Habitat/Ecosystem Objectives and Monitoring Procedures for Incremental and Backlog Silviculture Treatments

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EXECUTIVE SUMMARY

The Ministry of Environment, Lands and Parks recognizes the need for a provincial monitoring framework to assess the implications and effectiveness of silviculture treatments in maintaining habitat and ecosystem function and diversity. Habitat/ecosystem objectives for the Enhanced Forestry Program, which includes backlog and incremental silviculture activities, were developed for this purpose in consultation with ministry headquarters and regional staff in the Prince George pilot area. Comments and suggestions from Ministry of Forests headquarters staff pertaining to use and application of silviculture survey data available in the Integrated Silviculture Information System, along with a provincial Ministry of Environment, Lands and Parks review of initial pilot project results have been incorporated into this report.

The overall goals of backlog and incremental monitoring include:

- to assess existing and proposed silviculture treatments relative to stated or desired objectives and results proposed in prescriptions;
- to improve integration of fish, wildlife and water resource values with silviculture planning and implementation;
- to provide a baseline level of habitat and ecosystem information with which to better evaluate silviculture and other resource management objectives and strategies; and
- to ensure terrestrial and aquatic ecosystems are not exposed to avoidable risks.

Monitoring is an expected activity under the FRBC new land-based delivery model, and is the responsibility of the Ministry of Environment, Lands and Parks for habitat/ecosystem objectives under the Enhanced Forestry Program.

This report identifies a list of general habitat/ecosystem objectives that can be used in conjunction with monitoring of Enhanced Forestry Program activities. Each applicable monitoring objective is a desired result that has been described qualitatively. The first step in conducting the monitoring is to specify each applicable objective in a more quantifiable and measurable manner for the particular monitoring activity. From the more detailed objective, monitoring procedures can be designed that focus on assessing the effectiveness of the silviculture treatments and activities in achieving the desired results.

Identification of additional general and detailed habitat/ecosystem objectives specific to a particular region or district is encouraged, but they should be determined during the development of the monitoring plan. The monitoring plan is drafted early in the process to set monitoring objectives, determine participants, and design monitoring methods and standards based on the resources available to conduct the monitoring.

The monitoring process consists of an “office review” and, as required, “field reviews”. The office review consists of: identifying selected silviculture treatment areas to be monitored; reviewing plans, files, and referral comments; and documenting results in terms of stated objectives. The field review is conducted for selected treatment areas, as identified in the monitoring plan or as required, such as when insufficient information is uncovered during the office review to meet monitoring needs. A range of field procedures can be followed, depending on the level of information required by the monitoring plan. Many procedures and standards have been developed under the FRBC Resource Inventory Program. Following the reviews and prior to formal reporting, an internal exit meeting is suggested to be held with all monitoring

participants and others interested in the monitoring project (e.g., forest ecosystem specialist, planner, district manager, licensee).

This monitoring framework is intended to complement planning and implementation activities already in place for the Enhanced Forestry Program. Objectives for monitoring may be suggested early in the planning process, and may relate to ministry and or licensee responsibilities. Monitoring may take place at various stages; planning, field implementation, or well after activities have been conducted (i.e., results-based monitoring). The key to successful implementation of this monitoring framework is to set realistic goals that staff can achieve, and generate information that can be used to plan future enhanced forestry and other activities.

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LIST OF ACRONYMS

BCE ..... BC Environment of the Ministry of Environment, Land and Parks
BEC ..... Biogeoclimatic Ecosystem Classification
CWD..... Coarse Woody Debris
EFP..... Enhanced Forestry Program
FDP..... Forest Development Plan
FPC..... Forest Practices Code
GIS ..... Geographic Information System
HLP ..... Higher Level Plan
ISIS..... Integrated Silviculture Information System
LUP ..... Landscape Unit Plan
MELP..... Ministry of Environment, Land and Parks
MLSIS..... Major Licensee Silviculture Information System
MOF ..... Ministry of Forests
RMA..... Riparian Management Area
RMZ..... Riparian Management Zone
RRZ..... Riparian Reserve Zone
SIA..... Silviculture Information Access
SMP ..... Stand Management Prescription
SP..... Silviculture Prescription
STA..... Stand Treatment Area

1.0 INTRODUCTION

1.1 BACKGROUND

The Ministry of Environment, Lands and Parks (MELP) has a role in monitoring the impacts of forest development and management practices on fish, water, and wildlife resources. Specific to silviculture activities, MELP recognizes the need for a provincial monitoring framework to consistently assess the implications and effectiveness of silviculture treatments in maintaining habitat and ecosystem function and diversity. Any such framework must necessarily address specifics for threatened and endangered species. Compliance with the Forest Practices Code regulations and standards must also be considered. However, the main thrust of the monitoring activities described in this report is to monitor the effectiveness of the silviculture treatments in achieving habitat/ecosystem objectives.

In this context, properly planned and implemented silviculture activities may benefit both timber and non-timber resource values. Conversely, management activities conducted in the absence of planning direction, or if properly planned but poorly implemented at the field level, may compromise aquatic and terrestrial habitats and the variety of plant and animal species that are dependent upon those habitats for their survival. Results from monitoring can facilitate evaluation of such practices and further promote an adaptive approach to improving the effectiveness of programs, such as the Enhanced Forestry Program (EFP), in addressing non-timber resource values and objectives.

1.2 GOALS AND PURPOSE

The goals of the EFP are to improve forest productivity and values; forest health; information and evaluation of new silviculture practices; and, to include all forest values into silviculture planning. In the short term, a fundamental goal of EFP monitoring is to assess existing and proposed silviculture treatments relative to stated habitat/ecosystem objectives. This assessment includes monitoring of both the effectiveness of plans and treatment strategies in meeting stated objectives and the level of compliance of operators with legislation, regulations, standards and referrals.

Over the long term, the monitoring goals are:

- to ensure terrestrial and aquatic environments are not exposed to avoidable risks;
- to improve integration of non-timber resource values with silviculture planning and implementation; and
- to provide a baseline level of habitat/ecosystem information to better evaluate silviculture and non-timber resource management objectives and strategies.

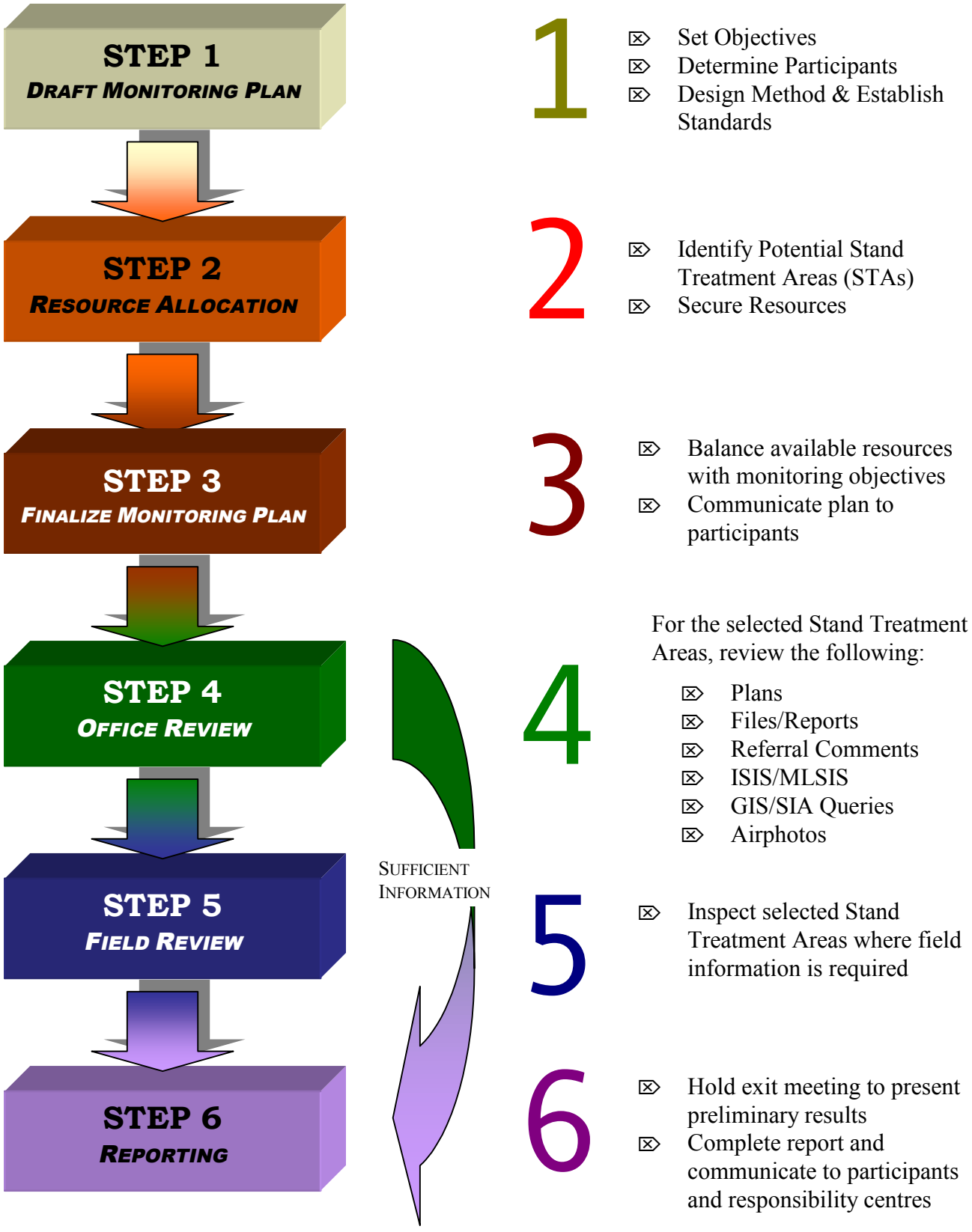
Identification of training needs associated with application of the monitoring framework is not part of this report, but will be addressed by the ministry as a component of developing the overall monitoring strategy.

The purpose of this study is to design a framework for monitoring of incremental and backlog silviculture treatments including:

- the establishment of habitat/ecosystem objectives for specific incremental and backlog silviculture activities; and
- the development of a monitoring process and procedures related to fulfilling the objectives.

This report thus serves as both a reference document for establishing habitat/ecosystem objectives and a manual for implementing the monitoring program. The reference component identifies the habitat/ecosystem objectives developed by MELP staff. The manual component outlines the procedures required for monitoring of backlog and incremental silviculture treatments in terms of the established habitat/ecosystem objectives. Figure 1 illustrates the overall steps and sequence of the monitoring process identified in this report.

Figure 1: Monitoring Steps Standards



2.0 ESTABLISHING HABITAT/ECOSYSTEM OBJECTIVES

2.1 HABITAT/ECOSYSTEM OBJECTIVES

Higher Level Plans, Landscape Unit Objectives, Forest Practices Code (FPC) Guidebooks, and the proposed Silviculture Agreement in the districts promote the incorporation of habitat/ecosystem objectives into operational plans. From a monitoring perspective, resource management objectives provide the standards for measuring compliance and performance, and assessing the outcomes or results of management activities.

One purpose of setting and monitoring resource management objectives is to improve industry/agency achievement in meeting the intent of the objectives. Equally as important is to assess how well the objectives represent the desired terrestrial and aquatic ecosystems and the variety of habitats and species they support. It is therefore assumed that the habitat/ecosystem objectives themselves will also undergo evaluation based on the results of monitoring.
The following is a summary list of broad habitat/ecosystem objectives developed by MELP headquarters and regional staff for this project, (note that the objectives may be expressed at the landscape level or at the stand level):

1) Retain "rare" ecosystems, forest, plant, and vegetation types.
2) Retain wildlife trees and tree patches.
3) Maintain a full range of native tree and vegetative species representative of the dynamics of natural forest ecosystems.
4) Maintain a variety of stocking densities within treatment areas and across landscapes for habitat diversity.
5) Minimize the adverse impacts of road access on fish and wildlife populations and their habitats.
6) Vary the spatial and temporal distribution of spacing activities within large contiguous areas to minimize disruption of wildlife patterns and usage of habitat.
7) Maintain habitat for identified wildlife, red and blue listed, and regionally significant species.
8) Ensure maintenance of Riparian Management Areas including Riparian Reserve Zones (RRZ) and Riparian Management Zones (RMZ).
9) Rehabilitate Riparian Management Areas.
10) Ensure maintenance of forest thermal cover and/or snow interception forest cover attributes.
11) Ensure that activities do not disrupt nesting sites of bald eagles, ospreys and herons.
12) Maintain visual screening corridors or buffers along linear corridors and on flat terrain.
13) Minimizing soil disturbance that can result in erosion, sediment transport, stream siltation and impacts on fish and aquatic environments.

14) Manage for maintenance of coarse woody debris (CWD).
15) Ensure that harmful agents do not enter aquatic environments.
16) Prevent introduction and spread of non-native and cultivated plant species.
17) Maintain snow interception forest cover attributes (e.g., ungulate winter range)
18) Mange for canopy heterogeneity (manage for stand vertical and horizontal structure)
19) Manage arboreal lichen production for lichen dependent species.
20) Ensure the fertilization loading sites are cleaned up after treatment to prevent contamination.
21) Prevent overgrazing by livestock (during vegetation control or general overgrazing).

These objectives are provincial in scope and additional general objectives should be identified as required to meet district or regional needs and priorities as identified in the monitoring plan.

As the monitoring plan is designed, each objective should be reviewed for its applicability to the units selected for monitoring. The chosen objectives will then need to be specifically described in the context of the unit, and restated as a quantified, measurable objective. Legislation, provincial and local policy, and experience should contribute to deciding upon the final measurable objectives.

For example, the desired general objective may be to "maintain a variety of stocking densities within treatment areas and across landscapes for habitat diversity". The detailed habitat/ecosystem objectives could be described as follows:

1. Within the boundaries of a juvenile spaced unit, an 'evenly spaced' density of leave trees (i.e., standard +- 100 spha) should not cover more than 20 hectares of contiguous area.
2. Within a forested area that contains 300 hectares of juvenile spacing, at least three densities of juvenile spacing should be represented (density being described as the standard +- 100 spha).

When objectives are established in operational plans, they must reflect the current management standards at the time of plan development. Unless specified otherwise in the monitoring plan objectives, results are compared with the habitat/ecosystem objectives as established in the plan.

In cases where habitat/ecosystem objectives have *not* been set prior to harvest or silviculture treatment, objectives can be established as part of monitoring, and should represent present day standards. The monitoring results will indicate a baseline, or 'state of the forest/environment' condition, rather than providing an opportunity to assess compliance or effectiveness of treatments.

2.2 SILVICULTURE INFORMATION RECORDS

The following four MoF silviculture data capture, storage and delivery systems are pertinent to the habitat objectives associated with monitoring of incremental and backlog silviculture treatments:

1. Major License Silviculture Information System (MLSIS)
2. Integrated Silviculture Information System (ISIS)
3. Silviculture Information Access (SIA), and
4. Opening Files

In addition, MELP Resources Inventory Branch is developing a Habitat Monitoring Database. The database has not yet been tested, and linkages to the EFP need to be established as this monitoring framework is implemented. Staff responsible for EFP monitoring should contact their Regional Wildlife Inventory to determine the status of the database.

The ***Major Licence Silviculture Information System (MLSIS)*** is an on-line, data entry and reporting system designed to record, update, inquire and report on post-October 1, 1987 silviculture information for major licence tenures. The tenure holder is responsible for supplying specific silviculture data to the MoF district office - which becomes responsible for entering and maintaining the data system. MLSIS is also used by the MoF to monitor major licensee's silviculture requirements and/or obligations, to produce annual reports and to update forest cover information. MLSIS information is available in all districts immediately after being entered into the system.

The ***Integrated Silviculture Information System (ISIS)*** has been fully operational since 1993, and is the largest MoF on-line data and information system. It is designed to capture and process pre-October 1, 1987 land-based information for Timber Supply Areas -- including areas logged under the Small Business Forest Enterprise Program and areas affected by fire or forest pests. All backlog Silviculture Prescription and Stand Management Prescription information, including juvenile spacing, pruning, fertilization, site preparation, brushing, planting and fill-planting information is stored in ISIS.

Although MoF districts are responsible for maintaining both MLSIS and ISIS related information, the data can also be accessed by other Ministry systems linked to the corporate database. ISIS and MLSIS also contain information from other corporate databases, such as the Client Management System (CLM), Forest Tenure Administrative System (FTAS), Nursery Information System (NIS), and Seed Planning and Registry System (SPAR). In the near future ISIS will also be linked to Range Management and Recreation, and Financial Administration systems.

Silviculture Information Access (SIA) is a reporting database which utilizes Microsoft Access to develop ad hoc queries. It contains all of the data from ISIS and MLSIS with the exception of

the *Comment* text fields from forms. SIA is only updated bi-weekly so the information may not always be as current as information contained in ISIS or MLSIS[1].

Opening Files each District Office historically tracks on the ground opening/block history on what is now identified as the *Opening File.* Prior to ISIS and MLSIS a summary of the history was electronically stored and updated on the *History Record* for each opening. Now the Opening Files contain the back up documentation of information entered into ISIS and MLSIS. Project files (either District or Licensee based) that contain data supporting information for the Opening File are often referenced in the Opening Files.

These MoF silviculture data recording and storage, and data reporting systems, in association with the many survey reports that contribute to these databases, contain much historical as well as current silviculture information which is vital in developing a MELP EFP monitoring program[2]. Cooperative recording and access to such information is critical in both monitoring and data base maintenance. The relationship between MELP habitat objectives and MoF silviculture planning and information systems is illustrated in Figure 2.

[1] For additional reference, refer to the *ISIS User Guide (July, 1994)*, the *MLSIS User Guide (April, 1995)* and *How to Enter Stand Management Prescriptions into ISIS (July, 1996)*. These documents provide further explanation, as well as step-by-step instructions on the use of ISIS and MLSIS.

[2] As ISIS is relatively new in development and contains only that data which has been entered from the field forms, there may, for the present, be a greater reliance on MoF field survey reports to develop the monitoring program. The usefulness of ISIS will grow as more data is entered into the system.

2.3 INCREMENTAL/BACKLOG SILVICULTURE TREATMENTS AND HABITAT/ECOSYSTEM OBJECTIVES

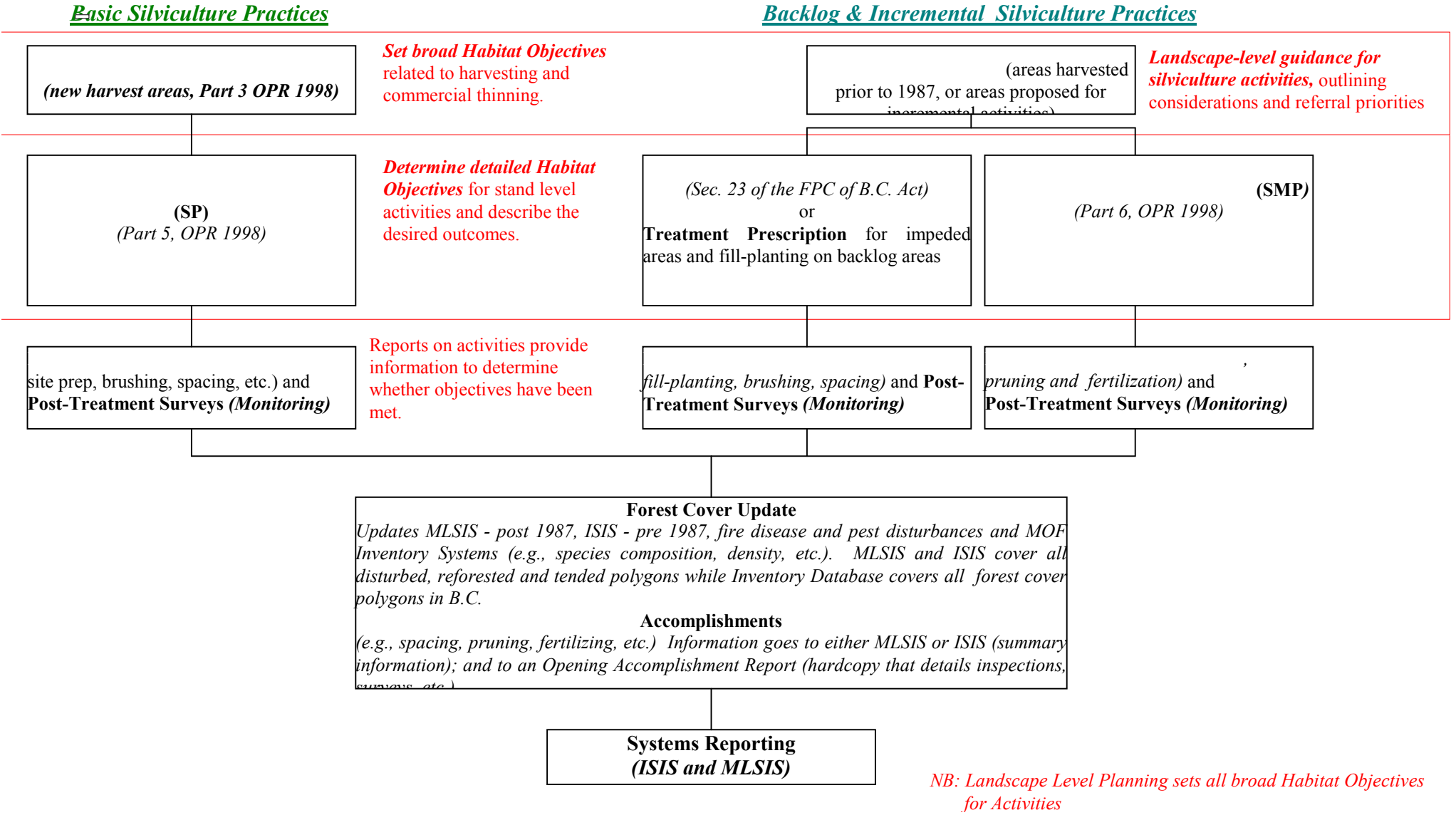
The following is a summary of silviculture treatments/activities and associated habitat/ecosystem benefits and risks that may result from each backlog or incremental silviculture treatment activity. The risks or benefits associated with a particular silviculture activity will depend on existing standards, resource management objectives/strategies of higher level and local plans, and the status of the forest land base relevant to the STA.

Juvenile spacing, (or pre-commercial thinning[3]), **is an incremental and/or backlog silviculture activity** that involves the removal of trees within a young stand to control stand density, maintain or improve growth, increase wood value, or achieve other resource management objectives. The thinned stems are usually left on the ground[4].

[3] Although commercial thinning was initially included as part of the monitoring strategy, it has since been confirmed that it is not eligible for funding under FRBC and has therefore been excluded from this program. Commercial thinning is not considered to be an EFP silviculture activity.

[4] (Forest Renewal BC, *Glossary of Terms*, 1996), and/or (*Spacing Guidebook*, 1995: 1)

Figure 2: Relationship between MELP EFP Habitat Objectives and the MoF Silviculture Planning and Information Systems



Potential habitat/species benefits of juvenile spacing may include increased forage production and temporary increased slash that may add habitat structure, particularly security cover, for small mammals. May improve mobility of ungulates through previously dense stands. Increases variability of stand density which contributes to biodiversity.

Potential habitat/species risks of juvenile spacing may include decreased forest structural and species diversity (e.g., retention of larger, healthier conifer crop trees only), reduced security cover for large mammals, and decreased snow interception. Large slash accumulations may temporarily impede large mammal movement through a treated area. The felling of danger trees may result in the removal of existing wildlife trees and the culling of damaged and diseased trees and less favourable tree species (e.g., deciduous trees) which may remove future potential wildlife trees or desirable habitat attributes.

Pruning is an incremental silviculture activity that involves the removal of branches from the stem of a tree or removal of multiple leaders from crop trees to promote the production of knot-free or clear wood.[5]

Potential habitat/species benefits from pruning include increased understory plant species diversity and forage production (usually in conjunction with spacing). Pruning slash may temporarily add habitat structure, particularly security cover, for small mammals.

Potential habitat/species risks associated with pruning include reduced forest security and thermal cover, loss or reduction in production and availability of lichens, and loss or reduction of vertical stand structure and nesting habitat.

Fertilization is an incremental silviculture activity that involves the application of fertilizers to promote tree growth on sites deficient in one or more soil nutrients.[6]

Potential habitat/species benefits from fertilization include increased short-term forage production and decreased timeframes on cutover areas to provide replacement forest cover habitat by promoting canopy closure.

Potential habitat/species risks from fertilization include truncation of natural plant succession and forage availability and the potential for leachate into enter water surface runoff and/or streams and lakes. The former may result in simplification of plant communities, which might encourage disease and insect attacks.

Site Preparation is a backlog silviculture activity that involves any planned measure to prepare a site for the favourable reception and satisfactory growth of naturally disseminated seed, sown

[5] (*British Columbia Forest Practices Code Standards*, 1994: 188); and/or (*Pruning Guidebook*, 1995: 1)
[6](*British Columbia Forest Practices Code Standards*, 1994: 178)

seed, or planted seedlings. Sites can be prepared using fire, mechanical or chemical methods, livestock, or a combination of these techniques[7].

Potential grazing habitat/species benefits of site preparation may include encouraging species which regenerate after fire or on exposed soils (e.g., thimble berry, fireweed, *Salix*) and a responding shift to early seral/pioneer species forage production.

Potential habitat/species risks of site preparation may include decreased forest diversity (e.g., retention of conifer crop trees only), temporary reduction in forage availability, removal of wildlife trees, reduction/removal of coarse woody debris, increased soil disturbance (transport/deposition), increased siltation into water bodies, increased spread of noxious weeds, reduced wildlife security cover, significant plant community shifts, and corresponding shifts in wildlife species and use. Machine windrowing of slash may restrict wildlife mobility.

Brushing is a backlog silviculture activity that involves using chemical, manual, grazing or mechanical means to control competing forest vegetation and reduce competition for space, light, moisture, and nutrients for crop trees or seedlings[8]. It is normally carried out before the first spacing, or prior to the young stand reaching the 'free growing' stage.

Potential habitat/species benefits of brushing may include increased mobility through areas of thick brush and greater ground forage production. Piling of brush may provide habitat for small birds and mammals.

Potential habitat/species risks of brushing may include decreased forest diversity (e.g., retention of conifer crop trees only), temporary forage reduction, removal of wildlife trees, reduced wildlife security cover, reduced nesting habitat for small birds, shifts in plant community species and relative abundance, and changes to wildlife seasonal forage resulting from vegetative shifts. Piles of cut brush may temporarily restrict wildlife mobility. Use of domestic animals for site preparation requires specific measures to ensure health of wildlife is not affected.

Planting is a backlog silviculture activity that involves establishing a forest by setting out seedlings, transplants or cuttings in an area[9].

Potential habitat/species benefits of planting may include earlier establishment of wildlife habitat and security cover, and improved soil stability.

Potential habitat/species risks of planting may include decreased forest diversity (e.g., planting of conifer trees only), loss of wildlife trees and tree patches due to danger tree removal, introduction of non-native species or variations, truncation of early vegetative sere and loss of forage production.

[7] (*Site Preparation Guidebook*, 1995: 1)

[8] (*British Columbia Forest Practices Code Standards*, 1994: 173)

[9] (Ministry of Forests, *Glossary of Terms*, 1996: 36)

Fill-Planting is a backlog silviculture activity that involves planting that is required to supplement poorly stocked naturally regenerated or previously planted sites[10].

Potential habitat/species benefits of fill-planting may include earlier establishment of wildlife habitat and security cover, and improved soil stability. Vertical and horizontal structure, on a small scale, may also be enhanced.

Potential habitat/species risks of fill-planting may include decreased forest diversity (e.g., planting of conifer trees only), loss of wildlife trees and tree patches due to danger tree removal, introduction of non-native species, truncation of early vegetative sere, reduction of forage production and an increase in cover to forage ratios.

[10] (Ministry of Forests, *Glossary of Terms*, 1996: 36)

3.0 MONITORING PROCEDURES

The monitoring framework described in this report is aimed at monitoring an incremental or backlog silviculture activity at the stand level. Results of this monitoring may form part of an audit, which is primarily conducted at the level of a program evaluation and usually focuses on the effectiveness of policy. The procedures described in this report may also be followed when auditing. (Note that terminology around the terms 'monitoring' and 'auditing' is not standardized.)

The overall purposes of monitoring at the activity level include:

1. To determine compliance as related to a legislated responsibility/obligation or contractual standard/obligation; in the latter case, is often considered as 'quality assurance'.
2. To generate 'state of the forest/environment' information that can be used to refine higher level and or operational plans.
3. To assess whether the proposed results were achieved; often termed 'effectiveness monitoring'.

The process and procedures recommended in this report have been primarily designed to meet the latter objective. However, in the interests of efficiency and priorities for monitoring, more than one objective can be achieved from a single monitoring activity.

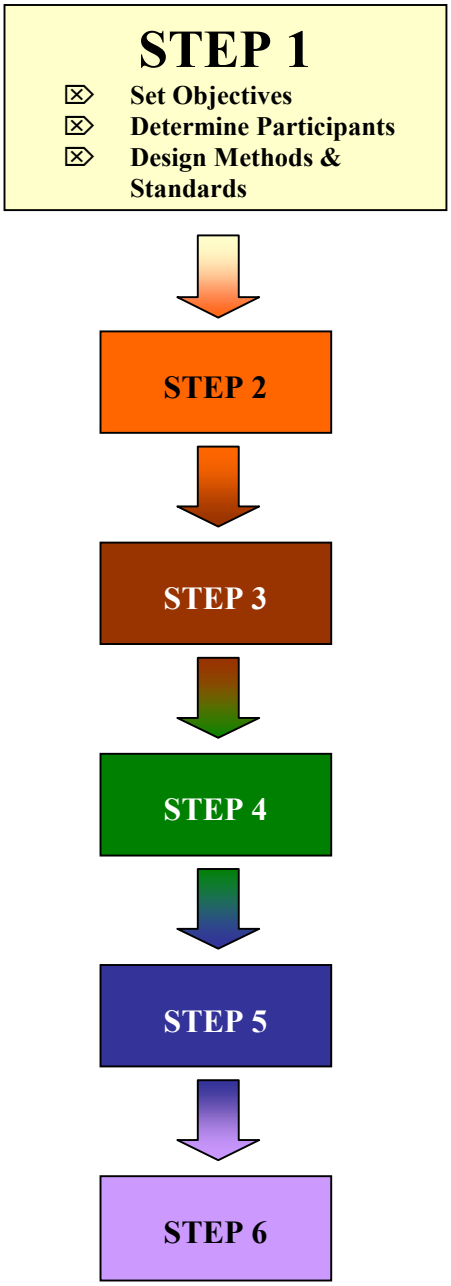
Whatever the purpose, the validity of the monitoring results will depend on the methods and standards identified in a monitoring plan, and the resources available to implement the plan. Figure 1 provides an illustration of the general procedures required to develop and implement a monitoring plan. Instructions for developing the monitoring plan component of the monitoring framework are detailed in Appendix A. The steps required to implement the overall monitoring strategy are outlined below.

3.1 STEP ONE - DRAFT MONITORING PLAN

A monitoring plan states the objectives for monitoring, the proposed method(s) of monitoring to meet the objectives and the resources required to carry out the plan. As always, objectives should be specific, measurable, achievable, realistic and time bound. Some examples of monitoring objectives include the following:

- to determine the overall compliance for Company "x" with Forest Practices Code legislation and standards for pre-commercial thinning activities in Landscape Unit "y", from June, 1995 to June, 1997;

- to evaluate the effects of pre-commercial thinning on ecosystem/habitat objectives in riparian management zones the SBS prior to June 1998; and
- to assess sites where wildlife trees have been retained and brushing activities have been conducted, to determine overall damage/loss from the activity or from other causes up to three years after brushing.



3.1.1 OBJECTIVES

Setting monitoring objectives and expectations early during planning will ensure that resources are allocated effectively and efficiently and the monitoring methods are designed to meet set objectives. If, on the other hand, sufficient resources cannot be secured to carry out the plan as designed, revisions to the original monitoring plan can be made based on stated objectives, priorities, and the available resources.

Reference to *when* the stated objectives can be evaluated should be made at certain steps during the monitoring process. For example, the objective for monitoring may be 'to review all silviculture treatments to evaluate wildlife tree and tree patch retention levels'. The original monitoring plan may have identified field review of at least ten treatment areas. However, the office review of existing information accurately documents the location, size, and number of wildlife trees and patches (with photo references) to satisfy monitoring results. At this point it may be decided to substantially reduce or eliminate the number of proposed field inspections.

Conversely, the objective for monitoring may be 'to ensure that harmful agents do not enter aquatic environments'. Unless aquatic monitoring stations were put in place, it would be virtually impossible to assess this monitoring objective without a field inspection carried out during operations. In this instance not only would the field monitoring be required, but it would also have to be timed to coincide with proposed activities. This scheduling factor must also be incorporated into the monitoring plan.

3.1.2 PARTICIPANTS

As the monitoring plan is being developed, it will be necessary for the monitoring team to identify the roles and responsibilities of the various participants in overall implementation of the plan (e.g., role of MELP, MoF, and or contractors related to access to information, files and data sources, etc.). The resources needed to carry out the monitoring and the intensity of the monitoring itself

will be dictated by the level of participation, responsibilities, and expectations assigned at the beginning of the project.

3.1.3 METHODS AND STANDARDS

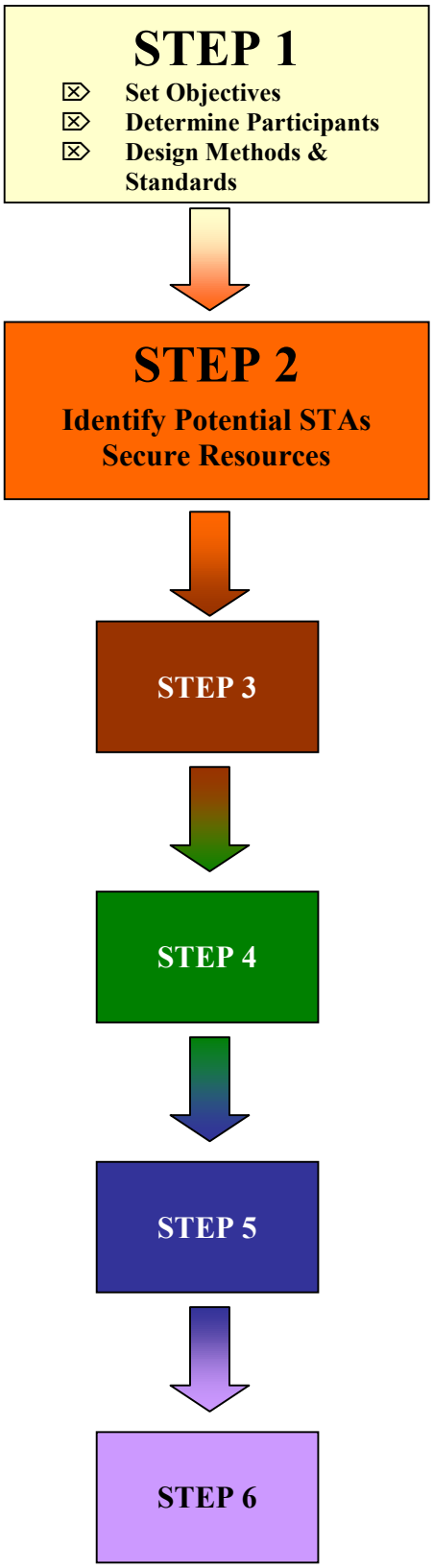
The chosen monitoring methods and standards, must be consistent with the monitoring plan objectives and available resources. Realistic monitoring methods will need to be decided that reflect the desired level of accuracy and precision around results, the knowledge level around the habitat/ecosystem attributes being measured, the desired monitoring standards, and the available resources.

In the monitoring plan, the methods used for the following aspects of monitoring should be described:

- identifying potential Stand Treatment Areas;
- applying risk assessment to the monitoring;
- selecting the sampling methodology;
- conducting office reviews;
- conducting field reviews; and
- reporting results.

Standards for these above methods should also be specified in the monitoring plan, or give a reference to sources where the standards are explained.

At this early stage, provincial monitoring methods and standards are at various level of development. District staff should check with regions and branches to determine the standards to which the monitoring should adhere, and the various methods that could be applied. Resources Inventory Branch and Resource Stewardship Branch are the primary sources for standards and methods.



3.2 STEP TWO - SECURE RESOURCES

In Step 2 the prospective Stand Treatment Areas (STAs) are identified using the method set out in the draft monitoring plan. Resources to carry out the monitoring plan are also confirmed.

3.2.1 IDENTIFY PROSPECTIVE STAND TREATMENT AREAS (STAS) (FIGURE 3.1)

The monitoring team will require access to ISIS/MLSIS and SIA databases as well as the use of Microsoft Access. They will also need to contact the District Silviculture Planner or appropriate

Ministry of Forests district staff for assistance in retrieving required information.

STA selection will be based on:

- stratification of silviculture activity by treatment type (e.g., juvenile spacing, pruning, fertilization, site preparation, brushing, planting and fill-planting);
- year of treatment (pre or post FPC[11]);
- risk of the silviculture activities adversely impacting the habitat/ecosystem objectives for the Landscape Unit and/or STA (Refer to Table 1);
- biogeoclimatic ecological classification (BEC);
- forest tenure (e.g., Forest License, Tree Farm License, Small Business Forest Enterprise Program, other); and
- representative sample(s) selection from the sampling methodology.

The sampling methods suggested for choosing STAs to monitor are:

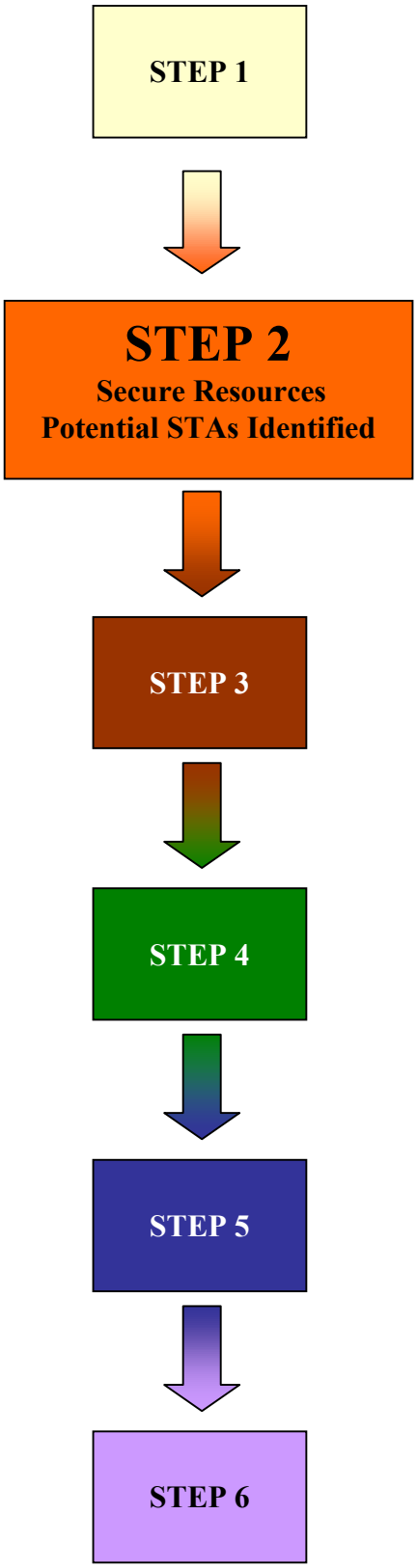
- select areas based on the risk associated with the silviculture treatment and the habitat/ecosystem objectives;
- randomly select STAs proportionally within tenure and landscape unit or biogeoclimatic (BEC) zones; or
- use a combination of risk and random selection.

The following reports need to be accessed:

- ISIS/MLSIS reports or SIA query of all openings that have undergone the treatment (e.g., juvenile spacing) over a defined period (e.g., one year or range of years), and
- ISIS/MLSIS *Opening Summary Report,* for each opening identified in the above report.

These reports can be sorted by biogeoclimatic zone, silviculture treatment, and tenure. If sorting will be by landscape units, the landscape units will need to be identified from district maps and/or GIS data base, and need to be included in the query parameters.

The *Opening Summary Report* provides ecological information, stocking stand, site sensitivity, soil disturbance, treatment unit summaries, etc.



[11] Pre-code treatments were approved prior to June 1995.

3.2.2 SELECT SAMPLING METHODOLOGY – RISK ASSESSMENT

As mentioned above, three general sampling methods are recommended:

- select areas based on the risk associated with the silviculture treatment and the habitat/ecosystem objectives;
- randomly select STAs proportionally within tenure and landscape unit or biogeoclimatic (BEC) zones; or
- use a combination of risk and random selection.

If risk will be incorporated to choose STAs for monitoring, assign each STA a risk rating associated with the particular habitat/ecosystem objective and silviculture treatment. Table 2 is *an example* of risk rating based on silviculture treatments and the general habitat/ecosystem objectives identified in this report.

Table 1: An example of risk to habitat/ecosystem objectives as a result of proposed silviculture treatments

	Habitat Ecosystem Objectives	Silviculture Treatment												
		Brushing									Site Prep.			
		Chemical	Livestock	Manual	Mechanical	Fertilization	Juvenile Spacing	Planting	Fill Planting	Pruning	Chemical	Livestock	Mechanical	Prescribed Fire
1	Retain "rare" ecosystems, forest, plant, and vegetation types.	H	VH	L	L	L	L				H	VH	L	M
2	Retain wildlife trees and tree patches.	VH		H	VH	H	H	M	M		VH		VH	VH
3	Maintain a full range of native tree and vegetative species representative of the dynamics of natural forest ecosystems.	H	VH	L	M		H	H	H		H	VH	H	L
4	Maintain a variety of stocking densities within treatment areas and across the landscapes for habitat diversity.						H	L	L				M	
5	Minimize the adverse impacts of road access on fish and wildlife populations and their habitats.		M		VH		L	L	L			M	M	
6	Vary the spatial and temporal distribution of silviculture activities within large contiguous areas to minimize disruption of wildlife patterns and usage of habitat.	H	L	L	L	L	H	M	L	M	H	L	L	VH
7	Maintain habitat for identified wildlife, red/blue listed species, and regionally significant species[12].	H	L-H	M	H		L	M	M		M	L-H	H	
8	Ensure maintenance of Riparian Management Areas including Riparian Reserve Zones (RRZ) and Riparian Management Zones (RMZ).	L	H	M	H	H	M				M	H	H	H
9	Rehabilitate Riparian Management Areas (RMA).	L	H	L	M	H	M				L	H	H	H
10	Ensure maintenance of forest thermal cover.						M			H			M	H
11	Ensure that activities do not disrupt nesting sites of bald eagles, ospreys, and herons.	H[13]			H	VH					VH			
12	Maintain visual screening corridors or buffers along linear corridors and on flat terrain.	L		L	H		VH			H			H	VH
13	Minimize soil disturbance that can result in erosion, sediment transport, stream siltation, and impacts on fish and aquatic environments.		H		VH							H	VH	H
14	Manage for maintenance of coarse woody debris (CWD).				M		L						M	VH

[12] Access impacts may include human related (poaching, displacement, problem wildlife), terrestrial (direct loss of habitat), and aquatic (increased run off, siltation).
[13] Aerial application

15	Ensure that harmful agents do not enter aquatic environments.	VH	H			H					VH	H		
16	Prevent introduction and spread of non-native and cultivated plant species.		H		VH		M	L	L			H	VH	
17	Maintain snow interception forest cover attributes (e.g., ungulate winter range).						H			H			M	VH
18	Manage for canopy heterogeneity (manage for stand vertical and horizontal structure).							H	M	H				
19	Manage arboreal lichen production for lichen dependent species (e.g., mule deer and caribou)						M			H			M	VH
20	Ensure the fertilization loading sites are cleaned up after treatment to prevent contamination					VH								
21	Prevent overgrazing by livestock (during vegetation control or general overgrazing).		VH									VH		

KEY

VH - Very High H - High M - Moderate L - Low Blank - Not Applicable	The risk rating applies to stand treatment areas or sensitive areas, riparian areas, reserves or buffers *within or adjacent to stand treatment areas. To use the table cross-reference the SILVICULTURE ACTIVITY with the HABITAT/ECOSYSTEM OBJECTIVE(S) for areas within or adjacent to the STA, to determine the risk of adverse impact to the objective as a result of the silviculture activity.

Risk is based on the hazard (e.g., the need to fall wildlife trees for safety purposes) associated with the consequences (e.g., loss of wildlife habitat). Risk may vary depending on:

- biogeoclimatic zonation;
- management objectives and strategies of local and higher level plans;
- site specifics factors, (e.g., presence of red or blue listed species and their habitats, riparian areas, fisheries sensitive zones, etc.);
- resource values; and
- spatial and temporal distribution of silviculture treatments.

A product of using risk assessment in monitoring may be to sample 10% of the STAs that have a high or very high risk for objective 8 – *ensure maintenance of Riparian Management Areas*.

A blank risk rating form is provided in Appendix B.

3.2.3 Select Sampling Methodology –Proportional Random Selection

Table 2 is an example of proportional random selection.. In this example, juvenile spacing activities are being monitored with an aim to sample 7.5% of the total STAs, or 11 samples of the population of 145 STAs (all of which were approved after June 1995). The proportional random sample will reflect the occurrence of STAs in the tenures, as follows:

- within the ESSF biogeoclimatic zone, STAs to monitor would be selected with 20% being in Forest License (FL) tenures, 20% being in Tree Farm License tenures (TFL) and 60% being in Small Business (SBFEP) operating area tenures;
- within the BWBS biogeoclimatic zones, 100% of the STAs would be in a TFL;
- within the SBS biogeoclimatic zone, 15% of the STAs would be in each of the FL and TFL tenure areas respectively, and 70% would be in areas classified as 'other'.

The table summarizes the number of samples to meet the above-described criteria. The actual STAs to monitor in each tenure by BEC and year would be randomly selected, by generating random numbers or using another acceptable statistical method.

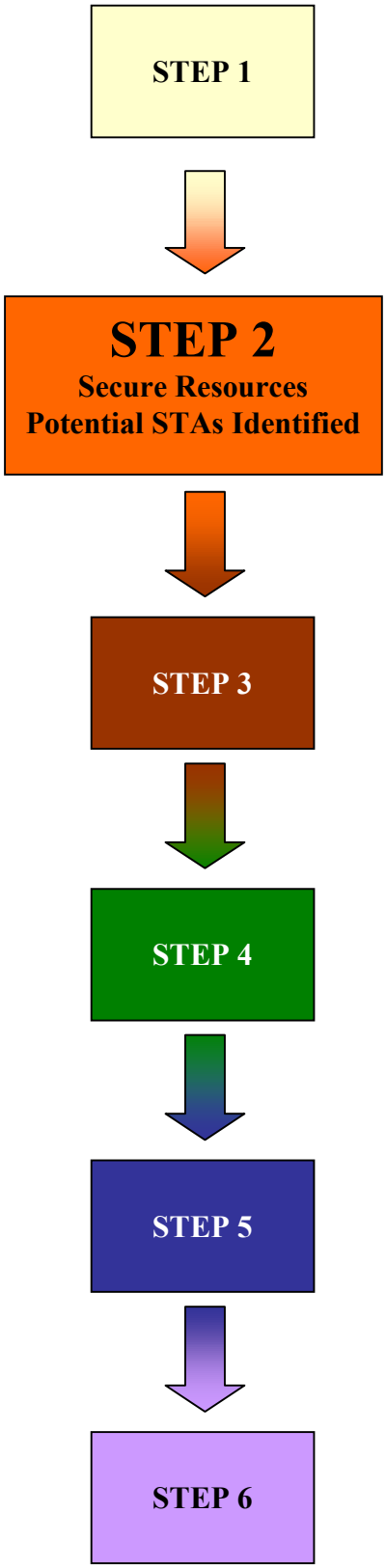


Table 2: Example of Proportional Random Selection of Stand Treatment areas for Monitoring

Treatment Type: Juvenile Spacing (post FPC)

Landscape Unit: k-10 (Littletree/Bighorn Creeks)

Treatment Year	BEC	FOREST LICENSE STAs			TREE FARM LICENSE STAs			SBFEP STAs			OTHER STAs			Total STAs		
		#	%	Sample Size	#	%	Sample Size	#	%	Sample Size	#	%	Sample Size	#	%	Sample Size
1996	ESSF	10	*20*	1	10	*20*	1	30	*60*	2	0			50	*35*	4
1996	BWBS	0			25	*100*	2	0			0			25	*17*	2
1996	SBS	10	*15*	1	10	*15*	1	0			50	*70*	3	70	*48*	5
TOTALS		20	1.4	2	45	2.7	4	30	1.4	2	50	2.0	3	145	7.5	11

3.3 STEP THREE - FINALIZE THE MONITORING PLAN

The draft monitoring plan is finalized by accounting for the following:

- the available resources, i.e., if resources are scarce in a particular year, what proportion of the intended monitoring can be carried out and when will the remainder be done in subsequent years; and
- the scope of the sample locations may have to be adjusted for various reasons including access, local concerns to focus monitoring in a certain landscape unit, information gleaned from other inspections, etc.

A schedule with anticipated required resources is drawn up and communicated to participants. Staff or contract services are secured and workplans are finalized.

The final monitoring plan should indicate realistic goals to be achieved for that particular year. The plan may have to be formally approved within the MELP or by other agencies, depending on the current funding arrangements and responsibilities. The plan can also serve as a measure of performance should an audit be conducted related to the Enhanced Forestry Program.

3.4 STEP FOUR - OFFICE REVIEW

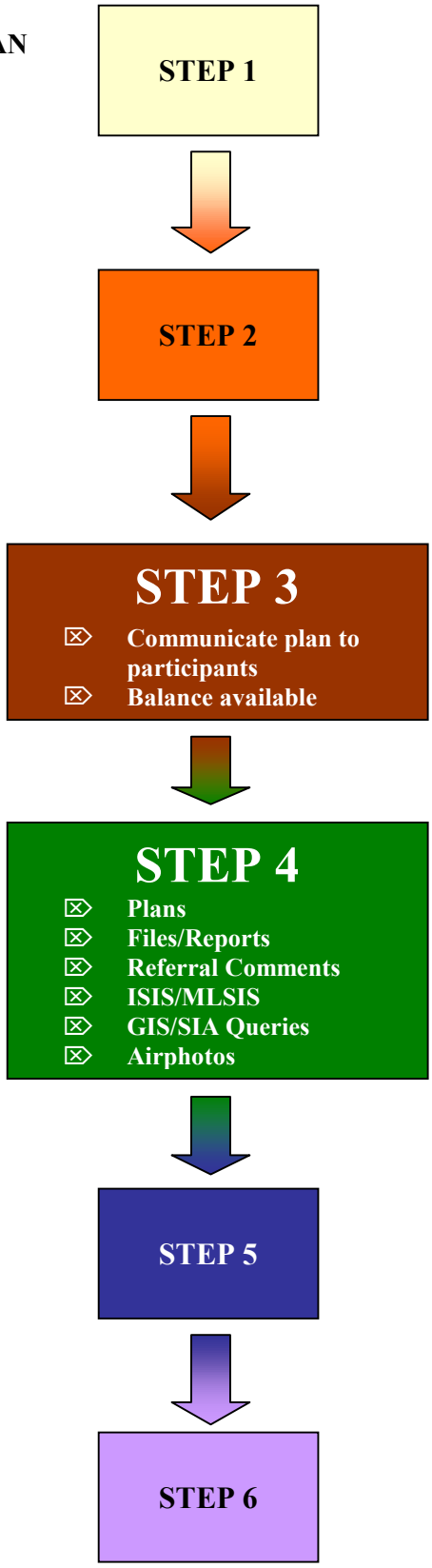
The office review of STAs is critical to assess the potential for adverse impacts on the habitat/ecosystem objectives, and to minimize the cost of monitoring by reducing field reviews where they may not be required. A review of existing information, including landscape unit plans, operational plans, summaries of site data and current photographs, is necessary for three reasons:

1. Determine which STAs do not need a field review.
2. Reduce the time and number of field reviews through planning.
3. Identify which STAs require field reviews and for what purposes.

The methods used in the office review, and the quality standards for those methods, should be specified in the monitoring plan.

The following ISIS/MLSIS reports are required to initiate the office review:

- ISIS/MLSIS *Silviculture Forest Cover Attribute Form, and*



- ISIS/MLSIS *Greensheet Report.*

The *Silviculture Forest Cover Attribute Form* provides species composition, age, height, DBH, stocking density, percent crown closure, etc.

The *Greensheet Report* includes all 'comment fields' that have been entered from hardcopy forms such as SPs, SMPs, etc. It also lists the date and source form of all comments. The advantage of running the *Greensheet Report* is that it provides all comments that would otherwise have to be accessed by calling up individual 'comments field' screens in ISIS.

Some districts, for various reasons, do not have up to date ISIS records. Therefore, at this point, there may be several blank screens for the selected area in the ISIS database. In these cases it will be necessary to access the hardcopy information that is required. The *Silviculture Forest Cover Attribute Form* should be on the opening file. If the information necessary to complete the office review is not on the opening file, it may be necessary to request project files from the licensee or district staff.

Review MELP files for documentation of recommendations concerning MELP referral comments. For each STA, review and document (or establish) applicable habitat/ecosystem objectives for incremental and backlog silviculture activities as identified by MELP staff.

Review records and forms, and document pertinent information. This may include, but is not limited to, review of MLSIS and ISIS computer screen information related to specific silviculture treatments (Table 3) and MoF and MELP field and recording forms (Table 4).

Table 4 is intended for use in conjunction with the ISIS information for each STA (opening). To use the table, find the relevant silviculture treatment along the top row, follow the column down accessing the ISIS Screen (applicable to the habitat/ecosystem objective). Review the ISIS information and document potential concerns with respect to any of the objectives. A more complete list of field form names and numbers is provided in Appendix C, and examples of information displayed on ISIS computer screens are contained in Appendix D.

Review the information gathered in Step 1. If necessary, review aerial photographs of STAs. Assess whether the monitoring objectives can be met by the office review. Determine if field

monitoring is required and, if it is required, to what extent field monitoring will be carried out. Field review is necessary if insufficient information was found on file to assess whether or not the habitat/ecosystem objectives have been met or compromised. For example, one monitoring plan objective may be to monitor all sites with very high and high risk of a silviculture treatment resulting in loss of wildlife trees. The office review finds sufficient documentation of both the wildlife tree objectives and wildlife trees retained in the STAs. Therefore it is decided that these STAs will not be field reviewed.

It is important to document *why* no field review will be completed.

If no field reviews are required, skip Step 5 and go to Section 3.7 of this report.

At this point, revisit the monitoring plan objectives. The office review may have found information that will result in a revision of the monitoring plan.

Legend to accompany Tables 3 and 4 – Habitat/Ecosystem Objectives

1	Retain "rare" ecosystems, forest, plant, and vegetation types.
2	Retain wildlife trees and tree patches.
3	Maintain a full range of native tree and vegetative species representative of the dynamics of natural forest ecosystems.
4	Maintain a variety of stocking densities within treatment areas and across landscapes for habitat diversity.
5	Minimize the adverse impacts of road access on fish and wildlife populations and their habitats.
6	Vary the spatial and temporal distribution of silviculture activities within large contiguous areas to minimize disruption of wildlife patterns and usage of habitat .
7	Maintain habitat for identified wildlife, red and blue listed, and regionally significant species.
8	Ensure maintenance of Riparian Management Areas including Riparian Reserve Zones and Riparian Management Zones.
9	Rehabilitate Riparian Management Areas
10	Ensure maintenance of forest thermal cover.
11	Ensure that silviculture activities do not disrupt nesting sites of bald eagles, ospreys, and herons.
12	Maintain visual screening corridors or buffers along linear corridors and on flat terrain.
13	Minimize soil disturbance that can result in erosion, sediment transport, stream siltation, and impacts on fish and aquatic environment.
14	Manage for maintenance of coarse woody debris (CWD).
15	Ensure that harmful agents do not enter aquatic environments.
16	Prevent introduction and spread of non-native and cultivated plant species.
17	Maintain snow interception forest cover attributes (e.g., for ungulate winter ranges).
18	Ensure the fertilization loading sites are cleaned up after treatment to prevent contamination.
19	Prevent overgrazing by livestock (during vegetation control or general overgrazing).

Table 3: ISIS/MLSIS Screen Information related to Silviculture Treatments and Ecosystem/Habitat Objectives

ISIS Screen Information	Silviculture Treatment												
	Brushing Chemical	Brushing Livestock	Brushing Manual	Brushing Mechanical	Fertilization	Juvenile Spacing	Planting	Planting, Fill	Pruning	Site Prep. Chemical	Site Prep. Livestock	Site Prep. Mechanical	Site Prep Prescribed Fire
Area Summary (PHP59)	3,7	3,13	1-2	1-2,13		1-2,6-7	2,5	2,5		2-3,6	3,13	1-3,6,13	13
Biodiversity (PHP57)	2	1	1-3	1-3,14	2	2-3	2-3	2-3	17	1-2		1-2,14	14
Bladed or Excavated Trails (PHP 55)		5,13		5,13		5	5	5			5,13	5	13
Brushing (PHP49)	6-7,11-12,15	13,15-16,17	1-3,8-9,12	1-3,5,8-9,12-15									
Brushing Planning (PAG15)	1-3,6-9,11-12,15	1,3,5,13,15	1-3,8-9,12	1-3,5,8-9,12-15									
Brushing Results (RAC11)	1-3,6-9,11-12,15	1,3,5,13,15	1-3,8-9,12	1-3,5,8-9,12-15									
Coarse Woody Debris(PHP)				14								14	14
Consistency with HLP/FDP (PHP32)	3	3								3	3	3	
DBH Distribution (PAG32)						2-3,10			10				
Ecology (PHP33)	1,3,7,15	3,13,15	1-3,15	1-3,13,15	2,15	1-2,5,6,8-9,15	3,5	3,5		1-3,15	1,3,13,15	1-3,13,15	13
Fertilization (PHP69)					2,15,18							11	
Fertilization Planning (PAG12)					2,15,18							11	
Fertilization Results (RAC09)					2,15,18							11	
Fisheries (PHP38)		5,13		5,13	15	5	5	5			5,13	5,13,15	13
Forest Cover (SUR60)	1-3,7-9,15	1,3,15	1-3,8-9,15	1-3,8-9,15	2,15	1,3-10	3-4	3-4	10	1-3,7-9,15	1,3,15	1-3,7-9,11,15	
Gully Assessment (PHP54)		5,13		5,13			5	5			5,13	5,13	13
Harvest Results(RAC12)						12							
Height Distribution(PAG33)						3,10			10				
Juvenile Spacing Planning (PAG07)						1-11,15							
Juvenile Spacing Results (RAC08)						1-11,15							
Long Term Managmenet(PHP53)	3	3								3	3	3	
Other Forest Values (PHP40)	1-2	1	1-2	1-2	2	12	2	2	17	1-2	1	1-2	
Planned Harvesting (PAG17)						12							
Planning, Stand Pruning (PAG08)									10,12				
Plantability (PAG30)							2-5	2-5					
Planting Planning (PAG05)							2-5	2-5					
Planting Results (RAC06)							2-5	2-5					
Planting Stock Condition (PAG16)							2-5	2-5					
Planting Stock Data (PAG06)							2-5	2-5					
Post Treatment Stand Label (RAC19)			3	3		3,10	2-5	2-5	10	3	3	3	
Pruning(PHP65)									17				
Pruning Detail (RAC18)									10				
Pruning Planning (PAG08,13)									10				
Pruning Results (RAC10)									10				
Range(PHP34)		16									16,21		
Recreation(PHP65)	12		12	12		12			12			12	12

ISIS Screen Information	Silviculture Treatment												
	Brushing Chemical	Brushing Livestock	Brushing Manual	Brushing Mechanical	Fertilization	Juvenile Spacing	Planting	Planting, Fill	Pruning	Site Prep. Chemical	Site Prep. Livestock	Site Prep. Mechanical	Site Prep Prescribed Fire
Regeneration (PHP62)							2-5,16	2-5,16					
Rehabilitation Plan (PHP61)		5,13		5,13		5	5	5			5,13	5,13	13
Reserves (PHP72)	1-2,8-9,11-12,15	1,15	1-2,8-9,12,15	1-2,8-9,15	2,15	1-2,7-9,11-12,15	2	2	12	1-2,8-9,11,15	1,15	1-2,8-9,12,15	12
Riparian Assessments (PHP58)	8-9	5,13	8-9	5,8-9,13	2,15	5,8-9,15	5	5		8-9	5,13	5,8-9,13	13
Sample Tree Data (PAG34)			3	3		3,10			10				
Seedling Requirements (PHP48)							3	3					
Sensitive Area (PHP60)	1-2,7-9,11-12,15	1,5,15	1-2,8-9,12,15	1-2,5,8-9,12,15	11,15	1-2,7-9,11-12,15		2	12,17	1-2,7-9,11,15	1,15	1-2,5,7-9,12,15	12
Silviculture System (PHP 66-67)			3			3,10,12							
Site Disturbance Limits (PHP42)		5,13		5,13		5	5	5			5,13	5,13	13
Site Prep. Planning Details (PAG14)										1,3,6,11,15	13	13	12-14
Site Prep. Result Details (RAC17)										1,3,6,11,15	13	13	12-14
Site Preparation (PHP47)				5						1-3,6-9,11,15	1,3,5,13,15-16	1-2,5-9,12-14,15	12-14
Site Preparation Planning (PAG04)										1-3,6-9,11,15	1,3,5,13,15	1-3,5-9,12-15	12-14
Site Preparation Results (RAC07)										1-3,6-9,11,15	1,3,13,15	1-3,6-9,12-15	12-14
Site Sensitivity Rating(PHP41)		13		5,13		5					5,13	5,13	13
Spacing (PHP50)						1-3,5-11							
Stand and Stock Table (PHP68)	3	3	3	3		3,6,10	3,4	3,4		3,6	3	3,6	
Stocking Requirements (PHP46)	3	3	3	3		3,6,10	3,4	3,4	10	3	3	3,6	
Treatment Schedule (PAG01)	6				15	6,10-11,15			10	1,6		6	
Vegetation Composition (PAG31)			3	3		3,10							
Visual Landscape (PHP36)	12		12	12		12			12			12	12
Watershed(PHP39)	8-9	5,13	8-9	5,13	15	5	5	5			5,13	5,8-9,13	13
Wildlife Habitat (PHP70)	2,7,11		1-2	1-2,14	2,11-12,14	2,7,10-12	2	2	10	2,5,7,11		1-2,7	14

NOTE: Habitat/Ecosystems objectives are referenced by number. See the LEGEND for a description of the habitat/ecosystem objectives.

Table 4: MOF/MELP information forms related to Silviculture Treatment and Habitat/Ecosystem Objectives

	Silviculture Treatment												
Information Source - MOF/MELP Forms	Chemical	Livestock	Manual	Mechanical	Fertilization	Juvenile Spacing	Planting	Planting, Fill	Pruning	Chemical	Livestock	Mechanical	Prescribed Fire
Forage Use - EM-7	1	1				10			10	1	1		
Forest Cover Attributes - FS 810	1-3,7-9,11	1,3	1-3,8,9	1-3,8,9	11	1-3,11	2-4	2-4	10	1-3,7-9,1,3	1,3	1-3,7-8	
Forest Cover Attributes - FS 811	1-3,7-9,12	1,4	1-3,8,10	1-3,8,10	12	1-3,12	2-5	2-5	10	1-3,7-9,1,4	1,4	1-3,7-9	
Photographic Record - EM-9	1-3,6,8,9,12,15	1,3,13,15	1,2,8,9,12	1,2,5,8,9,12-15	15	1,2,4,6,8-10	2-5	2-5	12	1-3,6,8,9,15	1,3,5,13,15	1-3,5,6,8,9,12,14,15	12-14
Planting Report - FS 753							4	4					
Planting Site Description - FS 739							4	4					
Post-Pruning Exam - FS 752													
Post-Spacing Exam - FS 749						10			10				
Pre-Stand Tending - FS 770	1,3,11,15	1,3,5,13,15		5,13,15	2,11,20	3,5,6,10,11	3,5	3,5	10	1,3,11,15	1,3,5,13,15	1,3,5,6,13,15	13
Project Description - EM-1	1-3,6-9,11,12,15	1,3,5,13,15	2,3,8,9,12	1-3,5,12-15	11	1-3,11,15	2-5	2-5	10,17	1-3,6-9,11,15	1,3,5,8,15	1-3,5-9,12-15	12-14
Silviculture Survey - FS 657	2,3,7,9	3,5,13	2	2,5,8,13,14	2	1,2,4,5,7,10,12	2-5	2-5	10,17	2,3,7	3,13	2,3,7-9,13,14	13,14
Silviculture Survey Summary - FS 659	1-3,7-9	1-3,13	3,8,9	3,8,9,13		1-4,8-10	2-5	2-4	10	2-3,7-9	3,13	2,3,7-9	13
Site Description - EM-2	1-3,6,8	1,3,13	1-2,8	1,2,8,13		1,2,4-6,8,10	1-3	1-4	10	1-3,6,8	1,3,13	1-3,6,8	13
Site Preparation Report - FS 737										15	15	1-2,6,8-9,15	
SMP - FS 68 (B-2)					2,11,15	1--12	5	5	10,12,17				
Soil Disturbance Summary FS 889		5,13		5	13	5	5	5			5,13	5,13	13
Soil Disturbance Survey FS 881		5,13		5		5	5	5			5,13	5,13	13
SP - FS 39C	1-3,6-9,11,12,14,15	1,3,5,13,14,16,19	1-3,8,9,12	1-3,5,8,9,12-14	2,9,11,14,15,18	1-12,15	2-5,7-9,1	2-5,12,16	2,10-12,17	1-3,5-9,11,14,1	1,3,5,13-15	1-3,5-7-9,11-14	12
Stand Tending Report - FS 758	3	3	3	3		3,6,8,10	3	3	10,17	3,8	3	3	
Vegetation Description - EM-3	1-3	1,3,13	1,2	1,2,13		1-4,10	2-4	2-4	10,17	1-3	1,3,13	1-3,13	1,13
Vegetation Description - FS1087	2,3	3,13	2	2,13		2-4,10	2-4	2-4	10,17	2,3	3,13	2,3,13	13
Wildlife Danger Tree - FS715	2,11		2	2	2,11	2,11	2	2		2		2,11	

3.5 STEP FIVE - FIELD REVIEW

The purposes of the field review, or inspections, are:

- to collect information not found during the office review; and or
- to field verify existing information from the records.

The extent of the field review will depend on the specific objectives of the monitoring plan as well as the associated monitoring methods and standards.

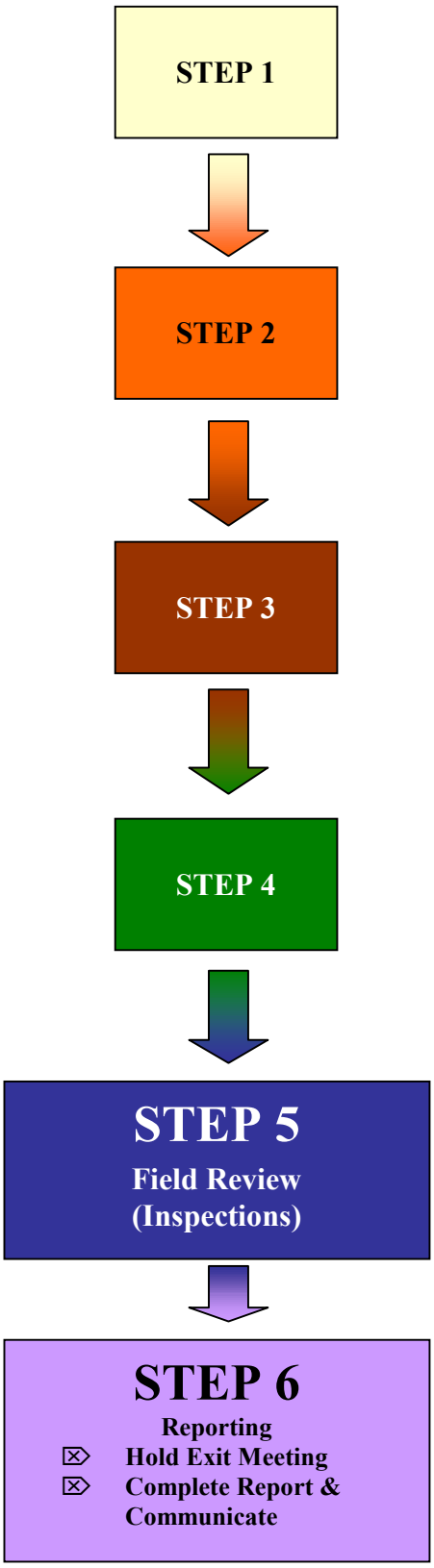
The methods used in the field review range from conducting a 'walkthru' with ocular estimates, to traversing a transect and measuring forest and environmental features as per the particular survey methodology. The field method(s) selected should match the desired sample accuracy, and be an effective use of the limited available resources for the anticipated risks of the treatments to the environment. The field methods to be followed, and the quality standards for these methods, should be described in the monitoring plan.

Prepare for field reviews by gathering the tools necessary for each field review (maps, photographs, field summaries and data cards), identifying information that needs to be collected to complete the inspection, and determining which measurements will be taken in the field.

Field reviews must be scheduled to match the habitat/ecosystem objective(s) being monitored. In this context, three types of field inspections have been identified:

1. Pre-treatment inspection (i.e., establish baseline information such as composition and distribution of natural forest ecosystems', 'rare' forest types, riparian habitats, etc.).
2. Active inspection (i.e., during operations to 'assess disturbance to nesting sites, ensure harmful substances do not enter aquatic environments, etc.).
3. Post-treatment inspection (i.e., to verify planned results such as Riparian Reserve Zones and Riparian Management Zones are in place, visual screening corridors and buffer widths' are maintained, wildlife trees and patches are retained, etc.).

Note that the third type, post-treatment inspections, may also be used to determine the state of the forest/environment.



3.6 STEP SIX - REPORTING

The method(s) of reporting should be specified in the monitoring plan, and should relate to the monitoring plan objectives as well as the habitat/ecosystem objectives. Other considerations that may impact the method of reporting are:

- timing of the monitoring;
- urgency of the information;
- resourcing limitations; and
- anticipated subsequent follow-up/outcome of the results.

Upon completion of office and or field monitoring and prior to final reporting, it is recommended that an 'exit meeting' is scheduled with all participants and others interested in the monitoring results. The 'exiting meeting' is a forum for presenting preliminary results and clarifying outstanding issues.

Collate the results. The final stage of monitoring is to review the results of the office and field review for accuracy. A report of the analysis including discussion and recommendations is then prepared according to the objectives of the monitoring plan and the results of the office and field reviews including:

- information deficiencies,
- data deficiencies,
- timing discrepancies,
- sampling methods, and
- accuracy of the results.

The results of monitoring in one year will influence the monitoring scheduled for subsequent years.

3.7 SPECIFIC MONITORING PROCEDURES FOR EACH HABITAT/ECOSYSTEM OBJECTIVE

The habitat/ecosystem objectives identified below were developed specifically with consideration to incremental and backlog silviculture activities. The objectives were initially derived in consultation with MELP staff in the Prince George pilot area, and have undergone a series of reviews by MELP regional and headquarters staff throughout the province.

It is important to point out, however, that these objectives are provincial in scope and additional management objectives should be identified, as required, to meet regional or district monitoring needs and ecosystem monitoring considerations.

Identification of additional objectives should remain fundamentally habitat or ecosystem based and should be clearly articulated in the monitoring plan. The office and field monitoring procedures outlined in this report are considered broad enough in approach, scope, and adaptability to accommodate monitoring of additional habitat/ecosystem objectives not identified in this report.

Sections 3.7.1 to 3.7.21 describe procedures and references specific to each habitat/ecosystem objective. In addition, the reports should contain results of the monitoring and recommendations. The following general categories for possible results/recommendations should be reviewed for their applicability to the specific habitat/ecosystem objective:

1. Objective met or sustained (e.g., 80% of rare forest type retained, wildlife trees and patches retained to 4/ha).
2. Further planning and/or better implementation required to meet objective (elaborate with specifics).
3. Insufficient information available to determine if objective has been met (elaborate with specifics).
4. Objective not met (document and detail specifics).
5. Objective not applicable (i.e., objective may not be appropriate to overall habitat/ecosystem goal, objective may not be measurable, etc.).

3.7.1 TO RETAIN "RARE" [14]ECOSYSTEMS, FOREST, PLANT, AND VEGETATION TYPES

APPLICABLE ACTIVITIES:

- juvenile spacing,
- mechanical, chemical and livestock preparation, and
- manual, mechanical, and chemical brushing

OFFICE	FIELD	REFERENCES
1. Access Conservation Data Centre point location inventory. 2. Conduct GIS (or similar) analysis at landscape level to identify "rare" ecosystems as defined by Biodiversity Guidebook. 3. Review MoF planning documents (i.e., FDP, LUP, SP, SMP, MP) and referral comments from MELP pertaining to the identification of the rare ecosystem, forest, plant, or vegetation type, and any suggested practice for the retention of the rare type. 4. Determine if field inspections recorded retention of rare ecosystem, forest, plant, or vegetation types.	AS REQUIRED: • conduct post-treatment inspection to verify retention of rare ecosystems, forest, plant and/or vegetation types • compare actual retention to recommended or desired retention INSPECTION ELEMENTS: • size and composition of rare plant, forest, or vegetation types • photographs	• Reports and ISIS/MLSIS records (see Tables 3 and 4) • *Biodiversity Guidebook* • *Higher Level Plans: Policy and Procedures* • *Forest Development Plan Guidebook* • *Range Management Guidebook*

[14] *A rare ecosystem is an ecosystem that makes up less than 2% of a landscape unit or is not common in adjacent landscape units* (*Biodiversity Guidebook*, 1995: 76).

3.7.2 TO RETAIN WILDLIFE TREES AND WILDLIFE TREE PATCHES

APPLICABLE ACTIVITIES:

- *juvenile spacing,*
- *fertilization,*
- *mechanical and chemical brushing*
- *mechanical, chemical and prescribed fire site preparation, and*
- *planting and fill planting.*

OFFICE	FIELD	REFERENCES
1. Refer to Table 20(a) or Table 20(b) of the *Biodiversity Guidebook* to identify wildlife tree requirements. 2. Review MoF planning documents (i.e., FDP, LUP, SP, SMP, MP) and referral comments from MELP for wildlife tree strategies at stand and landscape levels, and confirm wildlife tree and wildlife tree patch retention requirements. 3. Determine if field inspections recorded retention of wildlife trees and tree patches.	AS REQUIRED: • pre and/or post-treatment inspection • compare actual retention to recommended or desired retention levels INSPECTION ELEMENTS: • number of wildlife trees • size and number of patches • characteristics of wildlife trees and patches • observed use • wildlife tree decay class • photographs	• Reports and ISIS/MLSIS records (see Tables 3 and 4) • *Biodiversity Guidebook* • *Higher Level Plans: Policy and Procedures* • *Forest Development Plan Guidebook* • *Stand management Prescription Guidebook* • *Spacing Guidebook* • *Fertilization Guidebook* • *Site Preparation Guidebook*

3.7.3 MAINTAIN A FULL RANGE OF NATIVE TREE AND VEGETATIVE SPECIES REPRESENTATIVE OF THE DYNAMICS OF NATURAL FOREST ECOSYSTEMS

APPLICABLE ACTIVITIES:

- juvenile spacing,
- livestock, manual, mechanical and chemical brushing
- livestock, mechanical and chemical site preparation, and
- planting and fill planting

OFFICE	FIELD	REFERENCES
1. Refer to *Regional Site Identification and Interpretation Guide* (regional biogeoclimatic field guide) to develop a 'benchmark' list of tree and plant species representative of biogeoclimatic subzones/variants. 2. Review MoF planning documents (i.e., FDP, LUP, SP, SMP, MP) and referral comments from MELP regarding native plant and tree species management. 3. Determine if post-activity inspections have recorded existing native tree and vegetation species occurrence and distribution.	AS REQUIRED: • conduct pre- and post-treatment inspections to determine composition, occurrence, and distribution of vegetation and tree species • compare results to objectives INSPECTION ELEMENTS: • vegetative and tree species composition, distribution and abundance in reforested and natural forest stands • permanent vegetation plots • photographs	• Reports and ISIS/MLSIS records (see Tables 3 and 4) • *Herbicide Field Handbook* • *Interim Guidelines for the Use of Domestic Sheep for Vegetation Management in British Columbia* • *Biodiversity Guidebook* • *Higher Level Plans: Policy and Procedures* • *Forest Development Plan Guidebook* • *Stand management Prescription Guidebook* • *Spacing Guidebook* • *Site Preparation Guidebook* • *Seed and Vegetative Materials Guidebook* • *Regional Establishment to Free Growing Guidebook* • *Silviculture Surveys Guidebook*

3.7.4 MAINTAIN A VARIETY OF STOCKING DENSITIES WITHIN TREATMENT AREAS AND ACROSS LANDSCAPES FOR HABITAT DIVERSITY

APPLICABLE ACTIVITIES:

- juvenile spacing
- planting and fill planting

OFFICE	FIELD	GUIDEBOOKS
1. Review MoF planning documents (i.e., FDP, LUP, SP, SMP, MP) and referral comments from MELP for management objectives/strategies regarding stocking densities within STAs. 2. At the landscape unit and biogeoclimatic subzone levels, compare the stocking densities of the STAs. 3. Determine if field inspections recorded stocking densities occurrence and distribution differences within and between treatment areas.	AS REQUIRED: • conduct post treatment inspections to determine tree stocking densities within STAs • compare office field results to objectives INSPECTION ELEMENTS: • stocking densities within STAs • confirm survey results as required • photographs	• Reports and ISIS/MLSIS records (see Tables 3 and 4) • *Higher Level Plans: Policy and Procedures* • *Forest Development Plan Guidebook* • *Stand management Prescription Guidebook* • *Spacing Guidebook* • *Regional Establishment to Free Growing Guidebook* • *Silviculture Survey Guidebook*

3.7.5 MINIMIZE THE ADVERSE IMPACTS OF ROAD ACCESS ON FISH AND WILDLIFE POPULATIONS AND THEIR HABITATS

APPLICABLE ACTIVITIES:

- juvenile spacing,
- livestock and mechanical brushing
- livestock and mechanical site preparation,
- planting and fill planting

OFFICE	FIELD	REFERENCES
1. Review MoF planning documents (i.e., FDP, LUP, SP, SMP, MP) and referral comments from MELP for access management objectives and strategies. 2. Review Watershed Assessment Procedure results (i.e., access management, roadside buffers, visual corridors, sensitive areas for aquatic, fisheries or terrestrial habitats). **3.** Determine if field inspections recorded adverse impacts on fish and wildlife populations and their habitats due to road access.	AS REQUIRED: • confirm whether access management strategies have been implemented and assessment results considered INSPECTION ELEMENTS: • road and skid trail deactivation • in-stream structure problems • visual screening corridors and buffers • areas of erosion, stream siltation • photographs • see also 3.7.12	• Reports and ISIS/MLSIS records (see Tables 3 and 4) • *Biodiversity Guidebook* • *Higher Level Plans: Policy and Procedures* • *Forest Development Plan Guidebook* • *Channel Assessment Procedure Guidebook* • *Regional Watershed Assessment Procedure Guidebook* • *Riparian Management Area Guidebook* • *Regional Lake Classification and Lakeshore Management Guidebook* • Stream Crossing Guidebook for Fish Streams

3.7.6 VARY THE SPATIAL AND TEMPORAL DISTRIBUTION OF SILVICULTURE ACTIVITIES WITHIN LARGE CONTIGUOUS AREAS TO MINIMIZE DISRUPTION OF WILDLIFE PATTERNS AND USAGE OF HABITAT

APPLICABLE ACTIVITIES:

- all silviculture activities

OFFICE	FIELD	REFERENCES
1. Review MoF planning documents (i.e., FDP, LUP, SP, SMP, MP) to identify objectives and strategies regarding distribution and size of silviculture treatments across landscapes. 2. Conduct air photo interpretation, SIA, GIS (or similar) query for type, size and year of silviculture treatments. Assess the spatial and temporal distribution of silviculture activities by biogeoclimatic subzone and landscape unit.		• Reports and ISIS/MLSIS records (see Tables 3 and 4) • *Biodiversity Guidebook* • *Higher Level Plans: Policy and Procedures* • *Forest Development Plan Guidebook* • *Silviculture Surveys Guidebook* • *Spacing Guidebook* • *Stand management Prescription Guidebook*

3.7.7 MAINTAIN HABITAT FOR IDENTIFIED WILDLIFE, RED AND BLUE LISTED, AND REGIONALLY SIGNIFICANT SPECIES

APPLICABLE ACTIVITIES:

- juvenile spacing,
- chemical and mechanical brushing,
- chemical and mechanical site preparation,
- planting and fill planting

OFFICE	FIELD	REFERENCES
1. Review MELP plans, FPC requirements, and management strategies for identified wildlife, red and blue, and regionally significant species. 2. Review MoF planning documents (i.e., FDP, LUP, SP, SMP, MP) for management strategies consistent with MELP plans and strategies for identified wildlife, red and blue, and regionally significant species. 3. Review referral comments from MELP regarding strategies for identified wildlife, red and blue, and regionally significant species. 4. Determine if field inspections recorded consideration if listed species habitat needs.	AS REQUIRED: • conduct pre-treatment inspections to confirm habitat attributes for listed or regionally important species • conduct post-treatment inspection for implementation of identified management strategies • compare results to species habitat requirements INSPECTION ELEMENTS: • species specific habitat attributes (e.g., wildlife trees, grasslands, old lichen supporting forests) • adverse management impacts • photographs	• Reports and ISIS/MLSIS records (see Tables 3 and 4) • *Biodiversity Guidebook* • *Higher Level Plans: Policy and Procedures* • *Forest Development Plan Guidebook* • *Managing Identified Wildlife Guidebook*

3.7.8 ENSURE MAINTENANCE OF RIPARIAN MANAGEMENT AREAS INCLUDING RIPARIAN RESERVE ZONES AND RIPARIAN MANAGEMENT ZONES

APPLICABLE ACTIVITIES:

- juvenile spacing,
- mechanical or chemical brushing,
- manual, mechanical or chemical site preparation

OFFICE	FIELD	REFERENCES
1. Review MoF planning documents (i.e., FDP, LUP, SP, SMP, MP) and referral comments from MELP regarding riparian management area objectives, riparian 'best management practices' and confirm riparian classification of streams, lakes and wetlands within or adjacent to silviculture treatments. 2. Review MELP referrals for comments and/or recommendations regarding specific to riparian management areas. 3. Determine if field inspections confirmed presence and retention of RRZ and RMZ consistent with riparian classification.	AS REQUIRED: • post-treatment inspection of boundaries of the riparian management and riparian reserve zones as per the classification • assess implementation of riparian 'best management practices' in terms of stated objectives for the RMA and direction from the R*iparian Management Areas Guidebook* INSPECTION ELEMENTS: • Stream widths to confirm classification • Wetland and lake classification • RRZ/RMZ boundaries/widths based on classification • Best management practices: 1. Basal area retention 2. Wildlife tree retention in RMA 3. Windfirm considerations 4. Deciduous retained 5. Fisheries sensitive zone considerations 6. Active floodplain considerations 7. Wildlife tree 'stubs' • Fall away/yard away • Slash/debris removal • Photographs • Impacts on streambanks and streamside vegetation • Windthrow problems (i.e., have these been addressed in RMZ?)	• Reports and ISIS/MLSIS records (see Tables 3 and 4) • *Guidelines For The Protection of Fish and Fish Habitat Including Riparian Areas During The Use of Glyphosate and Other Selected Forestry Herbicides In British Columbia* • *Biodiversity Guidebook* • *Higher Level Plans: Policy and Procedures* • *Forest Development Plan Guidebook* • *Channel Assessment Procedure Guidebook* • *Regional Watershed Assessment Procedure Guidebook* • *Riparian Management Area Guidebook* • *Regional Lake Classification and Lakeshore Management Guidebook* • *Stream Crossing Guidebook For Fish Streams: A working draft for 1997/98*

3.7.9 REHABILITATE RIPARIAN MANAGEMENT AREAS

APPLICABLE ACTIVITIES:

- juvenile spacing,
- manual, mechanical and chemical brushing,
- mechanical and chemical site preparation

OFFICE	FIELD	REFERENCES
1. Review MoF planning documents (i.e., LUP, SMP, MP) and referral comments from MELP regarding rehabilitation of Riparian Management Areas. 2. Determine if riparian ecosystems are being rehabilitated consistent with objectives.	AS REQUIRED: • Conduct post-treatment inspection to assess whether or not the rehabilitation objectives for Riparian Management Areas within STAs, have been successfully implemented • photographs	• *Biodiversity Guidebook* • *Higher Level Plans: Policy and Procedures* • *Forest Development Plan Guidebook* • *Channel Assessment Procedure Guidebook* • *Regional Watershed Assessment Procedure Guidebook* • *Riparian Management Area Guidebook* • *Regional Lake Classification and Lakeshore Management Guidebook*

3.7.10 ENSURE MAINTENANCE OF FOREST THERMAL COVER

APPLICABLE ACTIVITIES:

- juvenile spacing
- pruning
- prescribed fire site preparation

OFFICE	FIELD	REFERENCES
1. Review MoF planning documents (i.e., FDP, LUP, SP, SMP, MP) and referral comments from MELP identifying objectives/strategies for thermal/snow interception cover. 2. Determine if field inspections confirm retention of forest thermal and/or snow interception forest cover attributes.	AS REQUIRED: • Conduct pre- and post-treatment measurements of forest crown and crown characteristics • compare results to objectives INSPECTION ELEMENTS: • tree density • tree height and dbh • crown characteristics 1. percent of crown closure 2. height of crown 3. distance from ground to base of crown 4. width of crown • photographs	• Reports and ISIS/MLSIS records (see Tables 3 and 4) • *Handbook for Timber and Mule Deer Management* • *Biodiversity Guidebook* • *Higher Level Plans: Policy and Procedures* • *Forest Development Plan Guidebook* • *Riparian Management Area Guidebook* • *Spacing Guidebook* • *Pruning Guidebook* • *Vegetation Management Guidebook* • *Silviculture Surveys Guidebook*

3.7.11 ENSURE THAT SILVICULTURE ACTIVITIES DO NOT DISRUPT NESTING SITES OF BALD EAGLES, OSPREYS AND HERONS

APPLICABLE ACTIVITIES:

- juvenile spacing,
- fertilization,
- chemical brushing
- chemical site preparation

OFFICE	FIELD	REFERENCES
1. Query Conservation Data Centre regarding point location inventory of active nest sites of bald eagles, ospreys and herons. 2. Review MoF planning documents (i.e., FDP, LUP, SP, SMP, MP) and referral comments from MELP documenting active nesting sites of bald eagles, ospreys and herons. 3. Determine if field inspections revealed any disturbance to active nesting sites.	AS REQUIRED: • conduct pre-, active- and post-treatment inspections to observe and record any impacts to nesting activities INSPECTION ELEMENTS: • visual observations • photographs	• Reports and ISIS/MLSIS records (see Tables 3 and 4) • *Biodiversity Guidebook* • *Higher Level Plans: Policy and Procedures* • *Forest Development Plan Guidebook* • *Managing Identified Wildlife Guidebook* • *Spacing Guidebook* • *Pruning Guidebook* • *Fertilization Guidebook*

3.7.12 MAINTAIN VISUAL SCREENING CORRIDORS OR BUFFERS ALONG LINEAR CORRIDORS AND ON FLAT TERRAIN

APPLICABLE ACTIVITIES:

- juvenile spacing,
- pruning,
- manual chemical and mechanical brushing,
- mechanical and prescribed fire site preparation

OFFICE	FIELD	REFERENCES
1. Review MoF planning documents (i.e., FDP, LUP, SP, SMP, MP), and referral comments from MELP for visual screening corridors and buffers requirements. 2. Determine if field inspections confirmed establishment of visual screening corridors or buffers, and if field inspections assessed overall effectiveness of buffers/corridors.	AS REQUIRED: • conduct post-treatment inspections to confirm existence of screening corridors and buffers INSPECTION ELEMENTS: • screening corridor and buffer widths • observed use (tracks, pellets, scats, feeding, territorial markings, bedding sites, etc.) • "effectiveness" evaluation of corridor • photographs	• Reports and ISIS/MLSIS records (see Tables 3 and 4) • *Biodiversity Guidebook* • *Higher Level Plans: Policy and Procedures* • *Forest Development Plan Guidebook* • *Spacing Guidebook*

3.7.13 MINIMIZE SOIL DISTURBANCE THAT MPACTS ON FISH AND AQUATIC ENVIRONMENTS

APPLICABLE ACTIVITIES:

- juvenile spacing,
- livestock and mechanical brushing
- livestock, mechanical and prescribed fire site preparation

OFFICE	FIELD	REFERENCES
1. Review MoF planning documents (i.e., FDP, LUP, SP, SMP, MP), water, soil and site disturbance results and referral comments from MELP that identify sensitive areas, unstable areas, fisheries sensitive zones, etc. 2. Determine if field inspections identified soil disturbance that impacted on fish and aquatic ecosystems.	AS REQUIRED: • conducts post-treatment reconnaissance level survey INSPECTION ELEMENTS: • levels of soil disturbance • debris and sediment transport into aquatic systems • potential problem areas • photographs	• Reports and ISIS/MLSIS records (see Tables 3 and 4) • *Interim Guidelines for the Use of Domestic Sheep for Vegetation Management in British Columbia* • Sheep/Carnivore interaction Monitoring Reports • *Biodiversity Guidebook* • *Higher Level Plans: Policy and Procedures* • *Forest Development Plan Guidebook* • *Community Watershed Guidebook* • *Gully Assessments Procedures Guidebook* • *Channel Assessment Procedure Guidebook* • *Interior or Coastal Watershed Assessment Procedure Guidebook* • *Riparian Management Area Guidebook* • *Regional Lake Classification and Lakeshore Management Guidebook* • *Hazard Assessment Keys for Evaluating Site Sensitivity to Soil Degrading Processes Guidebook* • *Soil Rehabilitation Guidebook* • *Soil Conservation Surveys Guidebook* • *Stream Crossing Guidebook For Fish Streams: A working draft for 1997/98*

3.7.14 MANAGE FOR MAINTENANCE OF COARSE WOODY DEBRIS (CWD)

APPLICABLE ACTIVITIES:

- mechanical brushing,
- mechanical and prescribed fire for site preparation

OFFICE	FIELD	REFERENCES
1. Review MoF planning documents (i.e., FDP, LUP, SP, SMP, MP) and referral comments from MELP for management objectives/strategies regarding maintenance of coarse woody debris. 2. Determine if field inspections confirmed maintenance of CWD.	AS REQUIRED: • conduct pre- and/or post-treatment inspections in treated and adjacent untreated areas • compare results INSPECTION ELEMENTS: • measure CWD and classify according to RIC standards for CWD • photographs	• Reports and ISIS/MLSIS records (see Tables 3.1 and 3.2) • *Biodiversity Guidebook* • *Higher Level Plans: Policy and Procedures* • *Forest Development Plan Guidebook*

3.7.15 ENSURE THAT HARMFUL SUBSTANCES DO NOT ENTER AQUATIC ENVIRONMENTS

APPLICABLE ACTIVITIES:

- fertilization,
- chemical and livestock site preparation,
- chemical and livestock brushing

OFFICE	FIELD	REFERENCES
1. Review MoF or Licensee plans for silviculture activities that identify chemical use or livestock as a treatment. 2. Review Pesticide Use Permits requirements. 3. Determine when field review should take place (i.e., timing of activity).	AS REQUIRED: • conduct active inspections to confirm pesticide free zones and riparian management and riparian reserve zone boundaries • assess the storage and handling of chemicals • contact Environmental Protection Branch (Water Quality) to coordinate the collection and analysis of pre and post treatment water samples (i.e., pH, total ammonia, total nitrogen, nitrate-N and total dissolved phosphorus) INSPECTION ELEMENTS: • pesticide free zones marked in field • RMZ/RRZ/RMA boundaries marked in field • boundaries above comply with operations • storage sites inspected • water quality studies • photographs	• Reports and ISIS/MLSIS records (see Tables 3 and 4) • *Guidelines for the Protection of Fish and Fish Habitat Including Riparian Areas during the Use of Glyphosate and Other Selected Forestry Herbicides in British Columbia* • *Sheep/Carnivore interaction Monitoring Reports* • *Interim Guidelines for the Use of Domestic Sheep for Vegetation Management In British Columbia* • *Fertilization Guidebook* • *Range Management Guidebook* • *Site Preparation Guidebook* • *Stream Crossing Guidebook For Fish Streams: A working draft for 1997/98*

3.7.16 PREVENT INTRODUCTION AND SPREAD OF NON-NATIVE AND CULTIVATED PLANT SPECIES

APPLICABLE ACTIVITIES:

- livestock or mechanical brushing
- livestock or mechanical site preparation

OFFICE	FIELD	REFERENCES
1. Review MoF planning documents (i.e., SP, SMP) and referral comments from MELP for strategies to prevent the introduction and spread of foreign/exotic plant species. 2. Determine if pre- or post-treatment inspections identified introduction or spread of foreign/exotic plant species.	AS REQUIRED: • conduct pre- post-treatment field inspections to identify presence of foreign/exotic plant species to establish a baseline to enable tracking of vegetation trends over time • compare results INSPECTION ELEMENTS: • vegetative surveys for species composition, relative abundance, trend • list noxious plants and/or introduced plant species found at sites • permanent vegetation plots (assess trend over time) • photographs	• Reports and ISIS/MLSIS records (see Tables 3 and 4) • *Interim Guidelines for the Use of Domestic Sheep for Vegetation Management In British Columbia* • *Biodiversity Guidebook* • *Range Management Guidebook* • *Site Preparation Guidebook*

3.7.17 ENSURE MAINTENANCE OF SNOW INTERCEPTION FOREST COVER ATTRIBUTES

APPLICABLE ACTIVITIES:

- juvenile spacing
- pruning
- prescribed fire site preparation

OFFICE	FIELD	REFERENCES
1. Review MoF planning documents (i.e., FDP, LUP, SP, SMP, MP) and referral comments from MELP identifying objectives/strategies for thermal/snow interception cover. 2. Determine if field inspections confirm retention of forest thermal and/or snow interception forest cover attributes.	AS REQUIRED: • Conduct pre- and post-treatment measurements of forest crown and crown characteristics • compare results to objectives INSPECTION ELEMENTS: • tree density • tree height and dbh • crown characteristics 1. percent of crown closure 2. height of crown 3. distance from ground to base of crown 4. width of crown • photographs	• Reports and ISIS/MLSIS records (see Tables 3 and 4) • *Handbook for Timber and Mule Deer Management* • *Biodiversity Guidebook* • *Higher Level Plans: Policy and Procedures* • *Forest Development Plan Guidebook* • *Riparian Management Area Guidebook* • *Spacing Guidebook* • *Pruning Guidebook* • *Vegetation Management Guidebook* • *Silviculture Surveys Guidebook*

3.7.18 MANAGE FOR CANOPY HETEROGENEITY (MANAGE FOR STAND VERTICAL AND HORIZONTAL STRUCTURE)

APPLICABLE ACTIVITIES:

- juvenile spacing
- pruning

OFFICE	FIELD	REFERENCES
1. Review MoF planning documents (i.e., FDP, LUP, SP, SMP, MP) and referral comments from MELP for management objectives/strategies for retention and development of structural attributes that contribute to habitat. 2. Determine if pre- or post-treatment surveys were recommended. 3. Determine if surveys were conducted.	AS REQUIRED: • conduct pre- and post-treatment surveys • compare results INSPECTION ELEMENTS: • survey to note attributes as described in the Biodiversity Guidebook • photographs	• Reports and ISIS/MLSIS records (see Tables 3 and 4) • *Biodiversity Guidebook* • *Higher Level Plans: Policy and Procedures* • *Forest Development Plan Guidebook* • *Spacing Guidebook* • *Pruning Guidebook* • *Handbook for Timber and Mule Deer Management*

3.7.19 MANAGE ARBOREAL LICHEN PRODUCTION FOR LICHEN DEPENDENT SPECIES

APPLICABLE ACTIVITIES:

- pruning

OFFICE	FIELD	REFERENCES
1. Review MoF planning documents (i.e., FDP, LUP, SP, SMP, MP) and referral comments from MELP for management objectives/strategies for retention of lichens (i.e., mule deer winter ranges and seasonal caribou habitats). 2. Determine if pre- or post-treatment surveys were recommended. 3. Determine if surveys were conducted.	AS REQUIRED: • conduct pre- and post-treatment lichen surveys • compare results INSPECTION ELEMENTS: • lichen assessment using methods described in Land Management Handbook, Field Guide Insert 7: 'Estimating the Abundance of Arboreal Forage Lichens' • photographs	• Reports and ISIS/MLSIS records (see Tables 3 and 4) • *Biodiversity Guidebook* • *Higher Level Plans: Policy and Procedures* • *Forest Development Plan Guidebook* • *Spacing Guidebook* • *Pruning Guidebook* • *Estimating the Abundance of Arboreal Forage Lichens Field Guide* • *Handbook for Timber and Mule Deer Management*

3.7.20 ENSURE THAT FERTILIZATION 'LOADING SITES' ARE CLEANED-UP AFTER TREATMENT TO PREVENT CONTAMINATION

APPLICABLE ACTIVITIES:

- fertilization

OFFICE	FIELD	REFERENCES
1. Review fertilization plans for strategies regarding 'loading sites'. 2. Determine timing of activity and therefore of monitoring.	AS REQUIRED: • conduct active inspection to field review 'loading 'site INSPECTION ELEMENTS: • loading site selection • loading site clean-up • photographs	• Reports and ISIS/MLSIS records (see Tables 3 and 4) • *Biodiversity Guidebook* • *Higher Level Plans: Policy and Procedures* • *Range Management Guidebook*

3.7.21 PREVENT OVERGRAZING BY LIVESTOCK

APPLICABLE ACTIVITIES:

- livestock brushing
- livestock site preparation

OFFICE	FIELD	REFERENCES
1. Review MoF planning documents (i.e., FDP, LUP, SP, SMP, MP) and referral comments from MELP for management objectives/strategies regarding the use of livestock. 2. Determine if field inspections identified overgrazing problems.	AS REQUIRED: • conduct pre- and post- treatment vegetation surveys to determine species composition relative to abundance and to establish baseline data to determine species trends • compare results over time INSPECTION ELEMENTS: • pre-grazing assessment (vigor/composition/abundance) • post-grazing assessment (use/vigor) • impacts on riparian ecosystems • permanent vegetation plots • photographs	• Reports and ISIS/MLSIS records (see Tables 3 and 4) • *Biodiversity Guidebook* • *Higher Level Plans: Policy and Procedures* • *Range Management Guidebook* • *Fertilization Guidebook* • *Field to Noxious and other Selected Weeds of British Columbia*

Glossary

Acceptable species: are ecologically suited to the site, but management activities are not aimed at establishing them. The reasons for including a species in this category may be a higher-than-acceptable site limitation, such as pest risk, or a lower productivity than preferred species. Special restrictions or limitations may apply to the use of these species. Acceptable species are generally selected from the list of primary, secondary or tertiary species provided in the *tree species selection and stocking tables.*

Access Management Plan: an operational plan identifying the requirements for all road construction, reconstruction, maintenance, and deactivation. (Not required post 1997).

Backlog area: is an area from which the timber was harvested, damaged, or destroyed before October 1, 1987; and that, in the District Manager's opinion, is *not satisfactorily restocked* (NSR) with healthy well-spaced trees of a commercially acceptable species.

Backlog silviculture: refers to treatments applied to backlog areas. These treatments include site preparation, planting, fill-planting, brushing and juvenile spacing.

Backlog Silviculture Prescription (bSP): a documented process, applied to a backlog area, for collecting site-specific field data, establishing site-specific management objectives and standards for producing a free growing stand, and prescribing a series of treatments necessary to achieving these objectives and standards. A backlog Silviculture Prescription is a legal requirement as per the *Forest Practices Code of British Columbia Act*. The content requirements are specified in the *Operational Planning Regulation* and the *Silviculture Practices Regulation* covers requirements

Blue-listed species: any indigenous species or subspecies (taxa) considered to be vulnerable in British Columbia. Vulnerable taxa are of special concern because of characteristics that make them particularly sensitive to human activities or natural events. Blue-listed taxa are at risk, but are not extirpated, endangered or threatened.

Brushing: a silviculture activity using *chemical, manual, grazing or mechanical* means to control competing forest vegetation and reduce competition for space, light, moisture, and nutrients with crop trees or seedlings.

Chemical site preparation/brushing: involves the application of herbicides to control competing vegetation before planting or natural regeneration, and during the early stages of seedling establishment (see *Herbicides*). Chemicals may also be used in *brushing* treatments.

Coarse woody debris: sound and rotting logs and stumps that provide habitat for plants, animals, and insects as well as being a source of nutrients for soil development. Material generally greater than 8-10 centimeters in diameter.

Commercially acceptable species: are the preferred and acceptable species, as specified by the District Manager, used to determine the stocking levels of backlog areas.

Commercially valuable species: are the preferred and acceptable species as specified in the silviculture prescription or stand management prescription (species will vary on a site-specific basis).

Commercial thinning: involves a partial cut in older immature stands where trees have reached merchantable size and value, carried out to provide an interim harvest while maintaining or restoring a high rate of growth on well-spaced final crop trees.

Competing vegetation: vegetation that competes for the limited common resources (space, light, water, and nutrients) of a forest site needed by future crop trees for survival and acceptable growth.

Critical wildlife habitat: part or all of a specific place occupied, or capable of being occupied, by a wildlife species or a population of such species and recognized as being essential for the maintenance of the population.

Crop tree: a tree in a young stand or plantation selected to be carried through to an interim or final harvest.

Cutblock: a specific area of land identified on a forest development plan, or in a licence to cut, road permit or Christmas tree permit, within which timber is to be or has been harvested.

Desired plant community: a plant community that produces the kind, proportion, and amount of vegetation necessary for meeting or exceeding the land use plan or plan objectives established for an ecological site. The desired plant community must be consistent with the site's capability to produce the desired vegetation through management, land treatment, or a combination of the two.

Ecosection: an area with minor physiographic and macroclimatic or oceanographic variation, defined at the regional level.

Ecosystem: a functional unit consisting of all living organisms (plants, animals, and microbes) in a given area, and all the non-living physical and chemical factors of their environment, linked together through nutrient cycling and energy flow. An ecosystem can be any size - a log, pond, field, forest, or the earth's biosphere - but it always functions as a whole. Ecosystems are commonly described according to the major type of vegetation and landscape features, for example, forest ecosystem, old-growth ecosystem, or range ecosystem.

Environmentally sensitive areas: areas identified as having a high resource value so that the contribution of the area to timber harvest is severely limited. Environmentally sensitive areas for forestry include potentially unstable soils and areas of high value to non-timber resources such as fisheries, wildlife, water, and recreation. (Note that ESAs do not contribute to the timber supply for allowable annual cut analysis).

Fertilization: the application of fertilizer to promote tree growth on sites deficient in one or more soil nutrients. Can be applied during planting, during initial growth, or before harvest.

Fill-planting: planting required to supplement poorly stocked naturally regenerated or previously planted sites.

Five-year Silviculture Plan: a plan to clearly identify the timing location and type of silviculture treatments proposed over a five year period. This was a FPC requirement until June 15, 1997. The Five Year Silviculture Plan is no longer required, and is being replaced in part by the Silviculture Agreement (initially termed the Landscape Silviculture Referral Process).

Ford: a dip constructed in the roadbed at a stream crossing, instead of a culvert or bridge. The streambed must be of erosion-resistant material, or such material must be placed in contact with the streambed.

Forest Development Plan (FDP): an operational plan guided by the principles of integrated resource management (the consideration of timber and non-timber values), which details the logistics of timber development over a period of at least five years. Methods, schedules, and responsibilities for accessing, harvesting, renewing, and protecting the resource are set out to enable site-specific operations to proceed. The FDP must describe the location of proposed cutblocks and roads; the schedule of proposed harvesting and road operations; and specify silvicultural systems, harvesting methods and measures to protect forest resources. The FDP must be consistent with higher level plans, and be signed and sealed by a professional forester.

Free growing stand: a stand of healthy trees of a commercially valuable species that meets stocking density standards, the growth of which is not impeded by competition from plants, shrubs or other trees.

Free growing tree: is a healthy, preferred or acceptable well-spaced tree that is at least the minimum height, and at least the minimum size relative to competing vegetation within the effective growing space specified in the silviculture prescription. The effective growing space is a 1-meter radius cylinder around a tree.

Grazing: livestock grazing can be used to prepare a harvested site for reforestation, or as a means of controlling competing vegetation after new seedlings have been established. It involves controlling domestic livestock (e.g., sheep, cattle) to consume or recycle large volumes of undersized vegetation (see *Livestock*).

Herbicides: "Herbicides are phytotoxic chemicals used to control, suppress or kill undesirable plants or else to severely interrupt their normal growth processes " (Weed Science Society of America, Herbicide Handbook, 1983). The most important uses are for site preparation prior to planting or release of conifers from brush or weed species during the establishment and stand tending stages. Can be applied by helicopter and fixed wing aircraft as well as on the ground using injection, stump treatment, backpack sprayers, spot guns or vehicle mounted sprayers.

Impeded area: is an area from which the timber was harvested, damaged or destroyed before October 1, 1987, and that in the District Manager's opinion, is *satisfactorily restocked* (SR) with healthy well-spaced trees of a commercially acceptable species, but does not meet free-growing standards.

Incremental silviculture: refers to treatments carried out to maintain or increase the yield and value of forest stands. These treatments include site rehabilitation, site preparation, planting and brushing of backlog sites; juvenile spacing; pruning; and fertilization.

Juvenile spacing: or pre-commercial thinning, involves the removal of trees within a young stand to control stand density, maintain or improve growth, increase wood value, or achieve non-timber resource management objectives. The thinned stems are usually left on the ground.

Landscape Silviculture Referral Process: renamed a Silviculture Agreement; this is a policy driven process that was initiated in 1997 to replace the silviculture review and referral process previously required under the Five-Year Silviculture Plan. The purpose of the LSRP is to ensure there is communication at the forest district level between MoF, MELP, licensees, and stakeholders (e.g., range users, First Nations, licensed guide outfitters, recreation users) to plan and implement backlog silviculture prescriptions, stand management prescriptions, and treatment prescriptions. The referral process was piloted in three forest districts in 1997, and is expected to be fully implemented in 1998.

Land and Resource Management Plan (LRMP): a strategic, multi-agency, integrated resource plan at the subregional level. It is based on the principles of enhanced public involvement, consideration of all resource values, consensus decision-making, and resource sustainability.

Landscape Unit (LU): a planning area, generally up to about 100,000 ha in size, delineated according to topographic or geographic features such as a watershed or series of watersheds. It is established by the district manager.

Landscape Unit objectives: objectives established for a landscape unit to guide forest development and other operational planning. Landscape objectives are established by the Ministry of Forests' district manager and a designated BC Environment official.

Large organic debris (LOD): entire trees or large pieces of trees that provide channel stability or create fish habitat diversity in a stream.

Livestock: as defined in the *Range Act* and described in the Silviculture Practices Regulation; means animals of the genus *Bos*, horses, mules, asses, sheep and goats, but does not include wildlife designated under the *Wildlife Act*, exotic game animals, buffalo, swine or poultry, but does include llamas.

Logging Plan: an operational plan that details how, when, and where timber will be harvested from an area and describes the measures that will be taken to ensure that the applicable standards and obligations stated in the Silviculture Prescription and the harvesting agreement are met. (No longer required post 1997).

Management plans: a management plan or management and working plan approved under: a) a tree farm licence; b) a woodlot licence; c) a pulpwood agreement; or, d) a forest licence. Management plans usually cover a period of five years and specify proposed management to establish, tend, protect and harvest timber resources and to conserve non-timber resource values.

Manual brushing: manual methods are accomplished through the use of hand held tools or manually operated or powered cutting tools, such as power saws, sandviks and Vrendenburg girdling tools, to remove competing vegetation or modify the environment to favour crop trees. Manual treatment can also be used for *site preparation* and *juvenile spacing*. Manual methods are considered where environmental or aesthetic considerations are important.

Mechanical brushing: mechanical treatment makes use of heavy equipment such as brush cutters, V-blades (V-plows), and brush blades to remove or reduce the amount of undesirable vegetation. Heavy equipment may also be used for *site preparation* and *juvenile spacing*.

Not Satisfactorily Restocked (NSR): Productive forest land that has been disturbed and has not been regenerated to the desired stocking standards for the opening.

Objective: qualitative and quantitative goals to be aimed for when managing resources. In the framework described in this document, *objectives* are described quantitatively. The first step when developing the monitoring plan is to select the broad qualitative *objectives*, and quantify them to facilitate measurement of achievement.

Operational Plan: the *Forest Practices Code of British Columbia Act* states that within the context of area-specific management guidelines, operational plans detail the logistics for development. Methods, schedules and responsibilities for accessing, harvesting, renewing and protecting the resource are set out to enable site-specific operations to proceed. Operational plans mean forest development plans, logging plans, access management plans, range use plans, silviculture prescriptions, stand management prescriptions and backlog silviculture prescriptions.

Planting: establishing a forest by setting out seedlings, transplants or cuttings in an area.

Pre-code blocks: are cutblocks that were approved prior to June, 1995.

Preferred species: are tree species ecologically suited to the site. Management activities are primarily aimed at establishing these species. The characteristics of these species are consistent with the desired timber and non-timber objectives for the site. Preferred species are generally selected from the list of primary, secondary or tertiary species provided in the *tree species selection and stocking tables.*

Prescribed burning: is used to maintain a specific seral stage of succession favourable to the treatment objective. A prescribed fire is a purposely set, free running ground fire which is controlled by planned firelines or breaks, climatic and/or fuel conditions, topographic features, preparation by reducing the mechanical obstructions to planting and as a forest vegetation management tool to increase the availability of light, moisture and nutrients for newly established seedlings.

Primary species: are ecologically acceptable and have a high rating for silviculture feasibility, reliability, and productivity under the average conditions for a site series. Primary species can be managed as a major component in a stand if the restrictions have been adequately addressed.

Pruning: involves the removal of branches from the stem of a tree or removal of multiple leaders from crop trees to promote the production of knot-free or clear wood.

Rare ecosystem: an ecosystem (site series or surrogate) that makes up less than two (2) percent of a landscape unit and is not common in adjacent landscape units.

Red-listed species: any indigenous species or subspecies (taxa) considered to be extirpated, endangered, or threatened in British Columbia. Extirpated taxa no longer exist in the wild in BC, but do occur elsewhere. Endangered taxa are facing imminent extirpation or extinction. Threatened taxa are likely to become endangered if limiting factors are not reserved. Red-listed

taxa include those that have been, or are being, evaluated for these designations. Taxa include those that have been, or are being, evaluated for these designations.

Referral: the process by which applications for permits, licences, leases, etc., made to one government agency by an individual or industry are given to another agency for review and comment.

Regionally important species: the regionally identified sensitive/vulnerable species (blue-listed) and those species not at risk but which require identification and protection of critical habitat at specific periods of their life cycle, and which are thus essential to the maintenance of their populations.

Riparian Management Area (RMA): the land adjacent to the normal high water line in a stream, river, or lake, extending to the portion of land that is influenced by the presence of the adjacent ponded or channeled water. Riparian areas typically exemplify a rich and diverse vegetative mosaic reflecting the influence of available surface water.

Riparian Management Zone: the outer portion of a riparian management area situated adjacent to a stream, lake, or wetland and established to conserve and maintain the productivity of aquatic and riparian ecosystems when harvesting is permitted.

Riparian Reserve Zone (RRZ): the inner portion of a riparian management area situated adjacent to a stream, lake, or wetland and established to conserve and maintain the productivity of aquatic and riparian ecosystems when harvesting is not permitted. Note that RRZs do not contribute to the allowable annual cut analysis.

Satisfactorily Restocked (SR): Productive forest land that has been disturbed and has been regenerated to the desired stocking standards for the opening.

Secondary species: are ecologically acceptable, but rank lower than primary species for one or more of silvicultural feasibility, reliability, or productivity. Depending on the nature and extent of these limitations, secondary species can be managed as either a major or a minor component in a stand.

Sensitive areas: small areas designated to protect important values during forest and range operations. These areas, established by the district manager in consultation with a Designated . Environment Official, guide operations on site-specific basis and require a combination of forest practices. Sensitive areas will be mapped by resource agencies, and include regionally significant recreational areas, scenic areas with high visual quality objectives, and forest ecosystem networks.

Silviculture Agreement (SA): initially termed Landscape Silviculture Referral Process, this is a policy driven process that was initiated in 1997 to replace the silviculture review and referral process previously required under the Five-Year Silviculture Plan. The purpose of the SA is to ensure there is communication at the forest district level between MoF, MELP, licensees, and stakeholders (e.g., range users, First Nations, licensed guide outfitters, recreation users) to plan and implement backlog silviculture prescriptions, stand management prescriptions, and treatment

prescriptions. The procedure was piloted in three forest districts in 1997, and is expected to be fully implemented in 1998.

Silviculture Prescription (SP): a document and process for collecting site-specific field data, establishing site-specific management objectives and standards for producing a free growing stand, and prescribing a series of treatments necessary to achieving these objectives and standards. A Silviculture Prescription is a legal requirement as per the *Forest Practices Code of British Columbia Act*. The content requirements are specified in the *Operational Planning Regulation*.

Silviculture survey: is an examination of an opening or cutblock for the purposes of providing information to the forest manager on how the site and stand are progressing relative to the prescribed management objectives. Survey information is used for prescription development, monitoring and auditing, as well as updating history files and forest cover maps.

Site preparation: any planned measure to prepare a site for the favorable reception and satisfactory growth of naturally disseminated seed, sown seed, or planted seedlings. Sites can be prepared using *fire, mechanical, or chemical methods, or a combination of these techniques*.

Stand: a community of trees sufficiently uniform in species composition, age, arrangement, and condition to be distinguishable as a group from the forest or other growth on the adjoining area, and thus forming a silviculture or management entity.

Stand density: a relative measure of the amount of stocking in a forest stand. Often described in terms of stems per hectare using certain criteria for including a stem in the tally.

Stand level: the level of forest management at which a relatively homogenous land unit can be managed under a single prescription, or set of treatments, to meet defined objectives.

Stand Management Prescription (SMP): a site-specific plan describing the nature and extent of the silviculture activities that will occur on a free-growing stand to facilitate the achievement of, among others, social, economic, and environmental objectives.

Stand structure: the distribution of trees in a stand, which can be described by species, vertical or horizontal spatial patterns, size of trees or tree parts, age, or a combination of these.

Tertiary species: are ecologically acceptable, but rank lower than primary or secondary species for one or more of silvicultural feasibility, reliability, or productivity. Depending on the nature of their limitations and on local conditions, tertiary species are normally only suitable as a minor component within a stand when establishing stocking and free growing status.

Threatened/Endangered species: species identified as *red listed* by the BC Ministry of Environment, Lands and Parks, these are indigenous species that are either threatened or endangered.

Treatment Prescription: operational details required for carrying out individual silviculture activities such as site preparation and planting.

Treatment unit: an area within a cutblock that is managed through uniform application of harvesting techniques and silviculture treatments. Stratification for treatment unit commonly occurs after silviculture surveys have identified areas that require specific treatments. Treatment

units are regularly used for the purpose of developing silviculture treatment contracts, and are not intended to be used in the development of SPs.

Wildlife tree patch: an area specifically identified for the retention and recruitment of suitable wildlife trees. It can contain a single wildlife tree or many. A wildlife tree patch is synonymous with a group reserve.

Wildlife tree: a standing live or dead tree with special characteristics that provide valuable habitat for the conservation or enhancement of wildlife. Characteristics include large diameter and height for the site, current use by wildlife, declining or dead condition, value as a species, valuable location, and relative scarcity.

Windrowing: windrowing or piling slash with bulldozers equipped with brush blades is one of the more traditional methods of mechanical site preparation. Generally, windrowing has the greatest effect on soil conservation. This is particularly true on sensitive sites with heavy slash loadings and large stumps.

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APPENDIX A

DEVELOPING A MONITORING PLAN

STEP ONE

DRAFT MONITORING PLAN

1. Identify issues and develop the objectives for monitoring.
2. Set priorities for monitoring.
3. Determine participants who will develop and maintain the monitoring plan (i.e., MELP, MoF, contractors, other agencies, etc.).
4. Outline methods and quality standards for:
   - identifying backlog and incremental silviculture treatment areas (STAs);
   - applying risk assessment to the monitoring;
   - selecting the sampling methodology;
   - conducting office reviews;
   - conducting field reviews; and
   - reporting results.

Note: Appendix B contains a blank risk rating form.

Risk ratings can be determined using the following formula:

consequence X hazard = risk

Where 'consequence' is the impact on a habitat/ecosystem objective as a result of a silviculture treatment (hazard).

Risk ratings incorporate mitigating factors and local knowledge.

STEP TWO

SECURE RESOURCES

1. The draft plan is the base for allocating resources.
2. Once resources are secured (i.e. funding, FTEs, etc.) then,
   - reassess the sample size of silviculture treatment areas,
   - assign responsibilities for components of the monitoring plan, and
   - prioritize/schedule silviculture treatment areas for monitoring.

STEP THREE

FINALIZE MONITORING PLAN

1. Finalize the monitoring plan based on Steps One and Two.
2. Obtain approval for the monitoring plan, where necessary.

APPENDIX B

RISK RATING FORM

Note: Form has not been updated to reflect the objectives as worded in the main body of this document.

		Silviculture Treatment /Activity													
		Brushing										Site Prep.			
	Habitat Ecosystem Objectives	Chemical	Livestock	Manual	Mechanical	Fertilization	Juvenile Spacing	Planting	Fill Planting	Pruning	Chemical	Livestock	Mechanical	Prescribed Fire
1	retain "rare" ecosystems, forest, plant, and vegetation types													
2	retain wildlife trees and tree patches													
3	maintain native tree and vegetative species representative of natural forest ecosystms													
4	maintain a variety of stocking densities within treatment areas and across landscapes													
5	minimize the adverse impacts of road access on fish and wildlife populations and their habitats													
6	vary the spatial and temporal distribution of spacing activities within large contiguous areas													
7	maintain habitat for identified wildlife, red and blue listed, and regionally significant species													
8	ensure maintenance of Riparian Management Areas including Riparian Reserve Zones and Riparian Management Zones,													
9	rehabilitate Riparian Management Areas													
10	ensure maintenance of forest thermal cover													
11	ensure that silviculture activities do not disrupt active nesting sites of bald eagles, ospreys and herons													
12	maintain visual screening corridors or buffers													
13	minimizing soil disturbance that can result in erosion, sediment transport, stream siltation and impacts on fish and aquatic environment													
14	manage for maintenance of coarse woody debris (CWD),													
15	ensure that harmful agents do not enter aquatic environments													
16	prevent introduction and spread of foreign/exotic plant species													
17	maintain snow interception forest cover attributes (e.g., ungulate winter ranges)													
18	manage for canopy heterogeneity (manage for stand vertical and horizontal structure)													
19	manage arboreal lichen production for lichen dependent species (e.g., mule deer and caribou)													
20	ensure the fertilization loading sites are cleaned up after treatment													
21	prevent overgrazing													

APPENDIX C

FS FORMS TO CONSIDER FOR MONITORING OF INCREMENTAL SILVICULTURE ACTIVITIES -- STAND DENSITY MANAGEMENT, PRUNING AND FERTILIZATION

For more information contact Pat Megson, Ministry of Forests, Forms Management & Mail Services Coordinator at Technical and Administrative Services Branch, 2414 Douglas Street, Victoria, BC, V8W 3E7.

Telephone: (604) 387-5494 or Fax: (604) 387-5714

To obtain FS Forms contact the nearest Forest District office or the Technical and Administrative Services Branch, Administrative Supply Warehouse, 1450 Government Street, Victoria, BC, V8W 3E7.

Telephone: (604) 387-8688 or Fax: (604) 387-8687

FORM NUMBER	FORM TITLE	FS RESPONSIBILITY
Form 39A	SILVICULTURE PRESCRIPTION PLOT CARD	Forest Practices Branch
Form 39B	SILVICULTURE PRESCRIPTION STRATUM CARD	Forest Practices Branch
Form 39C	SILVICULTURE PRESCRIPTION	Forest Practices Branch
Form 68	STAND MANAGEMENT PRESCRIPTION	Forest Practices Branch
Form 505F	VEGETATION INVENTORY - CWD	Forest Practices Branch
Form 657	SILVICULTURE SURVEY	Forest Practices Branch
Form 658	SILVICULTURE SURVEY PLOT	Forest Practices Branch
Form 659	SILVICULTURE SURVEY SUMMARY	Forest Practices Branch
Form 715 1/2	WILDLIFE/DANGER TREE FIELD ASSESSMENT DATA	Forest Practices Branch
Form 739	PLANTING SITE PRESCRIPTION	Forest Practices Branch
Form 748	PRE-STAND TENDING SURVEY	Forest Practices Branch
Form 749	POST-SPACING EXAMINATION	Forest Practices Branch
Form 752	POST-PRUNING EXAMINATION	Forest Practices Branch
Form 753	PLANTING REPORT	Forest Practices Branch
Form 758	STAND TENDING REPORT	Forest Practices Branch

FORM NUMBER	FORM TITLE	FS RESPONSIBILITY
Form 770	PRE-STAND TENDING SITE DESCRIPTION/PRESCRIPTION	Forest Practices Branch
Form 810	FOREST COVER ATTRIBUTE LIST	Forest Practices Branch
Form 881	SOIL DISTURBANCE SURVEY - Traverse Survey Calculation	Forest Practices Branch
Form 889	SOIL DISTURBANCE SUMMARY	Forest Practices Branch/Resource Tenures & Engineering Branch
Form 1087	VEGETATION DESCRIPTION	Research Branch
Form 1169	PROJECT DESCRIPTION (EM-1)	BC Environment or Integrated Resources Policy Branch, MoF
Form 1169 Wet	PROJECT DESCRIPTION (EM-1)	BC Environment or Integrated Resources Policy Branch, MoF
Form 1170 Dry	SITE DESCRIPTION (EM-2)	BC Environment or Integrated Resources Policy Branch, MoF
Form 1170 Wet	SITE DESCRIPTION (EM-2)	BC Environment or Integrated Resources Policy Branch, MoF
Form 1171 Dry	VEGETATION DESCRIPTION (EM-3)	BC Environment or Integrated Resources Policy Branch, MoF
Form 1171 Wet	VEGETATION DESCRIPTION (EM-3)	BC Environment or Integrated Resources Policy Branch, MoF
Form 1173A	HERBICIDE/FERTILIZER (EM-5A)	Forest Practices Branch/ BC Environment
Form 1175 Dry	FORAGE USE INSPECTION (EM-6)	BC Environment or Integrated Resources Policy Branch, MoF
Form 1175 Wet	FORAGE USE INSPECTION (EM-6)	BC Environment or Integrated Resources Policy Branch, MoF
Form 1175 Dry	FORAGE USE (EM-7)	BC Environment or Integrated Resources Policy Branch, MoF
Form 1175 Wet	FORAGE USE (EM-7)	BC Environment or Integrated Resources Policy Branch, MoF
Form 1177 Dry	PHOTOGRAPHIC RECORD (EM-9)	BC Environment or Integrated Resources Policy Branch, MoF

Form 1177 Wet	PHOTOGRAPHIC RECORD (EM-9)	BC Environment or Integrated Resources Policy Branch, MoF

APPENDIX D

COMPUTER SCREEN EXAMPLES OF INTEGRATED SILVICULTURE INFORMATION SYSTEMS (ISIS) INFORMATION

EXAMPLE OF DATA IN ISIS FOR HEIGHT DISTRIBUTION

The ***Height Distribution*** screen is used to record height distribution of activities that will be either brushed or juvenile spaced.

```
     Update   View     eXit     Help
--------------------------------------------------------------------------------
PAG33M01          Height Distribution     M View     V 1.00.00  DB SQLP1

Project Data:              Org Unit... DVE Vernon Forest District
Project Id.....          Unit.     Opening. 82L  017 0.0 33    ATU. JS1
--------------------------------------------------------------------------------
Reference Date.. 1991 06 18
Ht. Class(m)      *------------ CROP Tree Species (st/ha)-------* Combined
  Min. Max.  Layer   BL    PLI   SX                  Total   Total
   0.0   .4    1    1818        764                 2582    2582
   0.5  1.9    2    2418        682                  3100    3100
   2.0  9.9    3    1400     9   409                  1818    1818
  10.0 50.0    4      45        46                   91      91




       Totals.  5681     9   1901                   7591    7591
 MSG074I List successfully displayed

 Enter      F1=Help     F3=Exit     F4=Prompt    F10=Actions  F12=Cancel
 F18=SampTree F19=Comp     F24=Sendnote
```

EXAMPLE OF DATA IN ISIS FOR ECOLOGY

The ***Ecology*** screen contains the biogeoclimatic, soil and site productivity information from the silviculture prescription.

```
     Update   Delete   View     eXit     Help
--------------------------------------------------------------------------
PHP15M01     Ecology (ECO)              M View     V 1.00.00  DB SQLP1

Opening.....>  82L 043 0.0 1019          Licence No/Blk..> TFL 49 2
Location..... KELLY MTN.                 Gross Area (ha)..   11.9
--------------------------------------------------------------------------
                                        Strata   1 of   1
Strata Id..... 1          Plot No(s).
Strata Area (ha).....   11.9      SU X-Ref..> 1
Moisture/Nutrient.... 3 C Slightly Dry/Medium          Site Class.. M Medium
BGC Zone/Sub/Var/Ph.> IDF  mw  2
Site Series/Ph/Type.> 01
Elevations (m): Min.. 1210   Max... 1300   Avg... 1255
Slope Data:  Aspect.. N  North   Min%.   0 Max%.  40 Avg%.  10 Pos.. C Middle
Soil Description..... SILT LOAM

Critical Site Factors

Ecology Comments..... N
 MSG074I List successfully displayed
Command ===>
 F12=Cancel   F13=ATU     F14=PHSPAdm  F15=RecAct   F16=PrjMgmt  F17=Audit
 F19=Range    F20=SoilCon  F21=Harvest  F22=StdsUnit F23=OthrKeys F24=Sendnote
```

EXAMPLE OF DATA IN ISIS FOR FREE GROWING STOCKING STANDARDS

The ***Free Growing Stocking Standards*** screen contains the free growing stocking standards based on the silviculture prescription. These are the commitments that will be measured against to determine if the stand is free growing.

```
     Update   Delete   View     eXit     Help
--------------------------------------------------------------------------
PHP18M01  Free Grow Stocking Standards (STD) M View     V 1.00.00  DB SQLP1

Opening.....>  82L 043 0.0 1019          Licence No/Blk..> TFL 49 2
Location..... KELLY MTN.                 Gross Area (ha)..  11.9
--------------------------------------------------------------------------
                                      Stds Unit  1 of  1
Std Unit.....> 1
Regen Method..... PLANT Plant      Net Area To Be Reforested (ha).  11.9
Regen Delay(yrs)..... 7     Free Growing(yrs):  Early. 12 Late. 15
Max Density(st/ha)... 5000
Target Spacing Density(st/ha):     Min. 1200       Max. 2000
Crop Trees vs Comp(cm/%). 150 %

Preferred Species/Height(m).. PLI   1.6 FDI   1.0
Acceptable Species/Height(m). EP    1.6
WSS/ha:    Target 1200 Min  700 Min Pref 600  Min Horiz(m)  2.0
Target Residual Basal Area(m2/ha):  Min.           Max.
Rationale Comments... N
 MSG074I List successfully displayed
Command ===>
 F13=ATU     F14=PHSPAdm  F15=RecAct   F16=PrjMgmt  F17=Layers   F18=Ecology
 F19=Range   F20=SoilCon  F21=Harvest  F22=SeedlReq F23=OthrKeys F24=ForHlth
```

EXAMPLE OF DATA IN ISIS FOR STAND TENDING RESULTS

The ***Stand Tending Results*** screen records juvenile spacing, brushing, fertilizing or pruning activities. This screens tracks when the activity was completed and details who funded the activity. There are specific spaces to track fertilizer or pesticide use information. The example in this screen illustrates a chemical ground brushing treatment.

```
      Update   Delete   View     eXit     Help
--------------------------------------------------------------------------------
RAC08M01  Maintain Stand Tend. Results (MST) M View     V 1.00.00  DB SQLP1
Project Data:                Org Unit..... DVE Vernon Forest District
Project ID.......> BR95DVE14     Location..... WYPER ROAD/ SHIELL LAKE
Start Date..... 1994 08 17 A  End Date..... 1994 08 25 A
Comments..... Y      Contract Coordinator. J. SLADE
--------------------------------------------------------------------------------
                            Find Proj Unit:
Project Unit.   E     Opening.....>  82L 016 0.0  190     ATU. BR1
Objectives..... CGE
Actual Base Activity.. BR
Actual Technique.....> CG          Actual Method.....> BPACK
Completion Date..... 1994 08 17    Treated Area (ha).....   12.9
Eco-Strata ID.....> A           Stand Origin Code..... P
Pesticide Permit No... 401-387-94/96 Pesticide  Code..... GLY
 Pesticide  Amt(kg/ha)  +00001.87    Target Stems/ha.....
Performance Quality... 100 %        Target Species ALNUCRI  CALARUB  POPUTRE
Actual Funding Source. SBF          Total On-Site Cost.....   2902
Comments..... N           Cost Per Hectare.....    224.96
 MSG073I Record successfully displayed
Command ===>
 F13=ATU     F14=PHSP     F16=PrjMgmt  F17=Audit    F18=Pruning  F19=Pln/Rslt
 F20=PostStnd F21=ForCover F23=OthrKeys F24=Sendnote
```

EXAMPLE OF DATA IN ISIS FOR VEGETATION COMPETITION

The ***Vegetation Competition*** screen describes the potential brushing for planned juvenile spacing and brushing treatments.

```
     Update   View     eXit     Help
--------------------------------------------------------------------------
PAG31M01        Vegetation Composition     M View    V 1.00.00  DB SQLP1

Project Data:              Org Unit..... DVE Vernon Forest District
Project ID.....          Unit.    Opening.  82L 033 0.0   51  ATU. JS1
--------------------------------------------------------------------------
Reference Date.. 1993 07 19
     Brush    %  *-- Current Ht (cm) --*   Brush       *-- Comp. Rating --*
 Opt  Species  Cov Min.  Max.  Avg.  Incr.   Distribution Current    Potential
    CALACAN     6      50    50         P Patchy     M Medium   M Medium
    LONIINV     2      60    60        P Patchy     L Low      L Low
    POPUBAL2    1      60    60         S Scattered  L Low      L Low
    RUBUSPE     2      75    75         S Scattered  M Medium   L Low




 MSG074I List successfully displayed

 Enter      F1=Help     F3=Exit     F4=Prompt    F10=Actions  F12=Cancel
 F24=Sendnote
```

EXAMPLE OF DATA IN ISIS FOR POST TREATMENT STAND LABEL

The ***Post Treatment Stand Label*** screen describes the species, age, crown closure and residual stand density of the stand after a stand tending activity.

```
     Update    View      eXit      Help
--------------------------------------------------------------------------------
RAC19M01     Post Treatment Stand Label      M View     V 1.00.00  DB SQLP1

Project Data:
Project ID. JS96DVE03   Project Unit.   A  Opening.  82L 057 0.0   32 ATU. JS1
--------------------------------------------------------------------------------
                    SPP   % SPP   % SPP   %  SPP  %  SPP  %
Species Composition..... SX    40 BL   30 CW   10 FDI  10 PLI  10

Average Age (years)......  16

Average Height (m).......  2.4

DBH (cm):.............Avg.        Range.       to

Pct Crown Closure........

Remaining Total Stems/Ha.   1779   Slash Hazard Rating. H

 MSG073I Record successfully displayed

 Enter       F1=Help     F3=Exit     F4=Prompt    F10=Actions  F12=Cancel
 F24=Sendnote
```