these goals might be most important to the owner. For the landowner who has goals for specific portions of the landholding, drawing Management Units on the base map can provide a convenient way of displaying where on the ownership those goals are particularly important. Figure 3 illustrates how a landowner might choose to define Management Units representing unique combinations of goals.

In the case of Mock Ranch, the owner may be most concerned about visual quality (goal 4) around the homesite and along the road approaching the house. This area could be considered a Management Unit (MU-1) delineated primarily because one stated goal (maintain or enhance visual quality) is dominant within that portion of the property.

The other two Mock Ranch Management Units are delineated mainly on the basis of vegetative characteristics and

unique combination of management goals. The aerial photograph reveals that the relatively dense forests located southeast of the road (MU-2) are considerably different from the forests that comprise the area northwest of the road. The landowner may want to increase cattle use of the area southeast of the road (relates to Goals 5 and 6) and maintain or increase white-tail deer and elk use of the hillside south of the homesite (relates to Goal 7). Much of the area northwest of the road makes up a third Management Unit (MU-3) that may have unique relationships to some of the owner goals.

Inventory information for each Management Unit is gathered and summarized by the landowner in the MFSC education approach. Briefly described, Mock Ranch Management Unit 1 contains both multi-storied and even-aged forests of Douglas-fir and ponderosa pine, an area of even-aged lodgepole pine southeast of the road, and a small portion of even-aged western larch. Management Unit 2 consists of relatively dense even-aged forests of lodgepole pine and western larch containing scattered Douglas-fir. Management Unit 3 is comprised of multi-storied and even-aged forests of Douglas-fir and ponderosa pine; this Management Unit also contains scattered western larch in the northern portion.

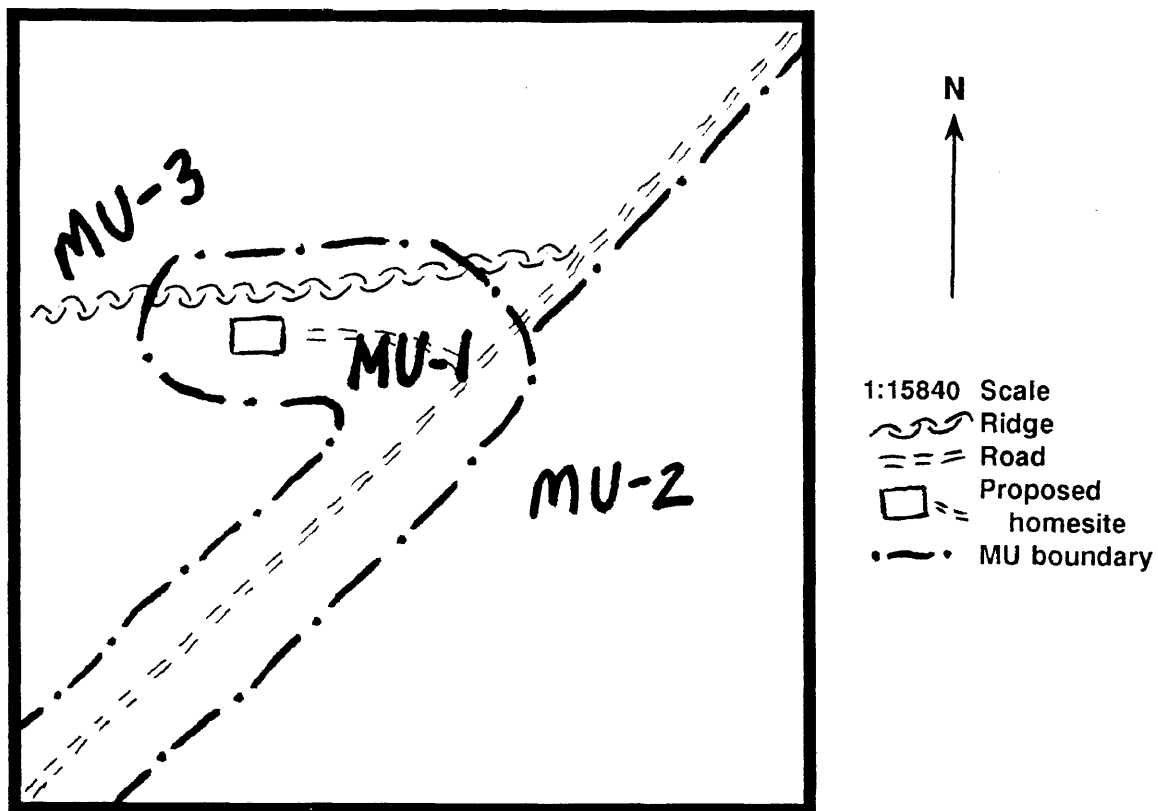


Figure 3 Mock Ranch Management Units
 (MU = Management Unit)

STEP 4 Identify Management Unit issues and concerns.

The professional helps interpret the meaning of the summarized inventory data with the landowner. As the owner comes to understand the meaning of the inventory data, concerns and issues about the forests within the Management Units might come up for discussion. The discussion can assist the landowner to understand how each Management Unit can contribute to the overall goals for the ownership. It also provides an opportunity for the professional and landowner to discuss tradeoffs and constraints associated with silvicultural activities within each Management Unit.

As a result of this discussion, the landowner may gain insights about forest conditions within the Management Units which could cause him or her to reconsider the stated goals for the property.

The consultant explains what the inventory information means relative to the stated goals for the ownership. For example, because the owner of Mock Ranch is concerned with visual resources in Management Unit 1, the use of some management activities may be precluded. For example, in Management Unit 1, tree harvesting activities designed to achieve some stated goals (such as reducing losses of trees to insects and improved tree growth) might not be acceptable to the owner.

STEP 5 State Management Unit resource objectives and resource emphasis.

At this point, the owner makes some choices. For each Management Unit, the owner decides on resource objectives and determines which objective(s) will take precedence.

STEP 6 Prescribe Management Unit treatments; evaluate treatment effects.

With the assistance of the resource professional, the landowner considers possible management treatments that may help achieve goals for each Management Unit. During this step, with the help of the professional, the owner also evaluates the effects of proposed management treatments. If the proposed treatments have undesirable effects, the

landowner might choose to revise a proposed treatment or revise the Management Unit or ownership goals.

STEP 7 Schedule implementation of the treatments;
analyze cash flows.

After the landowner has chosen an acceptable treatment alternative for each Management Unit, the professional estimates the cash flows identified with the treatments. Again, after the professional describes the costs and revenues associated with the proposed treatments, the landowner might wish to revise the goals for the ownership or Management Unit or ask the professional to modify the proposed treatments to achieve landowner goals.

The resource professional and landowner discuss how the Management Unit treatments can be scheduled to most easily accomplish owner goals.

In the case of Mock Ranch, scheduling a Year 2 harvest in Management Unit 3 may produce the revenue needed to install fire breaks in the northwest portion of the landholding.

The preceding seven-step planning process provides an incremental approach to developing a management plan for a NIPF landholding; the steps summarize the MFSC educational workshop approach.

3.3 A planning process based on Stand Units

This section describes a similar planning process. However, during this second description, the NIPF landholding is stratified into Stand Units. In addition,

this Stand Unit method takes a more conventional approach in that the natural resource consultant takes a lead role in developing the plan. Because several of the ensuing steps are similar to the previously described planning process, the following explanation will focus on the steps which differentiate the Stand Unit planning process from the Management Unit planning approach.

STEP 1 Describe the land.

Same as the Management Unit approach.

STEP 2 State landowner goals for the ownership.

Same as the Management Unit approach.

STEP 3 Delineate Stand Units; when possible, ascribe goals to Stand Units.

To assist the owner in attaining the stated goals for the landholding, it may be convenient to divide the landholding into smaller units. In this demonstration, the Mock Ranch ownership is divided into Stand Units. Each Stand Unit will contain stand or site conditions which distinguish it from adjacent stands. The natural resource professional will delineate distinct stands having observable differences on an aerial photograph of the landholding. In the case of Mock Ranch, four distinct stands have been delineated and are shown in Figure 4.

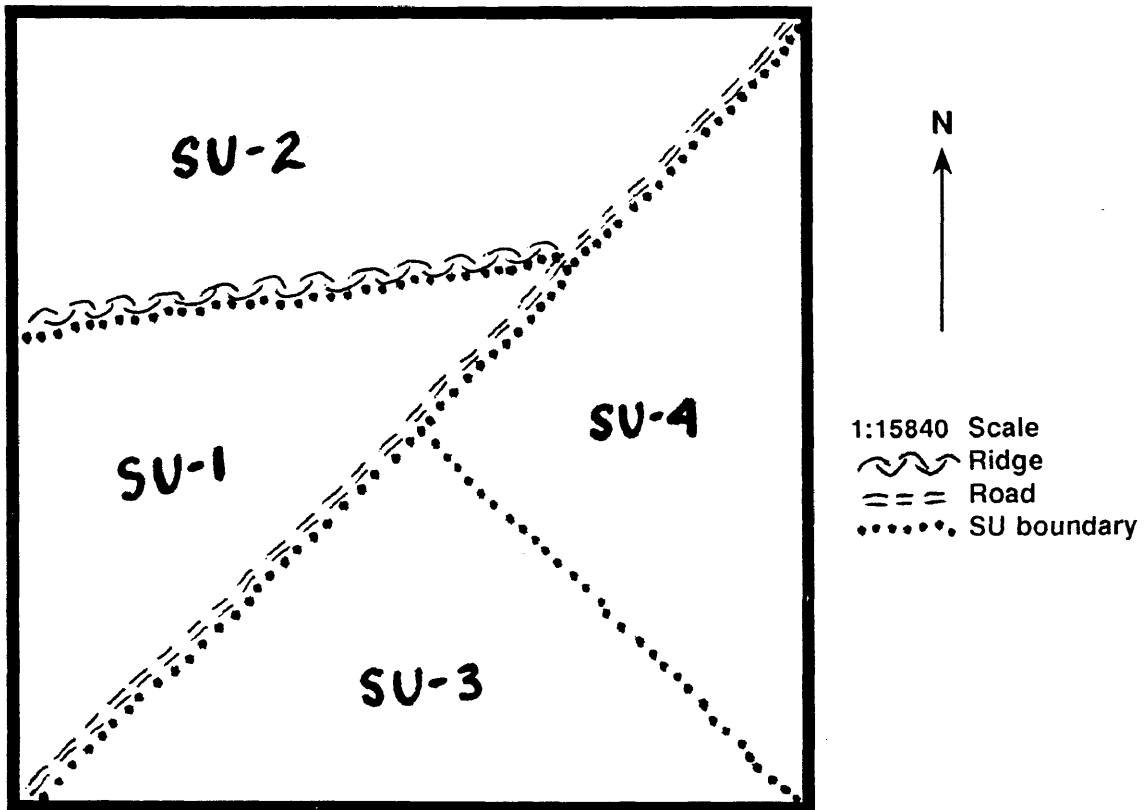


Figure 4 Mock Ranch Stand Units (SU = Stand Unit)

Though forest health and soil and water protection are goals for the whole ownership, dividing the land into Stand Units gives the owner a chance to assign other stated goals to individual Stand Units.

Within Mock Ranch, the owner wants to maintain the visual resources around the homesite and along the road approaching the house. The forested area along the road and around the house is comprised of portions of Stand Units 1, 2, 3, and 4. The owner wishes to increase cattle use of the area southeast of the road that dissects the property. This forested area consists of Stand Units 3

and 4. South of the homesite, in Stand Unit 1, the owner would like to maintain or increase use by white-tail deer and elk.

STEP 4 Collect Stand Unit inventory information.

The consultant conducts an inventory of the Stand Units within the ownership. Depending on owner goals and stand and site attributes, the inventory might be as simple as a walk-through examination of each Stand Unit or might consist of a more thorough sampling procedure. For this study, MFSC stewardship inventory procedures were used with three plots in each of the four stands comprising Mock Ranch; stand summaries are shown in Appendix A.

Described in relatively simple forest cover terms, Stand Unit 1 is comprised of a multi-aged stand of ponderosa pine and Douglas-fir. Stand Unit 2 consists of an even-aged stand of Douglas-fir, western larch, and ponderosa pine. Stand Unit 3 is a dense even-aged forest of lodgepole pine. Stand Unit 4 is a dense even-aged stand of western larch; this stand also contains an understorey of Douglas-fir seedlings and scattered large relic Douglas-fir.

STEP 5 Interpret Stand Unit inventory information.

An interpretation of the Stand Unit inventory reveals that the landowner will need to make some choices among stated goals and possible management treatment options. Since the owner wants to maintain or enhance the visual resources within portions of Stand Units 1, 2, 3, and 4

some management activities may be constrained. Harvesting activities designed to improve tree growth may be precluded in the area of the house and roadway where the owner considers the visual resources most important. In other parts of Stand Units 3 and 4, the owner can increase cattle use of the area by harvesting some of the trees and thereby increasing forage species. Since the owner has ascribed more than one goal to some Stand Units, the consultant and owner need to discuss the tradeoffs associated with emphasizing one goal (such as domestic grazing) versus another (such as aesthetics) within Stand Units 1, 2, 3, and 4.

STEP 6 For each Stand Unit, evaluate how management treatment alternatives can contribute to owner goals.

In Stand Unit 1, some harvesting might be used to enhance ungulate habitat. However, since the owner has concerns for the visual resources, some portions of Stand Unit 1 should show little or no evidence of logging activity.

Within Stand Unit 2, a harvesting treatment can decrease risk of loss of trees to insects and disease. Since the inventory reveals particulars about forest conditions within that stand, the consultant can provide some detail about how silvicultural treatments can maintain forest health. For example, applying a group selection harvest to Mock Ranch Stand Unit 2 (and regenerating the harvested

areas with a more resistant tree species) could reduce loss of timber to root rot.

Both Stand Units 3 and 4 could be thinned to encourage forage species and enable cattle to more easily move within the stand. However, portions of Stand Units 3 and 4 are adjacent to the road leading to the house; within these portions, harvesting might be constrained to maintain the visual amenities.

STEP 7 For each Stand Unit, choose the preferred treatment alternatives and analyze the cash flow.

After the consultant and landowner have discussed how alternative treatments can contribute to stated goals within each Stand Unit, the owner chooses preferred treatments for each Stand Unit.

To continue with the Mock Ranch example, within Stand Unit 1, the owner has decided to emphasize visual quality (over forest health and ungulate habitat) along the road approaching the house and the around the homesite. Thus, no tree harvesting is planned for that portion of Stand Unit 1. In the rest of Stand Unit 1, the owner chose to maintain some clumps of Douglas-fir (as wildlife thermal and hiding cover) while harvesting some of the overstory and suppressed trees in order to enhance forage species which can maintain or attract white-tail deer and elk populations.

Within Stand Unit 2, the owner chose to improve forest health by harvesting trees at risk of loss to forest insects and disease.

Within Stand Units 3 and 4, the owner considered the visual resource of prime importance along the road approaching the house. Therefore, tree harvesting will not occur in those portions of Stand Units 3 and 4. In other parts of Stand Units 3 and 4, trees will be harvested to encourage forage species and cattle use of these two stands.

With the owner having chosen management treatments for each Stand Unit, the consultant can then estimate revenues and costs associated with the treatments.

With Mock Ranch, the consultant will have to estimate treatment revenues and costs for each portion of those Stand Units with more than one set of management treatments. For example, only one portion of Stand Unit 1 will be harvested. Similarly, within Stand Units 3 and 4, harvesting treatments are prescribed for only portions of the stands.

The consultant will need to approximate the area to be treated within each stand (so treatment costs and revenues can be estimated) and ensure that the treated portion is sufficiently representative of the whole Stand Unit. (If the inventory of the whole Stand Unit does not sufficiently resemble the portion of the stand to be harvested, more

detailed stand information may be required so that treatment effects, costs, and revenues can be estimated.)

STEP 8 Integrate and schedule chosen

Stand Unit treatments.

The consultant assists the landowner in choosing a schedule for management treatments. The landowner may consider it most prudent to first schedule harvesting of some of the higher value stands in order to raise revenues to pay for desired improvements such as road and trail access to portions of the property. Alternatively, the consultant might advise the landowner to first address forest health issues.

Integration of the management treatments will thus require the owner and consultant to discuss the goals stated in STEP 1 and potential revenues and costs related to the Stand Unit treatments chosen in STEP 7. The landowner will then have to decide which Stand Units will be treated first. Because some Stand Units will require a series of treatments (such as harvesting, fuels treatment, site preparation, and regeneration), the consultant will need to apprise the owner of what revenues and costs can be expected over time.

3.4 Evaluation of approaches

Having described two approaches to developing a management plan for a NIPF landowner, it is useful to

compare the strengths and weaknesses of each method in order to develop an improved version.

One primary difference between the two planning processes is the manner in which the landholding is stratified. The other difference is in the relative balance of landowner/professional participation and control. Advantages and disadvantages of both approaches are discussed below.

Advantages of Management Units. When the landholding is stratified into Management Units, it is easier to "engage" the landowner in the planning process. This is because the owner has the opportunity to delineate Management Units on the basis of personal preferences and objectives, past experience, and convenience. At the beginning of the planning process, it will probably be easier for the lay landowner to identify Management Units on the basis of personal criteria than on the basis of ecological characteristics such as soils, vegetation, slope, aspect and so on.

Having the landowner delineate Management Units provides opportunities for the owner to explicitly describe objectives (on a map of his or her land) early in the planning process. Using Management Units can enhance communication between the consultant and the owner as well as address landowner interests up front.

Disadvantages of Management Units. If the owner establishes a Management Unit boundary based primarily on personal objectives and preferences, there may be considerable heterogeneity in stand and site conditions within the Management Unit. Inventory data from a heterogeneous area could be highly variable among plots. This data would be difficult to interpret and communicate to the owner. Because of the high variation, prescription of management treatments and prediction of outcomes would also be difficult to communicate. Further, it may be difficult to estimate cash flows for potential management treatments because of the inherent variability of costs and revenues within the Management Unit. (In cases where the Management Unit is located within a larger Stand Unit, this disadvantage will not apply.)

Advantages of Stand Units. Forest and site conditions within Stand Units will be relatively homogeneous. Because the inventory data is more site-specific, interpretation of the data can be more readily detailed. Stand Units will allow the consultant to spotlight, in a relatively definitive way, forest conditions that may be of concern to the landowner.

Using Stand Units, the consultant will be able to reveal the effects that recommended treatments will have on a range of forest resources; the owner can then decide on the acceptability of those effects.

Another advantage of gathering Stand Unit data relates to how the inventory information can be used to interpret the costs of management treatments and the revenues (and non-financial values) that might be derived from the forest resources. Since Stand Units provide relatively homogeneous information, the cost per acre for a given management treatment (such as commercial thinning) and the resultant resource output (such as the number of posts, poles, and rails per acre) should be easier to predict.

Disadvantages of Stand Units. A few disadvantages are inherent to stratifying an ownership into Stand Units.

In order to delineate Stand Units, aerial photographs need to be interpreted by an experienced professional; this will be an added cost of developing a management plan. Aerial photographs which have been stratified into stands may appear overly-complex to landowners. If there are a large number of Stand Units, field inventory procedures might be quite costly without a specialized sampling design.

Also, some of the owner management goals may have little relationship to stand boundaries. For example, an owner may set a Management Unit boundary on the basis of personal preferences. If that Management Unit falls completely within a Stand Unit, the inventory of the Management Unit may be sufficiently homogeneous to provide the basis for analyzing potential management treatments.

Summary of the comparison of Management Unit and Stand Unit approaches. Most lay landowners do not have an extensive scientific understanding of the biological and physical factors present on their land. A planning process designed for use with NIPF landowners can use the concept of Management Units to allow a landowner to express management objectives explicitly on a map of the ownership. This can clarify for the consultant what the owner deems important about the landholding.

However, Stand Units provide the foundation on which an inventory of site and stand conditions and potential management treatments should be based. Relatively homogeneous Stand Units will enable the consultant to more specifically address landowner concerns and interpret ecological conditions relative to the stated landowner objectives. In addition, the forest professional will be able to predict biological and financial outcomes of alternative management treatments; the owner will then be able to consider the acceptability of management treatment effects on each Stand Unit.

CHAPTER 4

A PROPOSED STEP-BY-STEP PLANNING PROCESS

In this chapter a hybrid planning method is proposed that incorporates the best features of two current approaches. This NIPF planning process is sufficiently generic that it can be used in either a traditional situation (in which a consultant develops a management plan for a landowner) or in a classroom scenario (in which a landowner is trained to create their own management plan).

4.1 The proposed planning process

The eight-step planning approach is described below; a discussion follows the description of the steps.

STEP 1 Describe the land.

The landowner provides a legal and narrative description of the landholding. If the owner does not already possess a topographic map (base map) and a stereoscopic pair of aerial photographs of the forested holding, the consultant secures these.

The consultant uses a photocopier to enlarge and adjust the scale of both the base map and one of the aerial photographs. When this is done, the base map and aerial photograph will be the same scale and sufficiently large to

use as working tools during the next steps in the planning process.

STEP 2 State landowner goals for the ownership.

At the beginning of this planning process, owner understandings of biological and physical attributes of his or her land may be relatively limited. With the encouragement of the professional, the landowner expresses goals in lay terms (rather than in biological or scientific language) based on personal experience with the land. This is a written statement of preliminary goals; it documents for both the consultant and the landowner the nature of owner interests, concerns, and attitudes about the forested land. Some landowners may find it difficult to express goals for their landholding. If this is the case, the consultant can probe for goals with leading questions.

STEP 3 Delineate Management Units; ascribe stated goals to Management Units.

The owner considers which ownership goals can be ascribed to specific portions of the holding. Using the written statement of ownership goals as a guide, the owner indicates where on the land he or she considers those goals to be important. To accomplish this, a sheet of clear acetate is laid over the basemap; the owner then delineates Management Units within which specific goals and concerns are spatially portrayed on the acetate.

While delineating the Management Units, the owner uses the following criteria to guide choice of Management Unit boundaries:

- overall ownership goals stated in STEP 2;
- management convenience factors (such as existing fences or roads); and
- constrained areas (such as visually sensitive sites).

STEPS 2 and 3 give the professional a good idea of what goals the owner wants to achieve and where on the land the owner deems those goals important. This understanding will allow the consultant to design an inventory process that is relevant to owner goals.

STEP 4 Delineate Stand Units on the aerial photograph;
collect Stand Unit inventory information;
interpret the inventory information.

The consultant begins the inventory process by delineating stands that are discernable on the stereoscopic pair of aerial photographs. During this planning process, these stands are referred to as Stand Units. Correcting for scale, the professional transfers the Stand Units to a clear acetate which can be laid over the basemap.

At this point, the landowner has a basemap plus two acetate overlays. One overlay shows the Management Units (which portray the spatial arrangement of owner goals); the other overlay shows Stand Units (which define the boundaries of relatively homogeneous stand and site

conditions). Figure 5 portrays Mock Ranch Management Units and Stand Units.

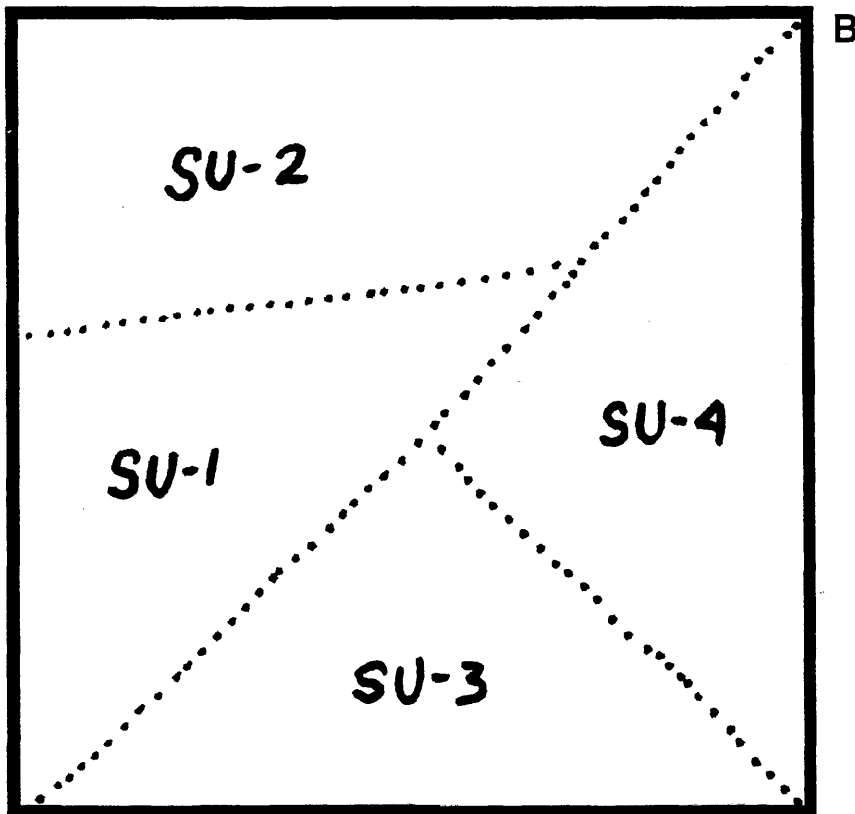
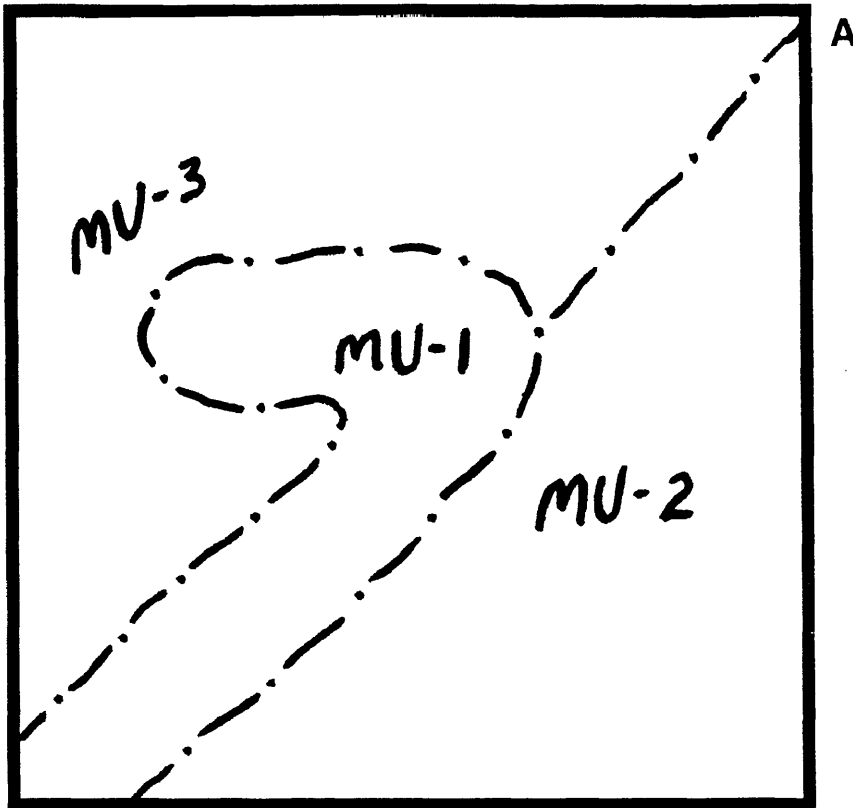


Figure 5 Overlay "A" shows Mock Ranch Management Units; Overlay "B" shows Mock Ranch Stand Units. MU = Management Unit; SU = Stand Unit

The consultant (or the landowner, if trained to do so) then goes out on the land and gathers and summarizes the inventory information from the identified Stand Units. (The intensity of the inventory will depend on landowner objectives and stand and site attributes. If, for example, the intention of the owner is to harvest mature timber on the landholding, a more intensive inventory may be needed than if the goal is to maintain white-tail deer thermal and hiding cover. In the case where the landholding contains many Stand Units, the owner and consultant may decide not to inventory each Stand Unit.)

After Stand Unit information is gathered and summarized, the professional and the landowner discuss the significance of the summarized inventory data. This discussion should enhance owner understanding of the relevance of the various stand and site inventory attributes, resource potentials, possible constraints to management, and tradeoffs associated with emphasizing one resource over another when trying to achieve the stated goals. By using the two acetate overlays on top of the basemap, the professional can point out how Stand Unit inventory attributes have the potential to contribute to specific Management Unit goals as well as to goals for the whole ownership.

At this point, the landowner might want to revise the preliminary goals. Insights gained during these first

steps might move the owner to either amend the original written goals or proceed with STEP 5.

STEP 5 For each Stand Unit, evaluate how treatment alternatives can contribute to ownership goals and Management Unit objectives.

Within each Stand Unit, the consultant proposes and leads a discussion of treatments which will be ecologically feasible and help accomplish owner goals for the corresponding Management Unit. This discussion can enable the landowner to understand and evaluate resource tradeoffs and forest attributes associated with each treatment option. If, for a particular Stand Unit, none of the treatment options are acceptable to the owner, proposed treatments may need to be modified. Alternatively, if other treatments are not feasible, the owner may need to revise Management Unit goals.

STEP 6 For each Stand Unit, choose the preferred treatment alternatives and analyze the cash flow.

Once an acceptable treatment is chosen for each Stand Unit, the consultant assists with a cash flow analysis of the management activities associated with that choice. After cash flow estimates are prepared, the owner decides whether the chosen treatments are financially acceptable. With an understanding of the financial implications associated with the Stand Unit treatments, the owner again may need to re-consider stated goals.

STEP 7 Integrate and schedule chosen

Stand Unit treatments.

Together, the landowner and consultant consider the complete landholding and integrate and schedule the chosen management treatments for all or portions of the Stand Units.

This completes the step-by-step planning process. The materials documented during the steps can be put into a 3-ring binder; these will comprise the Management Plan for the land.

Figure 6 displays a flow chart of the step-by-step planning process. The consultant can use this schematic to familiarize the landowner with the planning steps and enhance communication during the entire process of developing a management plan.

When the Management Plan is completed, the consultant should emphasize the need for a periodic review of the planning document. Plan review (or monitoring) keeps the plan current. After management treatments have been accomplished, the landowner can update inventories and produce a new overlay map of treated areas. In addition, the owner may amend goals or priorities if family or forest biological conditions change.

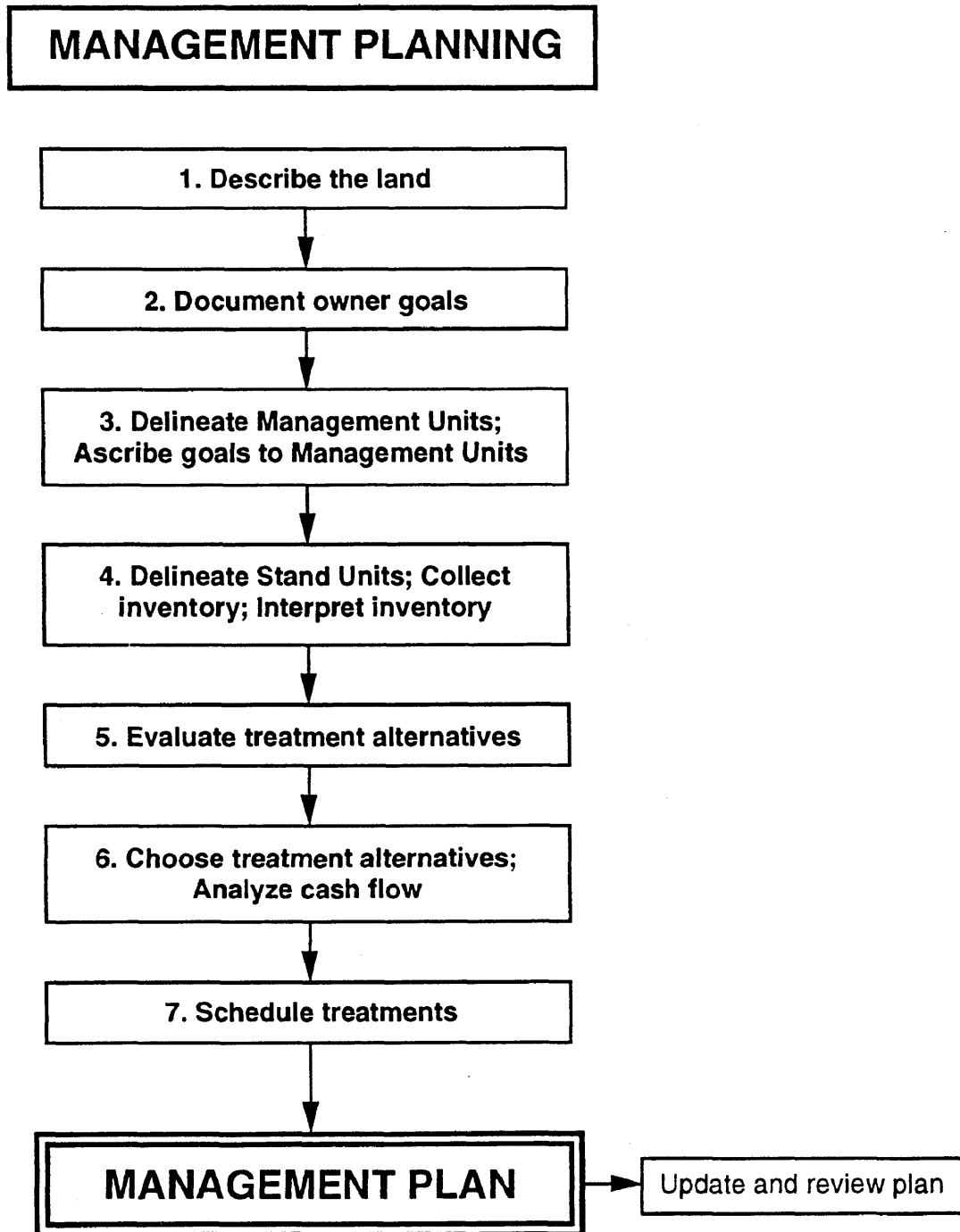


Figure 6 A flow chart illustrating the step-by-step planning process.

4.2 Discussion

If Management Units and Stand Units actually had the same boundaries, there would be few communication difficulties. This rarely happens in the real world. Three examples of real world possibilities are discussed below.

When a Management Unit is larger than the Stand Unit.

There will be cases in which the size of a Management Unit exceeds that of a Stand Unit. In this case, for each of the Stand Units within the Management Unit, the consultant recommends suitable treatments designed to meet the owner objectives as expressed for the Management Unit.

When a Stand Unit is larger than the Management Unit. On other private landholdings, the size of a Stand Unit may exceed that of the Management Unit. In this case, stand conditions in each of the Management Units are relatively homogeneous. The consultant proposes silvicultural treatments suited to achieving the owner objectives for each of the Management Units within the larger Stand Unit.

When Management Unit and Stand Unit boundaries overlap. To achieve owner goals stated for a particular Management Unit, suitable treatments will need to be devised for each portion of the Stand Units included within the Management Unit. In the case of Mock Ranch Management Unit 1 (in which road-side aesthetics is emphasized), the roadside portion of Stand Unit 3 will be treated differently than the segment of Stand Unit 3 which is inside Management

Unit 2 (where livestock grazing is a goal). The overlays of Management Units and Stand Units are well suited for this situation. A third overlay map showing each unique Management Unit - Stand Unit combination as a "Treatment Unit" may be a logical final product for clear communication and a basis for actions, monitoring, and future revisions; Figure 7 illustrates Treatment Units for Mock Ranch.

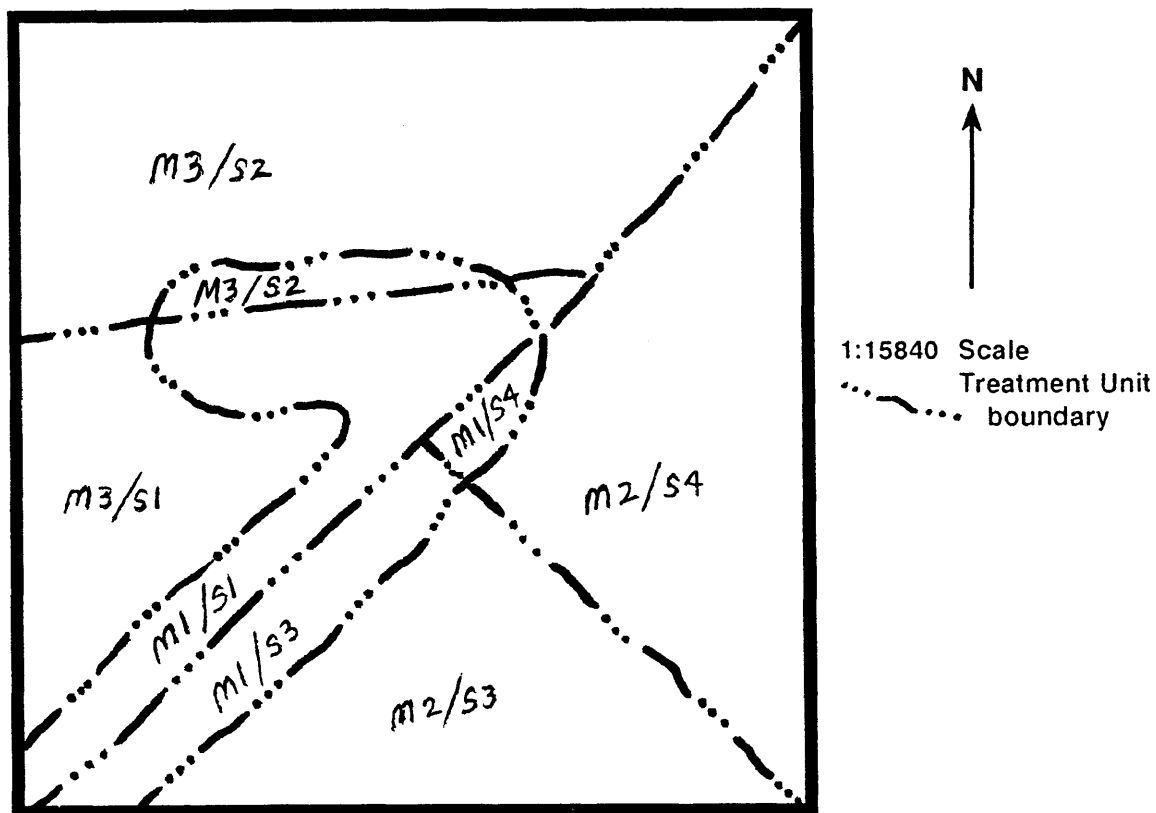


Figure 7 Mock Ranch Treatment Units (M2/S4 = symbol for the Treatment Unit which combines Management Unit 2 and Stand Unit 4)

CHAPTER 5

SUMMARY

The objective of this study was to produce a step-by-step method of guiding a forest professional and private landowner as they jointly consider management treatment alternatives designed to achieve the stated goals of the landowner.

The proposed planning process provides a step-by-step guide to assist forestry professionals as they consult with private landowners. The simple steps will enhance communication and enable the landowner to easily grasp the progression of stages considered in the development of a forest management plan. An explicit flow chart helps engage the landowner in the planning process so that he or she can benefit from the experience and technical expertise of the forestry professional.

The planning process begins with a focus on landowner goals, concerns, and interests. Then the landowner indicates (using Management Units) where he or she considers those goals particularly important on the landholding. During the planning process, the owner has several opportunities to reconsider goals in light of newly

acquired knowledge and insights gained through interaction with the forest resource professional.

The use of Stand Units facilitates consideration of a full range of forest resource potentials, opportunities to achieve owner objectives, and management constraints associated with individual stands within a landholding. By using a stand-based inventory, the consultant can propose specific management treatment options designed to address owner goals. The owner and consultant can then analyze the potential positive and negative tradeoffs associated with proposed treatment options. Proposed options can be considered for their biological and physical effects on multiple forest resources; in addition, treatments can be assessed for their financial impacts on the landowner. Landowners can then choose specific acceptable treatments that are prescribed to achieve their stated goals.

This planning process is designed to be used in a one-on-one relationship between a private landowner and a forestry consultant. However, the process may be adapted for use in a classroom or workshop setting.

In either a one-on-one or a workshop approach to planning, the importance of educating NIPF landowners has far-reaching consequences. Not only will educated forest owners make better decisions on their own lands, but they will have a basis to become informed participants in public forestry decisions.

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APPENDIX A

Selected inventory summaries of Stand Units comprising Mock Ranch using attribute inventory procedures from the MFSC Education Workshop.

APPENDIX A

SITE OR FOREST ATTRIBUTE	Stand Unit 1 n = 3 plots	Stand Unit 2 n = 3 plots	Stand Unit 3 n = 3 plots	Stand Unit 4 n = 3 plots
Slope	All 0-20%	All 0-20%	All 0-20%	All 0-20%
Forest structure (Type #'s 1 to 20)	33% #19 17% #18	67% #12 33% # 6	100% #2	50% #2 50% #6
Prominent shrubs	100% No	100% No	100% No	100% No
Tree crown cover class	67% Light 33% Moderate	67% Moderate 33% Light	100% Moderate	100% Moderate
Tree cover type	PP Primary DF Secondary	DF Primary WL Secondary	LP Primary	WL Primary DF Secondary
Trees/acre	PP DF WL	DF WL PP	LP DF WL	WL DF
Seedling	167 1200 0	33 0 34	0 33 17	0 683
Sapling	67 383 0	33 0 33	234 0 0	667 333
Pole	0 50 25	222 25 0	764 0 0	173 25
Immature	34 25 0	100 33 33	8 0 0	25 8
Mature	20 0 0	0 4 4	0 0 0	0 4
Overmature	9 0 0	0 0 0	0 0 0	0 0
Total TPA	297 1658 25	388 62 104	1006 33 17	865 1053
Basal area/acre By species	PP DF WL	DF WL PP	LP DF WL	WL DF
Total	88 52 7 (148 sq ft)	140 40 34 (214 sq ft)	224 0 0 (224 sq ft)	100 38 (138 sq ft)
Age	Ave Range PP 205 170-228 DF 77 76-78	Ave Range DF 105 96-110 WL 102 100-104	Ave Range LP 62 58-64	Ave Range WL 55 53-58 DF 76 53-98
10-year growth increment (10 ^{1st} of an inch)	Ave Range PP 2.3 2-3 DF 2 2	Ave Range DF 2.3 2-3 WL 4 4	Ave Range LP 2 2	Ave Range WL 2.3 2-3 DF 4.5 3-6
Health and appearance	100% Sweep 100% DF browse 67% Budworm 67% Fork 67% Fire scar	100% Sweep 100% DF browse 100% Budworm 100% Fork 100% Root rot	100% Fork 67% Porcupine 67% Rust	100% Sweep 100% Crook 100% DF browse 67% Budworm
Down-woody material	All sizes decayed; small + medium solid	All sizes decayed; small solid	All sizes decayed; small solid	All sizes decayed; small solid
Preferred or desired cattle forage	Absent/trace to minor	Absent/trace to minor	Absent/trace	Absent/trace to minor
Undesirable cattle forage	Absent/trace	Absent/trace	Absent/trace to minor	Absent/trace to minor
Preferred deer/elk forage	Absent/trace to common	Absent/trace to minor	Absent/trace to minor	Absent/trace to minor

Footnote: Percentages shown in the table refer to the proportion of Stand Unit plots exhibiting the site or forest attribute. For instance, in Stand Unit 1, 67% of the plots have light Tree crown cover.