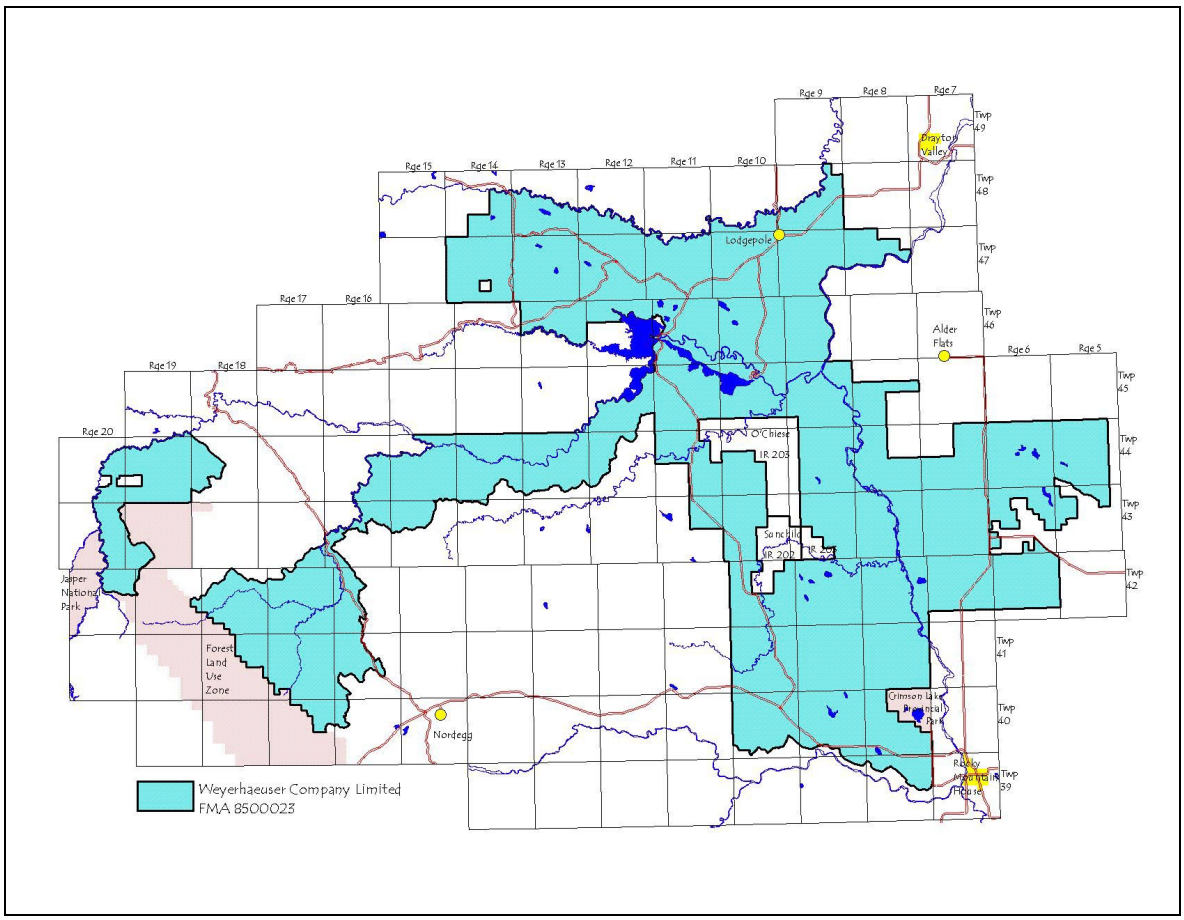
EXECUTIVE SUMMARY

This Detailed Forest Management Plan (DFMP) has been developed for Forest Management Agreement (FMA) 8500023. It replaces the current Preliminary Forest Management Plan approved on April 29, 1998, and will be the forest management plan for all forest management activities contained within the FMA Area. This is the second DFMP in the FMA Area's history and was precipitated as a result of an amendment to the FMA in 1997. A team of resource managers was used to develop this Plan, with participation by Alberta Environment.

The FMA Area extends from agriculturally developed lands on the eastern edge to west of the Bighorn Range. This east/west orientation provides a wide range of variation in plant and wildlife species, mesoclimate, topography and other ecological characteristics across the FMA Area (see map below).



Goals

The DFMP is a long-term strategic plan that sets forth how the Company will achieve a set of goals established for the DFMP itself. The DFMP goals have been established with public consultation so they incorporate ecological, societal and economic values. The DFMP Goals were approved by Alberta Environment on March 8, 1999. For the purpose of the DFMP, *goals* are defined as:

Broad statements of intent or direction relative to an aim, end or state of being to be achieved at some point in the future or maintained over a period of time.

The DFMP Goals and corresponding strategies are summarized as follows:

Goals	***Strategies***
Ensure that Weyerhaeuser's Drayton Valley facilities remain globally competitive with respect to fibre supply from the FMA Area.	• To be the forest products industry leader in forest stewardship – as judged by our employees, customers, communities and shareholders. • Provide for low cost / good value timber.
Maintain forest diversity at the stand and landscape level in terms of structure, composition, and function.	• Conserve habitat for rare and endangered species. • Provide habitat for all species (e.g., biodiversity). • Improve our knowledge of the response of fish and wildlife to our forest management activities. • Maintain a forest of all different age classes over time.
Maintain the productive capacity of the forest.	• Maintain soil productivity by minimizing disturbance and by reclaiming and restoring potentially productive sites.

(Continued on next page)

Goals	Strategies
Improve public acceptance of Weyerhaeuser's – Drayton Valley forest management activities.	• Obtain meaningful input from the public on our forest management activities. • Ensure ongoing consultation with stakeholders, including an issue resolution process. • Educate and communicate with the public about the forest, and Weyerhaeuser's forest management activities • Demonstrate commitment to and progress towards continuous improvement of Weyerhaeuser's skills in forest management and knowledge of ecosystem processes. • Manage and conduct our forest management activities in a socially acceptable manner.
Integrate with the management activities of other resource users.	• Manage access issues resulting from Weyerhaeuser's forest management activities. • Work cooperatively with other resource users such as: other timber operators, the oil and gas industry, the grazing disposition holders, etc. • Work cooperatively with recreational, and tourism stakeholders. • Minimize visual impacts in sensitive areas. • Cooperate with all land neighbors in the implementation of Weyerhaeuser's forest management activities. • Work proactively to build mutually beneficial relationships with First Nations.
Protect unique archeological and ecological sites	• Identify important archeological and ecologically sites during operational planning and consult appropriate authorities for protection requirements.

(Continued on next page)

Goals	Strategies
Maintain the integrity of watersheds.	• Comply with current legislation and Ground Rules for road and crossing construction to minimize the impact on water quality, quantity, and timing.
Increase the sustainable harvest level of deciduous and coniferous timber from the FMA Area	• Improve timber utilization. • Improve the utilization of lands for forest production. • Decrease loss of timber from natural causes.

For each strategy stated above, the DFMP provides specific objectives (68 in total) and targets to be implemented to varying degrees and points in time.

Public Involvement

Throughout the development of the DFMP, Weyerhaeuser followed the *Public Involvement Plan for FMA 8500023, July 31, 1998*. The Public Involvement Plan consisted of three distinct phases. Phase One was designed to facilitate input and reviews towards the establishment of the DFMP goals. Phase Two facilitated the input and review towards the development of specific strategies and objectives that best met the intent of the above DFMP Goals. The third and final phase of the *Public Involvement Plan* involves ongoing consultation regarding operational activities with stakeholders and members of the public after the DFMP has received approval and implementation has begun. Weyerhaeuser has developed a separate report on the results of its public consultation for the DFMP that is available to any interested parties. As well, Weyerhaeuser's ongoing Forest Advisory Committee (FAC) has been involved extensively in the public involvement process during the development of the DFMP. The FAC has prepared a two-part report on the DFMP that has been made available to Alberta Environment and any interested publics. Part one reviews the public involvement process and part two provides the FAC's comments on the DFMP itself. The key issues identified during public consultation are listed as follows:

- Sustainability
- Logging west of the Forestry Trunk Road
- Fish & wildlife protection
- Old growth
- Public involvement methods
- Reforestation
- Watershed protection
- Cumulative effects assessment
- Access management
- Impacts on grazing, recreation, tourism, oil & gas, trapping

FMA Area Overview

The DFMP utilizes a comprehensive and detailed land and vegetation inventory (Alberta Vegetation Inventory) updated to spring 1999. The FMA Area straddles the Lower Foothills, Upper Foothills and Subalpine natural subregions. Elevation ranges from 760 metres in the

northeast to 2620 metres in the southwest. A predictive ecosite classification of the FMA Area was completed in summer 1999.

The FMA Area is approximately 427,700 hectares in size, of which 257,620 hectares or 60% is available for DFMP forest management activities. Forest growing stock is 31 % deciduous and 69% coniferous, where deciduous and mixedwood forest predominate in the eastern parts of the FMA Area, and coniferous forest in the western portions. As a whole, the FMA Area is a mixedwood forest that reflects the opportunity Weyerhaeuser has developed with an oriented strandboard facility utilizing deciduous timber, and a sawmill facility utilizing coniferous timber. The forest resource is generally mature to over mature in age (88% of the forest is over 40 years in age). This age distribution is the result of effective fire suppression over the last 50 years and does not reflect a natural range for this region. An analysis of natural disturbance patterns versus the current patterns is provided in the DFMP. There have been no significant fires on the FMA Area in recent history with the exception of the O'Chiese fire in 1988 (8,143 ha.). Similarly, there have been no significant timber losses from insect and disease within the last 15 years.

The FMA Area is extensively developed for oil & gas with over 16,600 km. of linear disturbance. Linear development ranges from densities of 7 km. / sq. km. in the east to 1.4 km. / sq. km. in the west. Road development is extensive consequently Weyerhaeuser's road development needs are minimal. A landscape analysis (fragmentation) was conducted for the DFMP and shows that the current landscape diversity has been significantly altered by linear disturbances.

There are 43 grazing dispositions adjoining to, or part of, the FMA Area as well as a number of private lands. The FMA Area bounds to Crimson Lake Provincial Park and Jasper National Park, as well as a number of other recreation areas. There are two Special Places nomination sites within the FMA Area, which have not been officially designated by Alberta Environment at the time of this DFMP submission. Visual impacts from timber harvesting will be a key concern in certain areas.

The FMA Area is well known for its abundant wildlife resources and fisheries opportunities. The diverse environment (i.e. three natural subregions) supports a wide variety of wildlife and plant species. Since 1994, Weyerhaeuser has undertaken extensive research to provide baseline data that will be used for future monitoring, the results of which to date are reported in the DFMP.

The FMA watershed areas are divided among three basins – the Athabasca River basin, the North Saskatchewan River basin and the South Saskatchewan River basin. The highest priority in the overall management of the Eastern Slopes Region is place on watershed management. Protection measures are outlined in the DFMP, including watershed assessments for sensitive watersheds.

In order to set objectives most appropriate for a diverse landscape, the FMA Area has been divided into Landscape Management Units (LMU) that stratify the Area based on the varying ecological, social or physical characteristics of a particular landscape. The DFMP objectives are then refined for a given LMU throughout the Plan.

Ecological Sustainability

In accordance with the principles espoused by the Alberta Forest Legacy and the Canadian Biodiversity Strategy, The DFMP addresses concerns about the conservation of biodiversity by adopting a coarse filter approach. This requires managing forest ecosystems as a whole, recognizing their dynamic nature, the autecology and successional patterns of the major tree

species, and the dependence of all biota on the presence of a variety of structures and seral stages widely distributed over a forested landscape. The coarse filter approach requires:

1. planning and operating over large landscapes;
2. maintaining landscape interspersion, diversity, and connectivity, and minimizing fragmentation; and
3. retaining structural diversity at the stand level.

The coarse filter approach will be complemented by a fine filter component to address the habitat needs of feature species[1] and both approaches will be integrated in Weyerhaeuser's forest management activities. Consistent with the above concepts, in its progress towards ecologically sustainable forest management practices in Alberta, Weyerhaeuser has developed ecological guidelines for timber harvesting operations. The timber supply analysis for the DFMP attempts to assess the impacts of the aforementioned considerations on the AAC and harvest sequencing.

Integrated Resource Management

All of the FMA Area falls within one of three Sub-Regional Integrated Resource Plans (IRP) for the Eastern Slopes Region, plus one Local Integrated Resource Plan. Consequently, the DFMP objectives are aligned with the objectives, guidelines and zonation of the overlapping Alberta Environment IRP's.

The DFMP identifies the requirements for integration with other resource users, and sets forth the basic objectives and tactics that will be used to achieve minimal conflict between Weyerhaeuser's forest management activities and other resource uses within the framework of Provincial legislation and policy. The other resource uses addressed in the DFMP are:

Oil & gas	Grazing
Trapping	Recreation & tourism
Access development	Unique resources (archeological & historical)

Timber Management

The DFMP defines a commitment to improving timber utilization, maintaining a long-term sustainable timber harvesting landbase from the FMA Area, minimizing the loss of timber from natural causes, and ensuring the maintenance of soil productivity.

Harvest levels for this DFMP (i.e. the timber supply analysis) were established through modeling. All inputs to the models can be grouped into three basic components as follows:

1. Forest area (land base)
2. A projection of how the forest develops over time (yield projections)
3. Management policies and objectives

The integration of these three components was achieved with the use of Woodstock® and Stanley® modeling software.

[1] "Feature" species are those that are rare, threatened, endangered or of social value.

Woodstock is a high-level programming language that allows for the creation of a harvest schedule as the output from a linear programming problem. The linear programming problem served to define an annual harvest volume subject to objectives for operability and sustainability of both timber and non-timber resources. Yield relationships were applied to specific forest types over a specified planning horizon. Harvest activities were applied to the forest within the model based on specified objectives and parameters.

Stanley is a simulation-based spatial activity allocation model. Stanley was used to derive an operationally feasible schedule of harvest openings from the Woodstock-defined optimal harvest schedule, while accounting for policies governing the spatial distribution of harvests such as green-up constraints, block size, and minimum distance between blocks. The result is a mapped harvest sequence that can be used in operational forest planning constrained by factors, which may not have been accounted for by the modeling.

The timber supply analysis considered planning horizon, flow policy, age class constraints, harvesting age, operability, regenerated yields, species optimization, integrated resource management and ecological sustainability constraints. The models used provided the opportunity to evaluate alternative management strategies, gain insight into the complex relationships that exist in the forest, and evaluate the management for other resource values.

Volume sampling data used in the timber supply analysis was comprised of a variety of stratified random sampling programs. The majority of the data was from temporary sample plots although permanent sample plot data collected from Weyerhaeuser's program on the FMA was also used (initial measurements and re-measurements). Yield relationships were developed and/or applied on the basis of species, Natural Subregion, ecosite classification, age, site index (age-height) and inventory classifications. The FMA Area was essentially treated as one landbase i.e. deciduous, coniferous and mixedwood landbases.

The Provincial regeneration standards (C, CD, DC, D) will be used to evaluate the performance of regenerating cutovers. The standards will be applied to regenerating cutovers based on the corresponding stand stratum used to determine the annual allowable cut. Operationally, provision will be made for alternate strategies provided that a "balancing" method is in place for overall yield assumptions as per Provincial policy in effect at the time of this DFMP.

An enhanced forest management research program is being developed on the FMA Area. However, due to time and modeling constraints this Plan does not incorporate the benefits of enhanced forest management activities. The intent of the enhanced forest management research program for the period of this plan is to establish trials to:

- gain operational experience in implementing these activities;
- demonstrate the results of these activities; and
- provide a basis for evaluating the forest response to these activities

Weyerhaeuser's FMA Area encompasses four Forest Management Units (FMU's), R1, R2, R3, and R4. None of these FMU's is fully contained within the FMA Area (i.e. portions of these FMU's lie outside the boundaries of the FMA Area). These FMU's support the timber allocations for four different Quota holders (one of which is Weyerhaeuser) plus in part two other FMA holders, as well as the FMA Area for this DFMP. Essential to this DFMP was developing agreements and understandings as to how the FMA Area's in these FMU's could be reconciled as the new FMU's and align the corresponding Quota allocations accordingly. The DFMP describes how this is to be accomplished with the support of all the other timber operators. The result for this DFMP is that the Weyerhaeuser FMA Area supports the Quota timber commitments to Tall Pine Timber Ltd. and two programs administered by Alberta

Environment: the Rose Creek West Community Timber Program and the Local Timber Permit program. The DFMP determines what the harvest levels are for these other timber commitments based on the timber supply analysis and current Provincial policy for Quota holders.

The proposed Annual Allowable Cut levels for the FMA Area are: 404,018 m^3/year of coniferous and 291,942 m^3/year of deciduous. These harvest levels would be divided between Weyerhaeuser, Tall Pine Timber Co. Ltd. and the Alberta Environment administered Timber Permit Programs for the FMA Area as per the following table.

Company	Coniferous AAC	Deciduous AAC
Weyerhaeuser Company Limited	319,400 m^3/year	289,023 m^3/year
Weyerhaeuser Company Limited FMU R2	49,958 m^3/year	
Tall Pine Timber Co. Ltd.	26,625 m^3/year	
Rose Creek West Community Timber Program	4,035 m^3/year	
Timber Permit Program	4,000 m^3/year	2,919 m^3/year
Totals	**404,018 m^3/year**	**291,942 m^3/year**

Implementation

The basic framework for DFMP implementation will be the three traditional methods: Planning and Operating Ground Rules, General Development Plans, and Annual Operating Plans.

Forest management for the FMA Area will take an *adaptive management* approach, which can be described as a learning approach that incorporates the experience gained from the results of previous actions and decisions. The adaptive management approach used to implement this DFMP involves three basic elements – *monitoring, analysis and adjustment.* Monitoring will be an ongoing process and integrated with regular operations of the Company. It will address the basic aspects of:

- Tracking actual activities versus planned activities
- Tracking actual responses to forest management activities compared to expected responses
- Identifying impacts arising from changes in assumptions, terms of reference or unplanned events

To restate from the Interim Planning Manual, regulatory performance or compliance will be reported through existing, separate systems.

Information systems designed to manage monitoring data will be acquired or developed not only to meet the needs of this DFMP, but also to serve future initiatives for environmental certification (e.g. ISO, CSA, etc.).

Reporting will be done in two reports: ***Annual Forest Management Report*** and ***Stewardship Report***, both of which will be available for public reading.

The DFMP outlines the activities that will be done in anticipation of future DFMP submissions or amendments. This includes continuing research on other resources, silvicultural strategies, growth & yield, and adapting to landbase changes.

Detailed Forest Management Plan for FMA8500023

December 22, 2000

Weyerhaeuser

The future is growing™

Drayton Valley - Alberta Division

Weyerhaeuser

DETAILED FOREST MANAGEMENT PLAN FOR FMA 8500023

December 22, 2000

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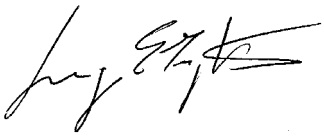
Morgantini, Luigi	Forest Ecologist	
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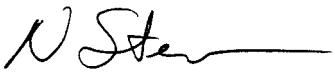
Stevens, Neil	Timber Supply Analyst	
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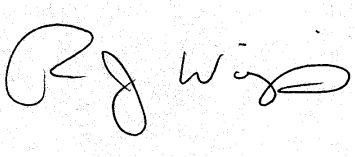
Winship, Bob	Forestlands Superintendent	

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ACKNOWLEDGEMENTS

In the development of this Detailed Forest Management Plan Weyerhaeuser Company Limited would like to thank the following individuals and organizations for their assistance and cooperation in the development of this Plan:

1. Weyerhaeuser Company Limited – Staff of Drayton Valley Forestlands for their assistance and support during the preparation of this Plan. Without their enthusiasm and dedication to the daily operations the time to complete this Plan would not have been available.
2. Weyerhaeuser Company Limited – Edmonton Forestlands for their valued assistance with the preparation and editing of this Plan.
3. Alberta Environment Brazeau Forest Area for their participation on the planning team; and their cooperation, guidance and editing during the preparation of this Plan.
4. The Drayton Valley Forest Advisory Committee for their continuous constructive feedback and valued advice.
5. The numerous individuals and interest group representatives who took the time to contact Weyerhaeuser with valued input or concerns.
6. Tall Pine Timber Co. Ltd. for their patience, cooperation and feedback in the development of certain sections of this Plan.
7. Those companies involved in the development of FMA area inventories and spatial databases used to complete the Plan:
    a. Silvacom Ltd.
    b. Geographic Dynamics Corporation
    c. GISmo Solutions Ltd.
8. Those individuals and companies which assisted in the fish and wildlife inventories and data collection:
    a. Aspen Ecological Consulting Ltd.
    b. Alberta Conservation Association
    c. Bighorn Environmental Design Ltd.
    d. Alpha Wildlife Research and Management Ltd.
    e. Ursus Ecosystem Management Ltd.
    f. University of Alberta – Heidi Lippert, Leslie McInenly, Cam Stevens
9. Those companies that assisted us with the technical analysis of the FMA area:
    a. Forestry Corp.
    b. Watertight Solutions Ltd.
    c. Timberline Forest Inventory Consultants Ltd.
    d. GISmo Solutions Ltd.
10. Those companies for their efforts in the sample plot data programs:
    a. Forest Pro Consulting Inc.
    b. Kalfor Forest Consulting Ltd.

c. Canyon Forestry Consulting Ltd.

d. Geographic Dynamics Corporation

e. Brinkman and Associates Ltd.

11. The companies which assisted Weyerhaeuser with the quality control programs through out the development of this Plan:

    a. EZRA Consulting Ltd.

    b. Kalfor Forest Consulting Ltd.

12. For the much appreciated editing and layout of the Plan:

    a. Kim Sanderson of the Pembina Institute for Appropriate Development

    b. Dana Koch of Koch Ink Design Solutions

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SECTION I
RESOURCE MANAGEMENT PHILOSOPHY AND GOALS

1. WEYERHAEUSER COMPANY LIMITED - DRAYTON VALLEY MANAGEMENT PHILOSOPHY

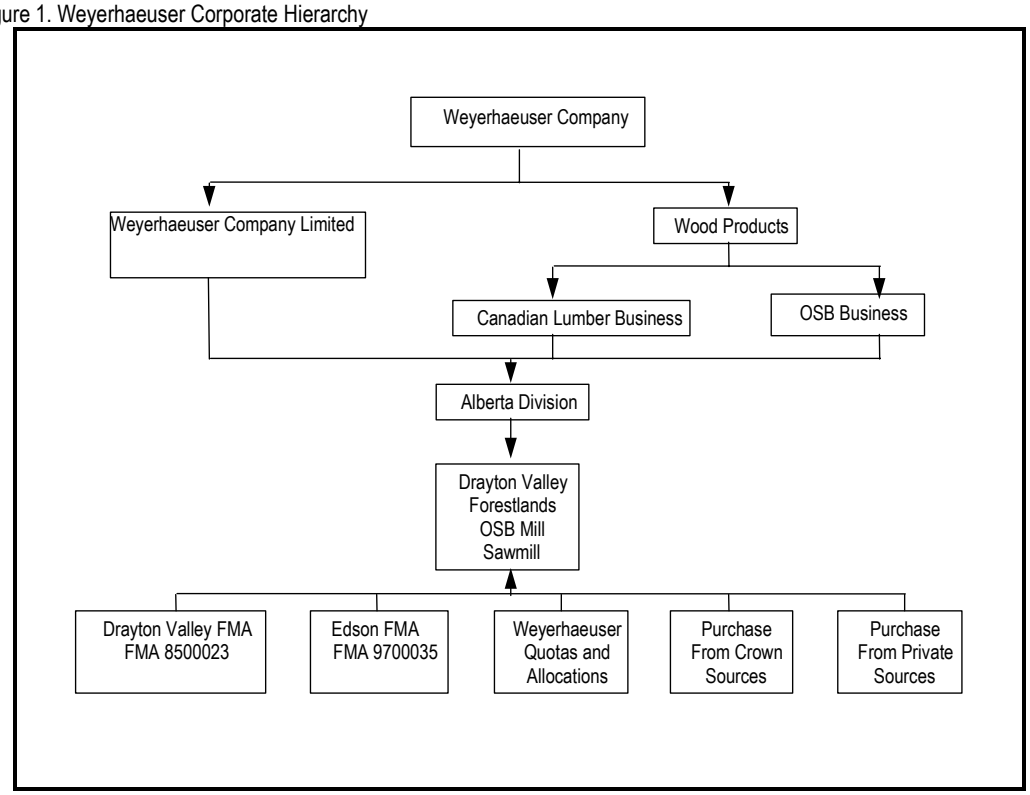
1.1 Corporate Hierarchy

Weyerhaeuser Company Limited is a wholly owned subsidiary of Weyerhaeuser Company of Tacoma, Washington. In Alberta, Weyerhaeuser is organized into two divisions, one with operations in Drayton Valley, Edson, and Slave Lake, and the other with operations in the Grande Prairie/Grande Cache area.

Within the Weyerhaeuser organization, the Drayton Valley sawmill reports to Weyerhaeuser's Canadian Lumber Business, and the oriented strand board (OSB) mill reports to the Oriented Strand Board Business. Figure 1 shows the corporate hierarchy just described.

The Forestlands team in Drayton Valley serves both the sawmill and OSB mill teams, reports to the Forestlands manager in Edmonton, and is responsible for the management of the Drayton Valley Forest Management Agreement (Appendix 1).

Figure 1. Weyerhaeuser Corporate Hierarchy



1.2 Management Philosophy

1.2.1 Vision

Weyerhaeuser Company and Weyerhaeuser Company Limited share a vision, which is to be:

"The Best Forest Products Company in the World."

1.2.2 Values

In pursuing this vision, the company subscribes to core values around People, Customers, Citizenship, and Shareholders. The Citizenship value states:

"We support the communities where we do business, hold ourselves to the highest standards of ethical conduct and environmental responsibility, and communicate openly with Weyerhaeuser people and the public."

1.2.3 Policy

In keeping with the Citizenship core value is the Weyerhaeuser Environmental Policy, which states:

"Weyerhaeuser employees will work to ensure that we comply with applicable laws and regulations and to continuously improve our environmental performance wherever we do business."

Employees are accountable for ensuring compliance with applicable laws and for managing and operating our business to conform to the company's goals of:

- Practicing sustainable forestry, as defined by the *Interim Planning Manual*,
- Reducing pollution, and
- Conserving natural resources through recycling and waste reduction."

1.2.4 Principles

Weyerhaeuser Company Limited has refined its definition of these directives with a statement on "Weyerhaeuser Company Forest Stewardship Principles." Herein we state that:

"We are committed to being industry leaders in stewardship on public forest land. We continuously improve our management practices to sustain environmental quality and enhance the economic value of forests entrusted to us. We accomplish this by practicing sustainable forestry and integrated resource management based on sound science and proven technology . . .. We listen to and consider public expectations in preparing forest management plans."

Consistent with these statements is the vision statement for the Weyerhaeuser, Alberta Division, Forestlands:

"To be the forest products industry leader in forest stewardship - as judged by our employees, customers, communities, and shareholders"

1.3 Planning Process

The scope of our planning for the management of forest resources on the Drayton Valley Forest Management Agreement area is to plan for forest harvesting and renewal activities and their integration with other forest values.

Consistent with this scope Weyerhaeuser intends to continue to plan for and practice sustainable forest management that strikes a balance between ecological, societal, and economic values. Identifying the desired balance of values and adopting an appropriate management strategy to deliver these values is the purpose of the management planning process.

1.3.1 Ecological

Ecological values have been integrated into the planning process through ecological sustainability guidelines. These guidelines have been formulated with reference to the following principles:

1. Maintain landscape diversity and stand structure within the range of natural variability.[2]
2. Conserve habitat for threatened and endangered plant and wildlife species.
3. Maintain the integrity of watersheds.

These principles direct our perspective such that we take both a coarse filter approach (that is, managing the resource as ecosystems), and a fine filter approach (managing the resource for feature species). Weyerhaeuser's approach to maintaining biodiversity is outlined in Appendix 2.

1.3.2 Societal

Societal values have been integrated into the planning process through:

1. a public involvement process that ensured the public an opportunity to convey to Weyerhaeuser their issues and concerns on forest management, and
2. compliance with government legislation and policy.

1.3.3 Economic

Economic values have been integrated into the planning process by adopting a management strategy that recognizes economic needs of other stakeholders and provides an acceptable return to Weyerhaeuser shareholders.

1.4 Management Approach– Adaptive Management

The Detailed Forest Management Plan has been designed to deliver on the goals and objectives developed from thorough consultation with other stakeholders. To aid in meeting these objectives, adaptive management will be used to implement the forest management plan. An adaptive management approach provides:

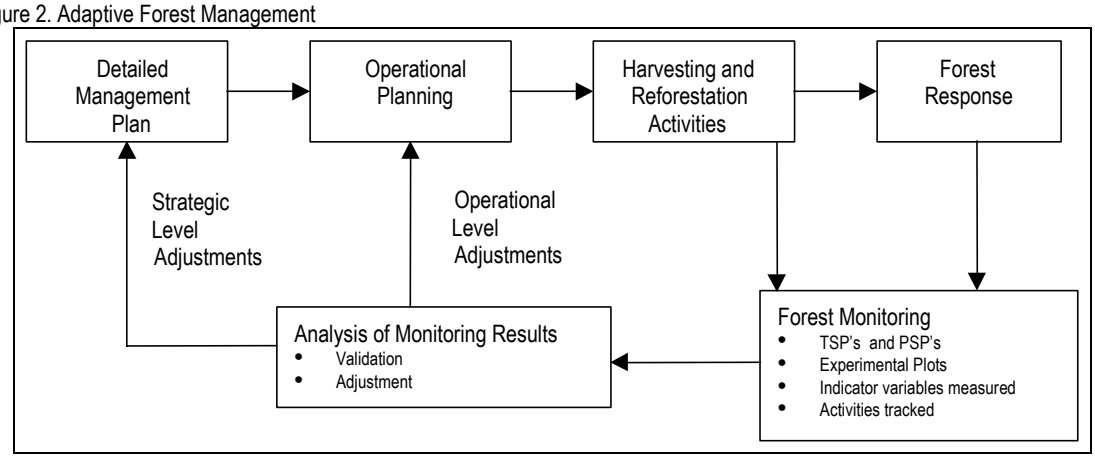
- confidence in management by identifying variances between forecasted conditions and actual conditions, in a timely manner,

[2] Range of natural variation broadly refers to "ecosystem dynamics over a time frame relevant to understanding the behavior of contemporary ecosystems". "Range of variability" characterizes fluctuations in ecosystem conditions or processes over time. It can describe variations in diverse characteristics such as tree density, vertebrate population size, water temperature, frequency of disturbance, rate of change, etc. Determining range of variability will consider: 1) points in time prior to significant anthropogenic development (e.g. logging, fire suppression, etc.), 2) the dynamics of forest succession over time, and 3) societal expectations.

- an opportunity to modify practices to ensure DFMP goals are attained,
- flexibility in how to adjust management to account for identified variances, and
- a better information base to meet future planning needs.

Figure 2 represents the adaptive management approach.

Figure 2. Adaptive Forest Management



Monitoring

An essential component of adaptive forest management is an effective monitoring program. Each management objectives has key measures that can be monitored to assess management success. By measuring these key measures and comparing actual forest condition and development with planning forecasts, variances with the objectives can be identified. Commitment and adherence to planned activities and programs will also be monitored.

Adaptive management also implies adjusting the course of action relative to the variances identified in monitoring. There is an opportunity to make operational adjustments within the implementation of the management plan. These operational adjustments may take the form of corrective activities or compensating activities. The corrective actions directly address the identified shortcoming or variance identified. A prime example of this type of activity would be re-treatment of a regenerating cutover to meet a particular reforestation standard. An additional operational adjustment tactic would be compensation. This activity would indirectly address the identified variance by way of modifying plans. An example of a compensating adjustment could be re-classification of cutovers to meet reforestation standards.

Monitoring programs also provide information that is of value in subsequent revisions to the DFMP. Information from monitoring programs can be of use in modifying objectives, forecasts, and/or strategies for new plans. In extreme situations, variances in forecasts could result in a revision to the DFMP or the timber supply analysis.

Temporary and permanent sample plots, along with experimental research plots, will be used to monitor forest condition and development.

2. WEYERHAEUSER DFMP GOALS

2.1 Goals

Weyerhaeuser, with the involvement of the Forestry Advisory Committee and input from key stakeholder groups, has developed a set of goals for use in the Detailed Forest Management Plan (following page). The DFMP Goals were approved by Alberta Environment on March 8, 1999.

For the purpose of this planning process, *goals* are:

> *Broad statements of intent or direction relative to an aim, end or state of being to be achieved at some point in the future or maintained over a period of time.*

Ecological, societal and economic values are represented in the management planning process by alignment with the DFMP goals.

Table 1 – DFMP Values

Value	Description
Ecological	Ecological values have been integrated into the planning process through guidelines that are based on the following principles: 1. Maintenance of landscape diversity and stand structure within the range of natural variability. 2. Conservation of habitat for threatened and endangered plant and wildlife species. 3. Maintenance of the integrity of watersheds.
Societal	Societal values have been integrated into the planning process through: 1. A public involvement process that ensured the public had an opportunity to convey to Weyerhaeuser their issues and concerns on forest management. 2. Adherence to government legislation and policy.
Economic	Economic values have been integrated into the planning process by adopting a management strategy that recognizes economic needs of other stakeholders and provides an acceptable return to Weyerhaeuser shareholders.

The DFMP Goals are:

- **Ensure that Weyerhaeuser's Drayton Valley facilities remain globally competitive with respect to fibre supply from the FMA Area.**
- **Maintain forest diversity at the stand and landscape level in terms of structure, composition, and function.**
- **Maintain the productive capacity of the forest.**
- **Improve public acceptance of Weyerhaeuser's – Drayton Valley forest management activities.**
- **Integrate with the management activities of other resource users.**
- **Protect unique archeological and ecological sites.**
- **Maintain the integrity of watersheds.**
- **Increase the sustainable harvest level of deciduous and coniferous timber from the FMA Area.**

Appendix 3 contains the summary document of the public input received during the development of the DFMP Goals.

3. FOREST MANAGEMENT AGREEMENT AREA

3.1 History of Weyerhaeuser's Drayton Valley Forest Management Agreement

1980

The Weyerhaeuser Drayton Valley FMA had its origins in what was called the Brazeau Timber Development Area (TDA). In 1980, the Province requested proposals for forest industry development for the forest resource generally located between Rocky Mountain House and Drayton Valley. The TDA was divided into two major "Blocks" known as the O'Chiese Block (primarily deciduous timber) and the Nordegg Block (primarily coniferous timber). Public hearings were held on the proposals in 1982 but no forest industry development occurred right away.

1985

Pelican Mills Ltd. was awarded the original FMA Area in 1985 in exchange for a commitment to build and operate an oriented strand-board (OSB) plant in Drayton Valley. The FMA Area was loosely based on the former O'Chiese Block from the Brazeau TDA as the OSB plant uses deciduous timber. Wood requirements were met from the FMA Area, purchased wood and from Deciduous Timber Allocations acquired by the company from the Province for areas outside the FMA Area. At this point, most Crown deciduous timber supplies in the region were committed.

1987

A Preliminary Forest Management Plan was submitted in February 1987 and subsequently approved by the Province in October. Mill production began in March 1987 and timber harvesting operations in the same year.

Pelican Mills pursued the acquisition of Coniferous Timber Quotas, both from public and private sources, and built a dimensional lumber sawmill-planer complex. It was a logical progression for the company as much of the deciduous timber was in mixed stands with conifer timber, and the conifer timber supply in the region was still under-utilized. Similarly, wood supply for the sawmill was procured from the FMA, Coniferous Timber Quotas and purchased sources. The resulting Crown wood supply areas that occured at this point in time are described on the *Weyerhaeuser 1987 Timber Supply Area Map* on page 1 of Appendix 4.

1990

A Detailed Forest Management Plan (DFMP) for the original FMA Area was submitted to the Province in accordance with the requirements of the FMA, and was subsequently approved in June of 1994. The period between the submission of the DFMP and its approval was unusually long, mainly because this was a time of evolving expectations for forest management plans and for the approval process, including public involvement. Thus three drafts were required, each with formal reviews, to satisfy both the company and the Province. The company also established its first public Forest Advisory Committee in 1990.

In 1990 Weyerhaeuser Company Ltd. acquired Pelican Mills Ltd. There were no significant changes as a result of the takeover by Weyerhaeuser although the company continued to seek additional Crown coniferous wood supplies in the form of Quotas. About the same time, the region experienced substantial growth in the forest sector and virtually all remaining Crown timber resources had become committed.

1996

In 1996, the company submitted to the Province what was termed a Status Report for the FMA Area. The report was essentially a summary of forest management activities, reporting on the company's performance against the FMA requirements and providing some direction for future forest management plan development. The Status Report was submitted to the Province for information and for public reading.

1997

As virtually all of the Crown timber resource in the region was fully committed by 1997, it was a logical progression for Weyerhaeuser to seek to have its wood supply areas described on the *Weyerhaeuser 1987 Timber Supply Area Map* (page 1 of Appendix 4) combined into one FMA Area. The only exception to this would be Weyerhaeuser's Quota in the R-2 forest management unit, which would remain in Sunpine Forest Products Ltd.'s FMA Area. This would provide the company with greater security of supply and a better opportunity for forest management. The Province in return would receive a greater commitment from the company towards resource management. This involved determining what portion of the company's Quota area in the R-3 and R-4 forest management units was needed to support the company's AAC share from those units, and then amalgamate that Quota area into the original FMA Area.

The amendment was done in consultation with, and with the approval of, the other forest companies operating in these units. This precipitated a unique arrangement between Weyerhaeuser and Sundance Forest Industries in Edson whereby both parties committed to supplying each other with equal volumes of timber as part of their respective FMAs. In addition to the Area amendment, some terms of the FMA itself were renegotiated with the Province. As there was no change to the area committed to timber management, there was no public involvement for this amendment to the FMA. However it did trigger the need for a revised forest management plan to incorporate the amended area.

1998

A Preliminary Forest Management plan for the amended FMA Area was submitted in January and subsequently approved in April, and forms the basis for this DFMP submission.

3.2 Description of Drayton Valley Forest Management Agreement Area

The information provided in the following sections, taken from a variety of data sources (provincial and company), is for the gross FMA Area and is current to May 1, 1999 unless otherwise stated. Weyerhaeuser maintains this data in a Geographic Information System (GIS) in Drayton Valley.

3.2.1 FMA Physical Features

Weyerhaeuser's Drayton Valley FMA Area (see *FMA 8500023 Base Map* on page 2 of Appendix 4) extends from agriculturally developed lands on the eastern edge to west of the Bighorn Range. This unique east / west orientation provides a wide range of variation in plant and wildlife species, mesoclimate, topography, and other ecological characteristics across the FMA Area.

Ecological Information[3]

The FMA Area straddles the Lower Foothills, Upper Foothills and the Subalpine natural subregions, as determined through the ecological classification of the FMA Area using SiteLogix (see *Natural Subregions Map* on page 3 of Appendix 4). The Lower Foothills natural subregion is characterized by deciduous forests, deciduous-dominated mixedwood forests, and coniferous forests made up of white spruce and lodgepole pine. The Lower Foothills natural subregion represents a transition from the aspen and white spruce dominated boreal mixedwood forest to the lodgepole pine dominated forests of the Upper Foothills natural subregion. The Lower Foothills natural subregion is the predominant region in the FMA Area, accounting for approximately 84% of the FMA Area.

The Upper Foothills natural subregion occurs above the Lower Foothills natural subregion. Coniferous forests containing mainly lodgepole pine dominate the natural subregion. The Upper Foothills can be distinguished from the Lower Foothills natural subregion by the general lack of aspen The mixing of white spruce and Engelmann spruce in conifer forest stands has also been observed in the Upper Foothills. The Upper Foothills natural subregion accounts for less than14% of the FMA Area.

The Subalpine natural subregion occurs above the Upper Foothills and is dominated by stands of lodgepole pine. The presence of Engelmann spruce instead of white spruce in successionally mature stands, along with subalpine fir, is another indication of the Subalpine natural subregion. The Subalpine natural subregion makes up less than 3% of the FMA Area.

Elevation and Topography

The FMA Area ranges in elevation from 760 metres in the northeast to 2620 metres in the southwest along the Bighorn Range (see *100m Contour Map* on page 4 of Appendix 4).

The topography for the western portion of the FMA Area within the Subalpine natural subregion and for some of the Upper Foothills natural subregion is characterized by a pattern of medium to high relief, steeply inclined bedrock ridges, and inter-ridge valleys. The area within the eastern portion of the Upper Foothills natural subregion and western portion of the Lower Foothills is characterized by strongly rolling ridges interspersed with lowland areas. The eastern

[3] Beckingham, J.D., I.G.W. Corns and J.H. Aarchibald. 1996 Field guide to ecosites of West-Central Alberta. Can. For. Serv., Northw. Resgion Special Rep. 9. UBC Press, Vancouver.

portion of the FMA Area within the Lower Foothills natural subregion is made up of rolling topography. Of particular note in the eastern portion is the area in the vicinity of Medicine Lake, which is characterized by poorly drained, hummocky moraine deposits.

Soils

The soils in lower elevations of the Lower Foothills can be described in terms of their predominant parent materials: glacial till, organic, fluvial, and eolian. Till deposits cover much of the FMA Area. In the northwest FMA Area, the parent material consists of slightly to moderately stony, loamy textured till in the uplands, interspersed with 20 - 45% organics in the lowlands. Along the Brazeau River gravelly textured outwash deposits with sandy to silty textured veneers are common. The Medicine Lake area is characterized by well to poorly drained hummocky moraine deposits with 26 to 45% organic materials. Eolian parent materials occur in both the northern and southern portions of the FMA Area. Eolian deposits in the northern portions are discontinuous sandy veneer over fine textured till deposits. The eolian deposits in the southern portion are deep, sandy textured, and wind blown, exhibiting rapid permeability. Fluvial deposits occurring along the North Saskatchewan River and associated streams are often associated with floodplains and alluvial flats, and are enclosed by steeply sloping valley walls. The predominant parent materials in the Subalpine natural subregion are heterogeneous mixtures of colluvium, till, residuum, and glaciofluvial and fluvial deposits found along major creeks and valley bottoms. Organic sites are dispersed throughout the FMA Area and are generally associated with bogs and poor fens.

A map showing the primary parent materials as described in the Ecological Land Classification database is provided on page 5 of Appendix 4 (*Parent Material Map*).

3.2.2 Landscape Management Unit Development

For the Detailed Forest Management Plan, the FMA Area was divided into ten areas that Weyerhaeuser has termed Landscape Management Units (LMUs – see *Landscape Management Units Map* on page 6 of Appendix 4). The specific purposes of developing LMUs include to:

- set objectives most appropriate for that landscape, but aligned with the entire FMA Area,
- provide spatial opportunities for conflicting goals,
- stratify the landscape because of varying physical, social, or economic characteristics,
- allow for areas of emphasis distributed across the landscape,
- simplify administration, and to
- link the DFMP with operational implementation.

The division of the FMA Area into Landscape Management Units involved the following steps:

1. production of thematic maps of the FMA Area,
2. analysis of thematic maps and data-sets to determine differentiation of units based on physical, social, or economic characteristics,
3. production of draft Landscape Management Unit boundaries,
4. determination of initial concerns and/or objectives for each LMU,
5. review of draft LMUs and the concerns/objectives with Weyerhaeuser Forest Advisory Committee,

6. submission of draft LMU boundaries to Land and Forest Service (Ecological Landscape Division), and[4]
7. provide LMU boundary information at open houses for public review.

3.2.3 Description of Landscape Patterns and Structure

Age Class and Seral Stage Distribution

For the DFMP, the age class of the AVI stands on the FMA is defined by the stand age. The stand age is determined by using the DFMP base year (1999) minus the AVI origin plus five years. The age is calculated in this manner because the AVI origin classes are 10 year periods (e.g. 1940 – 1949 = 1940); and therefore, the midpoint would be 1945. The age was then grouped into age classes where 0 to 4.99 = 1, 5 to 9.99 = 2, 10 to 14.99 = 3, etc. The age reported in the following tables represent a mid point age for the age class. The age class distribution for all of the forested stand types on the FMA Area is presented in Table 2 (also by landscape management unit) and Figure 3 (includes broad cover group separation).

A spatial representation of the age class distribution of the forest is provided on the *Age Class Map* on page 7 of Appendix 4. The *Age Class Map* also shows the increasing presence of older age classes in the western portion of the FMA Area, in the Upper Foothills and Subalpine natural subregions. The age class distribution on the FMA Area is, in part, a result of the fire suppression policy and programs within the province.

The age class distribution of all forested stand types has been divided into five seral stages:

- *Early seral stage* – defined as stands between establishment and ten years old, representing the period from disturbance to initial crown closure.
- *Immature seral stage* – stands between 11 and 40 years old; in other words when the stands first start to reach merchantability (e.g. for commercial thinning).
- *Mature seral stage* – defined as stands between 41 and 90 years old.
- *Late seral stage* – defined as stands between 91 and 140 years old.
- *Very Late seral stage* – defined as stands greater than 140 years old; (see Section II 2.2.3).

As Table 2 demonstrates, almost 50% of the forests on the FMA Area are in the late seral stage and a small portion (<5%) are in the very late seral stage. This unnaturally high proportion of forest stands older than the average conifer rotation age raises longevity concerns for the long-term management of commercial timber values on the FMA Area. As large amounts of the forest reach the late and very late seral stages the susceptibility to and risk of a catastrophic event caused by fire, insects or disease increases.

Table 3 shows the relative proportions of broad cover groups by origin class and seral stage. The very late seral stage is made up almost exclusively of coniferous-dominated stands (greater than 99%).

[4] Letter of review dated March 7, 2000: "The shape of your FMA makes delineation of LMU's on an ecological basis problematic…. There is still value to the LMU boundaries as outlined in your proposal. These boundaries can still be used to develop area specific objectives such as watershed protection, wildlife habitat, or enhanced forest management."

Table 2. Age Class Distribution by Landscape Management Unit and Summary by Seral Stage.

	Landscape Management Unit										
Age	Baptiste	Blackstone	Elk River	Marshybank	Medicine Lake	Nordegg River	O'Chiese	Sand Creek	Tall Pine	Willesden Green	Total for FMA
2.5	1,625.1		357.9		9.2	1,453.3	2,259.4	673.2	358.6	586.3	7,323.0
7.5	1,131.4		466.4			1,650.5	1,774.5	2,286.2	1,711.9	1,994.1	11,015.0
12.5	1,215.0		1,773.8			12.3	611.2	1,279.4	2,225.5	1,208.1	8,325.3
17.5	151.4	266.0	406.5	289.8		60.4	56.4	445.1	126.7	19.3	1,821.6
22.5	315.3		265.1	180.8	77.5	815.9	190.4	868.7	1,049.0	969.8	4,732.5
27.5	156.4	96.7	688.6	49.5		161.5	80.4	185.5	283.1	230.6	1,932.3
32.5	1,398.4	9.1	765.4	90.5	1,358.4	474.2	77.7	1,010.6	842.6	2,820.9	8,847.8
37.5			16.0								16.0
42.5	2,644.7	304.2	407.2	22.4	859.8	330.4	120.4	1,551.5	2,394.7	13,530.0	22,165.3
52.5	5,436.1	1,217.3	727.7	411.7	9,533.5	712.7	516.8	3,692.7	2,811.9	6,537.7	31,598.1
62.5	9,274.6	1,244.6	5,265.1	496.3	347.6	1,160.0	1,498.1	3,022.8	2,220.3	4,463.8	28,993.2
72.5	4,393.0	3,565.7	1,274.1	579.2	584.4	1,518.5	392.7	2,551.0	3,372.4	695.5	18,926.5
82.5	3,069.6	161.3	371.9	586.0	66.2	3,681.1	2,209.1	10,430.9	3,690.8	3,661.7	27,928.6
92.5	10,343.7	364.2	14,132.7	205.3	1,011.9	4,730.3	7,743.6	4,089.7	2,788.6	1,884.0	47,294.0
102.5	13,852.4	16,014.7	9,319.7	7,656.2	1,883.6	17,845.5	5,112.4	3,841.4	3,494.2	6,095.7	85,115.8
112.5	2,453.8	1,114.7	3,286.1	454.8	1,691.3	4,122.2	520.1	891.7	3,118.4	294.3	17,947.4
122.5	4,409.2	1,067.0	1,026.1	270.3	1.3	1,056.6	1,797.9	879.9	2,300.7	1,328.7	14,137.7
132.5	260.4	5,180.5	3,227.7	1,437.4		3,698.3	338.3	128.2	500.4	125.7	14,896.9
142.5	770.7		272.5	636.3	281.5	109.8	57.4	22.2	182.8	124.4	2,457.6
152.5	25.9	3,175.2	796.6	662.2	8.0	199.8	228.7		10.6	55.8	5,162.8
162.5		11.9	212.3	15.1						4.9	244.2
172.5		150.4	137.0	870.5	77.8	11.1				188.4	1,435.2
182.5	4.2					9.6			2.2		16.0
192.5		636.5	47.3	20.4							704.2
202.5		510.1									510.1
222.5		2.8									2.8
232.5		1,726.7		2,125.5							3,852.2
242.5				139.3							139.3
>250				2,080.2							2,080.2
Totals	62,931.30	36,819.60	45,243.70	19,279.70	17,792.00	43,814.00	25,585.50	37,850.70	33,485.40	46,819.70	369,621.6

Early	Immature	Mature	Late	Very Late
18,338.0	25,675.5	129,611.7	179,391.8	16,604.6
5.0%	6.9%	35.1%	48.5%	4.5%

Figure 3 – AVI Age Class Distribution by Broad Cover Group

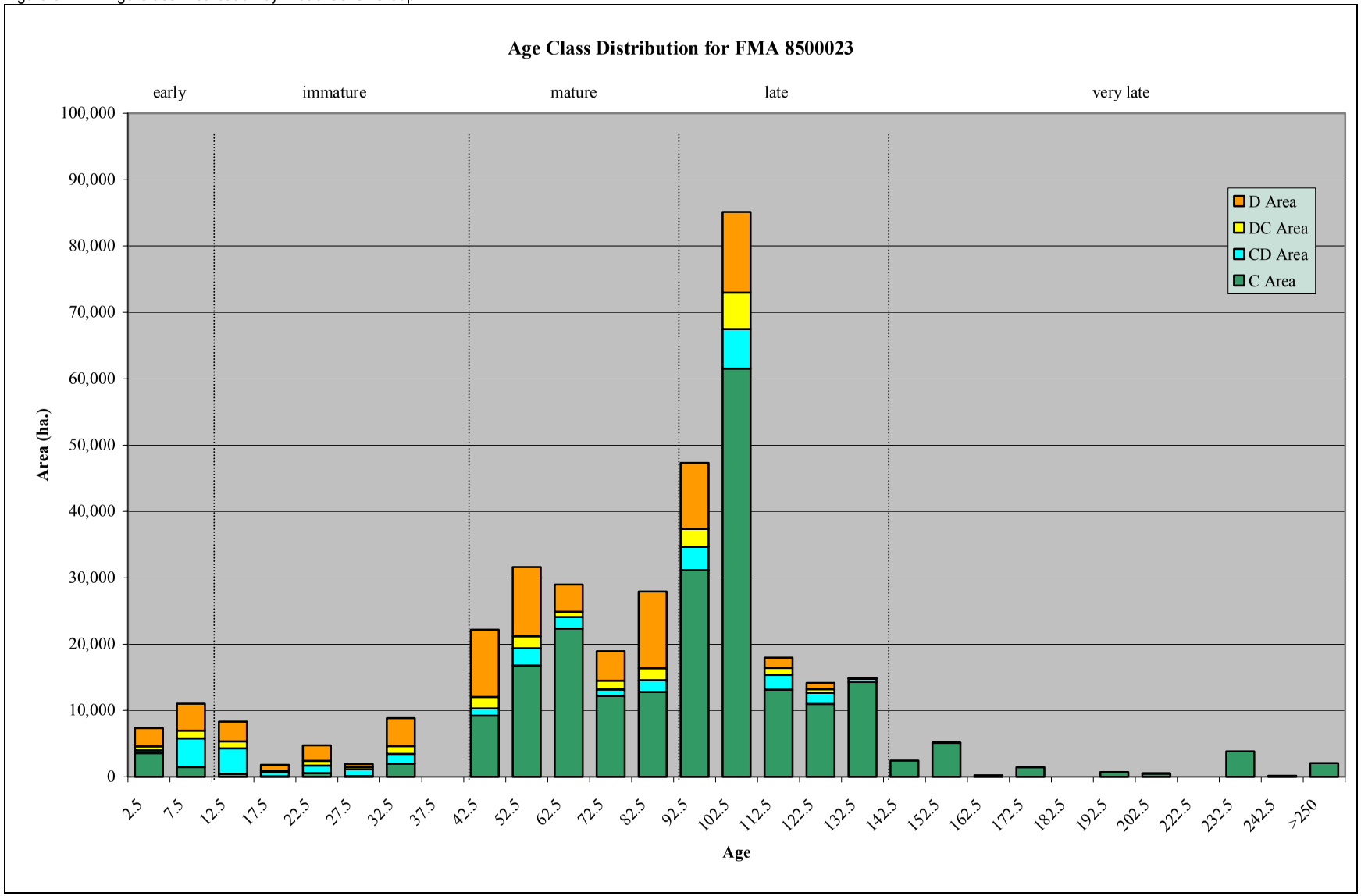


Table 3 – Relative Age Class Distribution by Broad Cover Group for the FMA Area and Summary by Seral Stage

Age	Coniferous	Conifer/Decid	Decid/Conifer	Deciduous
2.5	49.0%	5.4%	8.2%	37.4
7.5	13.2%	39.3%	10.8%	36.7
12.5	5.6%	45.9%	12.6%	36.0
17.5	3.2%	36.2%	12.7%	47.9
22.5	11.8%	23.9%	15.5%	48.8
27.5	6.5%	52.8%	16.5%	24.2
32.5	22.6%	16.4%	13.2%	47.8
37.5	0.0%	100.0%	0.0%	0.0
42.5	41.5%	5.1%	7.7%	45.7
52.5	53.1%	8.2%	5.7%	33.0
62.5	77.2%	5.9%	2.7%	14.3
72.5	64.4%	5.3%	7.0%	23.4
82.5	45.8%	6.4%	6.5%	41.3
92.5	65.9%	7.4%	5.7%	21.0
102.5	72.3%	7.0%	6.5%	14.3
112.5	73.1%	12.4%	6.0%	8.5
122.5	77.8%	11.9%	3.8%	6.5
132.5	95.9%	3.3%	0.3%	0.5
142.5	99.9%	0.0%	0.0%	.01
152.5	99.0%	0.5%	0.1%	0.4
162.5	100.0%	0.0%	0.0%	0.0
172.5	99.8%	0.2%	0.0%	0.0
182.5	100.0%	0.0%	0.0%	0.0
192.5	99.5%	0.5%	0.0%	0.0
202.5	98.2%	1.8%	0.0%	0.0
222.5	100.0%	0.0%	0.0%	0.0
232.5	100.0%	0.0%	0.0%	0.0
242.5	100.0%	0.0%	0.0%	0.0
>250	100.0%	0.0%	0.0%	0.0

BCGP	Early	Immature	Mature	Late	Very Late
C	27.5%	12.5%	56.6%	73.1%	99.6%
CD	25.8%	31.5%	6.3%	7.7%	0.3%
DC	9.8%	13.6%	5.7%	5.5%	0.0%
D	36.9%	42.4%	31.4%	13.7%	0.1%

Forest Types – Broad Cover Group and Leading Species

The broad cover group information for the FMA Area and for each landscape management unit is presented in the following tables and spatially on the *Broad Cover Group Map* (page 8 of Appendix 4). Broad cover group is defined by the predominance of coniferous and/or deciduous in a given AVI stand:

- Coniferous - stands with at least 80% conifer,
- Coniferous/Deciduous - stands with at least 50% and less than 80% conifer,
- Deciduous/ Coniferous - stands with at least 30% and less than 50% conifer, and
- Deciduous - stands with less than 30% conifer.

Table 4 – Broad Cover Group for the FMA Area

Broad Cover Group	% of FMA forested area
Deciduous – D	23.7%
Deciduous / Coniferous – DC	7.2%
Coniferous / Deciduous – CD	6.4%
Coniferous - C	62.8%

Table 5 – Broad Cover Group by Landscape Management Unit

LMU	Coniferous	Conifer/Decid	Decid/Conifer	Deciduous
Baptiste	64.6%	6.5%	20.2%	8.7%
Blackstone	99.7%	0.2%	0.0%	0.0%
Elk River	74.1%	7.8%	10.0%	8.1%
Marshybank	99.8%	0.0%	0.2%	0.0%
Medicine Lake	50.9%	6.6%	33.4%	9.2%
Nordegg River	79.6%	4.5%	9.2%	6.6%
O'Chiese	50.9%	8.5%	31.8%	8.8%
Sand Creek	31.0%	9.0%	51.5%	8.4%
Tall Pine	50.5%	10.6%	28.6%	10.3%
Willesden Green	35.2%	7.6%	49.1%	8.1%

Coniferous species increasingly predominate from east to west on the FMA Area. Both the Blackstone and Marshybank LMUs are made up almost exclusively of coniferous-dominated stands. This large proportion of coniferous stands is one of the factors contributing to the high aesthetic values of these LMUs.

Based on species and percentage information from the Alberta Vegetated Inventory for the FMA Area the following tables represents an area-weighted summary of tree species on the FMA Area and Landscape Management Units. A map representing the predominant tree species (leading in AVI) is provided on page 9 of Appendix 4 (*Leading Species Map*).

Table 6 – Tree species on the FMA Area

Tree Species	% of FMA forested area
Aspen	26.5%
Balsam Poplar	3.9%
Birch	0.6%
Balsam Fir	0.1%
Black Spruce	16.2%
Lodgepole Pine	29.7%
Tamarack	7.1%
White Spruce	15.8%

Table 7 – Tree species by Landscape Management Unit

LMU	AW	PB	BW	FB	SB	PL	LT	SW
Baptiste	27.7%	1.6%	0.0%	0.0%	19.1%	32.4%	10.9%	8.3%
Blackstone	0.2%	0.0%	0.0%	1.0%	6.6%	58.6%	0.0%	33.5%
Elk River	17.7%	1.8%	0.0%	0.0%	22.5%	39.5%	10.0%	8.5%
Marshybank	0.2%	0.0%	0.0%	0.2%	4.5%	57.3%	0.0%	37.8%
Medicine Lake	38.4%	1.2%	1.0%	0.0%	26.2%	16.0%	6.0%	11.1%
Nordegg River	15.6%	1.4%	0.1%	0.0%	20.5%	35.5%	12.8%	14.1%
O'Chiese	35.8%	4.5%	0.2%	0.0%	16.4%	16.7%	11.3%	15.1%
Sand Creek	46.9%	11.2%	1.4%	0.0%	11.3%	9.6%	3.7%	15.9%
Tall Pine	32.7%	5.6%	0.7%	0.1%	17.3%	17.2%	6.2%	20.2%
Willesden Green	44.1%	9.4%	2.7%	0.1%	13.6%	15.1%	4.0%	11.0%

The most common tree on the FMA Area is lodgepole pine, with a large component of it being found in the Baptiste, Blackstone, Elk River, Marshybank, and Nordegg River LMUs. Lodgepole pine is a relatively short-lived tree (seldom over 200 years old) and thrives in areas that are periodically burned by forest fires[5]. The predominance of lodgepole pine on the FMA Area and the age class origin presented in Tables 2 and 3 is a point of concern to Weyerhaeuser for the long-term management of the conifer forests over the FMA landscape.

Please note that the White Spruce numbers include the incidental presence of Engelmann Spruce in the Upper Foothills natural subregion.

Timber Harvesting Landbase

Of the total FMA Area, not all of it is available for timber production. The timber harvesting landbase (THLB) is the portion of the total land area of the FMA that can be considered to contribute to and be available for long-term timber supply. It is the landbase remaining after deductions for areas that cannot, should not, or will not be managed for timber production[6].

The THLB is determined based on specific AVI covertype and ecosite combinations (ecological), landuse management objectives (societal), and the cost of harvesting and/or manufacturing (economic).

Inventory stratification

Land dispositions	• protected areas such as the O'Chiese and Jack Knife Springs Natural Areas. • oil and gas developments, PNTs, etc.
Private land	• all private land on the FMA Area.

Forest management considerations

Stream buffers	• riparian buffers of 30m on small permanent streams and 60m on large permanent streams.
IRP zones	• Prime Protection areas identified in the IRP's have been excluded from the THLB.
Corridor buffers	• a 100 metre visual management zone along highways 11 and 22 and the North Saskatchewan River.
Seismic lines	• an eight-metre width has been assigned to all seismic lines in the data set.
Inoperable areas	• areas that are inoperable due to excessive slope or are not accessible.
Productivity/ Reforestation	• all stands with 20% larch or more in the covertype. • all stands with 80% black spruce or more in the covertype. • low productivity sites as per the ecosite classification – LF-k/l, LF-h/j, LF-h/k, LF-l, LF-l/m, LF-m, LF-j, UF-k/l, UF-l/m, UF-m, UF-i, UF-i/j

[5] Kershaw, L., MacKinnon, A. and Pojar, J. 1998. Plants of the Rocky Mountains. Lone Pine Publishing.
[6] Cortex Consultants Inc. 1998. Timber Supply Concepts for Alberta, AAFMI

A more detailed description of the land base determination is provided in Section III 2 (*Landbase Determination*).

Table 8 – Timber Harvesting Landbase by Landscape Management Unit.

LMU	Total LMU Area	THLB Area	% of LMU Area	% of FMA THLB
Baptiste	75,831.7 ha	42,743.6 ha	56.4%	16.2%
Blackstone	40,183.0 ha	27,363.0 ha	68.1%	10.3%
Elk River	51,074.2 ha	29,704.6 ha	58.2%	11.2%
Marshybank	20,058.2 ha	16,018.8 ha	79.9%	6.1%
Medicine Lake	20,599.4 ha	11,647.8 ha	56.5%	4.4%
Nordegg River	46,925.7 ha	27,605.4 ha	58.8%	10.4%
O'Chiese	30,721.6 ha	17,610.3 ha	57.3%	6.7%
Sand Creek	46,188.7 ha	31,206.1 ha	67.6%	11.8%
Tall Pine	40,412.0 ha	23,848.4 ha	59.0%	9.0%
Willesden Green	55,708.7 ha	36,868.5 ha	66.2%	13.9%
Entire FMA Area	427,703.2 ha	264,616.4 ha	61.9%	

Landscape Characteristics

Forested ecosystems are complex and dynamic mosaics of vegetation patches that vary in size, composition, age structure and distribution. Their dynamic heterogeneity is driven by natural processes (e.g. succession), by stand-replacing events (e.g. fire, insect outbreaks, or disease epidemics), and by disturbances that occur at smaller scales (e.g. mortality of individual trees).

The variety and juxtaposition of forest and non-forested stands in a landscape[7] provide habitat for all wildlife species in a specific region. Landscape characteristics that provide habitat features include the range of forest age classes, the size and shape of patches[8] in each age class, and the variety in overstory and understory structure and floristic composition.

In order to develop harvest designs that maintain heterogeneous forest ecosystems (away from cut/leave patterns), current and historic landscape diversity need to be described and quantified through the use of spatial statistics. To that objective, Weyerhaeuser retained GISmo Solutions Limited to provide detailed Landscape Analysis of all Landscapes Management Units.

Landscape Analysis was done through the Patch Analyst 2.0 program developed by researchers at Lakehead University as part of the Sustainable Forest Management Network research program at the University of Alberta. Patch Analyst is an extension to the ArcView® GIS application that facilitates the spatial analysis of landscape patches and the modeling of attributes associated with patches. Patch Analyst (Grid) includes a user interface to FRAGSTATS[9], as well as separate based spatial analysis functions.

For landscape analysis purposes, and given the disturbance-driven nature of the forest ecosystem in the Drayton Valley FMA Area, a patch[8] was defined as a vegetation stand of the same age regardless of its floristic composition. Numerous patch metrics were calculated, including mean and median patch size, patch size coefficient of variance and standard variation, edge density, mean shape index, fractal dimension, interspersion and juxtaposition, Shannon's

[7] Landscapes are defined as a "mosaic where a mix of local ecosystems or land uses is repeated in similar form over a kilometers-wide area" (Forman 1996).

[8] *Patche*s can be defined as " a relatively heterogeneous non-linear area that differs from its surroundings" (Forman 1996. Land Mosaics. Cambridge University Press 642 pp.).

[9] Fragstats is a statistical package that quantifies landscape structure through numerous metrics including: area, patch density, size and variability metrics; edge, shape, core area, and diversity metrics, and contagion and interspersion metrics (McGarigal, Kevin; Marks, Barbara J. 1995. FRAGSTATS: spatial pattern analysis program for quantifying landscape structure. Gen. Tech. Rep. PNW-GTR-351. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 122 pp.)

diversity index, and core area index. These landscape diversity indices measure the current (1999) spatial heterogeneity of each Landscape Management Unit. However, as described in Section I 3.2.6, the Drayton Valley FMA Area is dissected by many linear corridors (powerlines, pipelines, roads, etc.) that, over time, have altered the number, distribution, sizes and shapes of forest stands. The amount of linear disturbance currently on the landscape does not naturally occur in forest landscapes. In this context, it is reasonable to infer that the current landscape diversity may not reflect a naturally functioning forest ecosystem and may not provide enough habitat diversity to meet the needs of all wildlife species.

To better understand the natural diversity of each Landscape Management Unit, spatial analysis and modeling were used to remove all linear corridors from each landscape and recreate the forest mosaic that most likely existed prior to 1960. The year 1960 was selected based on the earliest year of land disposition within the land use data set. An example for the Sand Creek LMU is provided in Figures 4 and 5. Landscape analysis was then conducted on the recreated forest mosaic and compared with the current conditions.

Landscape analysis shows that the current landscape diversity of the Drayton Valley FMA Area has been significantly altered by linear disturbances. Figure 6 shows the degree of patch fragmentation that results from roads, pipelines and powerlines. In LMUs such as Marshybank and Medicine Lake, the percent increase in the number of patches is relatively small (28 and 52%, respectively); in other LMUs such as Sand Creek the percent increase reaches 668%.

Figure 4 – Example Forest Age Distribution for Sand Creek LMU

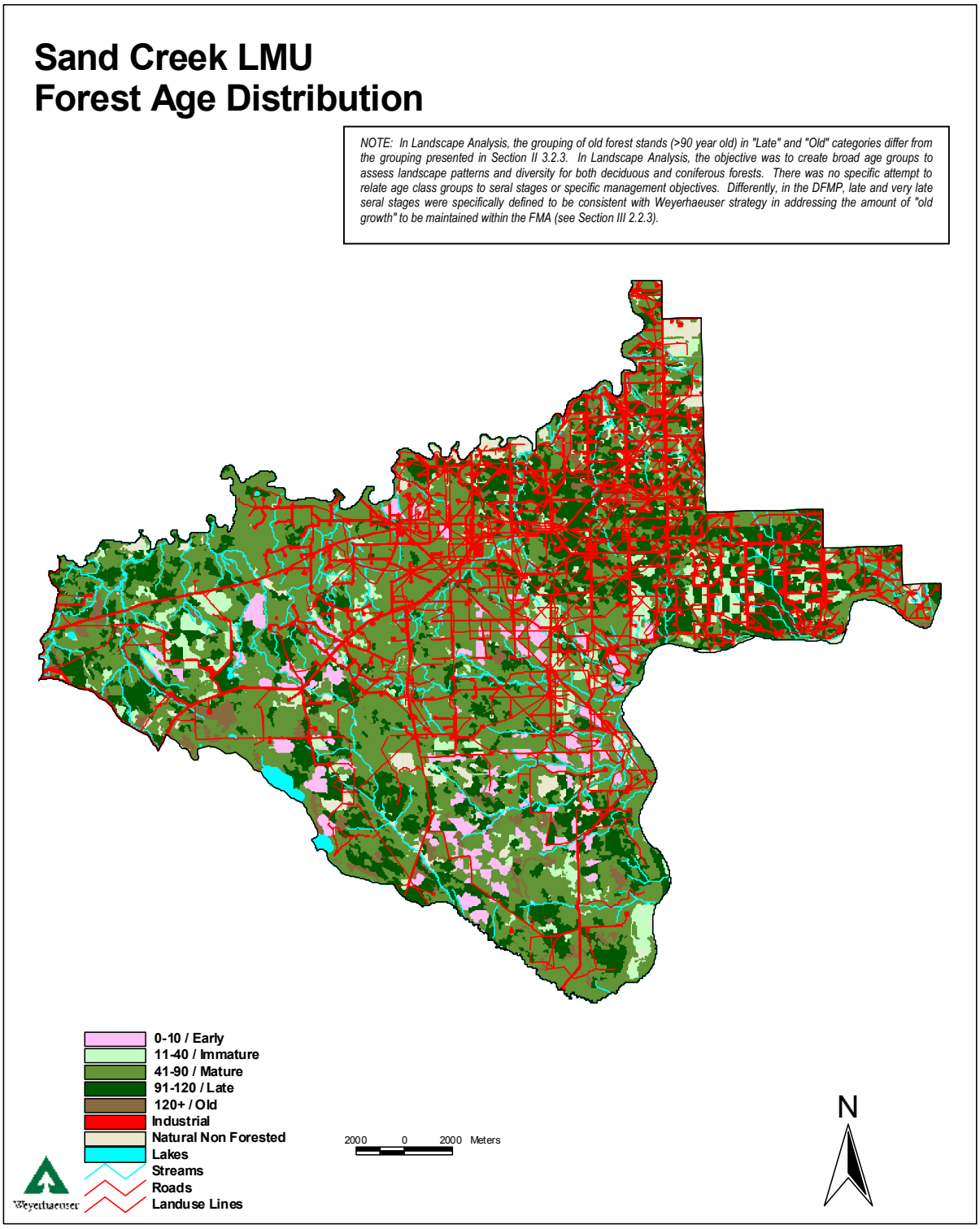


Figure 5 – Example Reclaimed Forest Cover for Sand Creek LMU

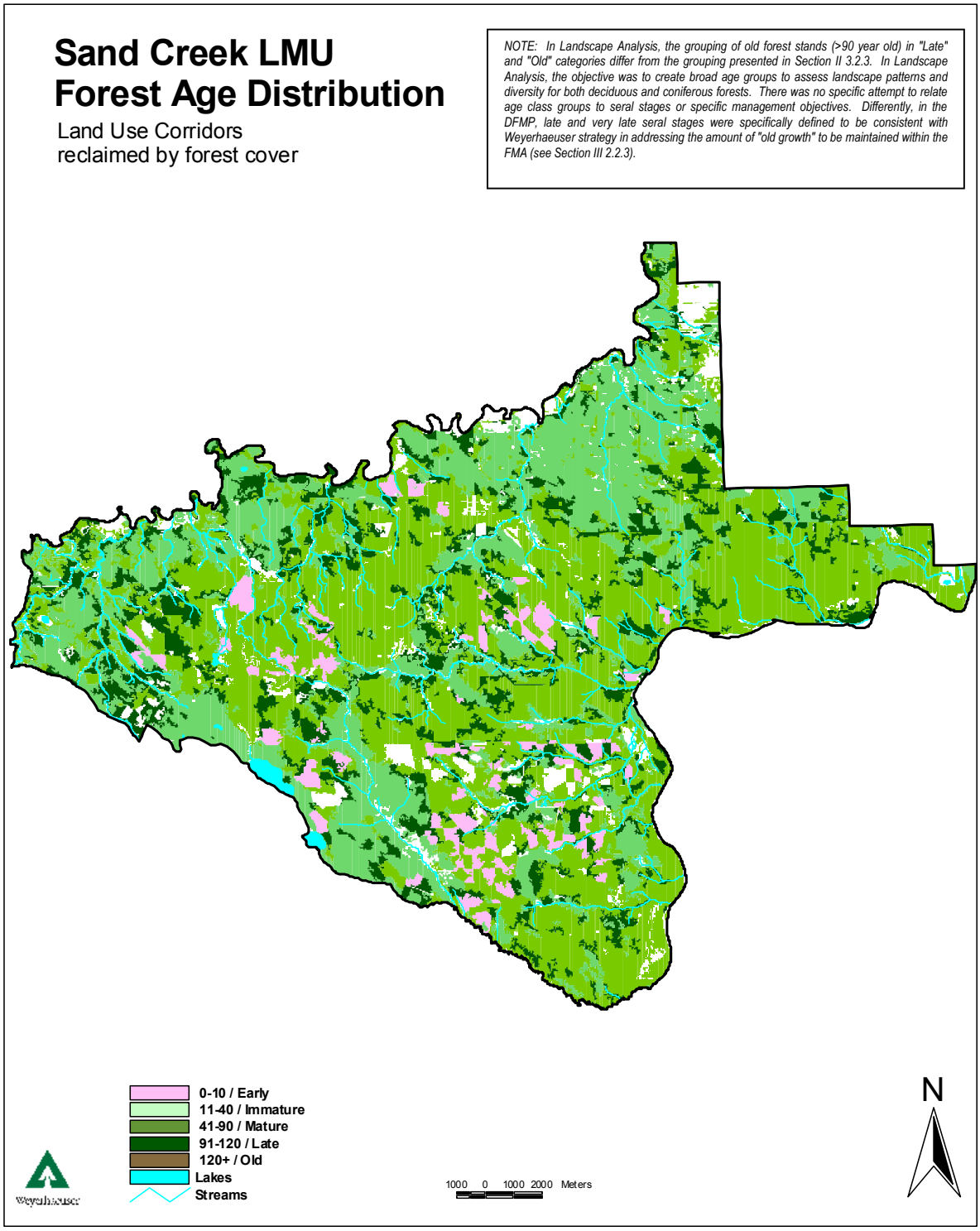
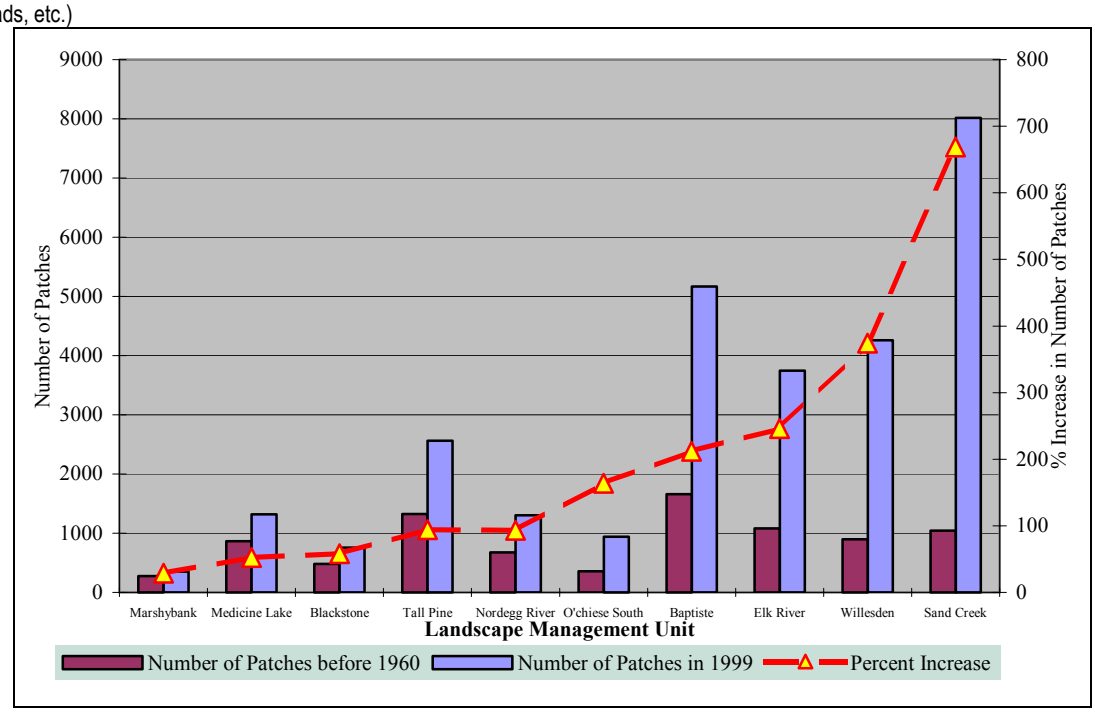


Figure 6 – Changes in number of patches within Landscape Management Units caused by linear disturbances (pipelines, powerlines, roads, etc.)



The high degree of landscape fragmentation is reflected in many other Landscape Indices (GISmo) such as the average patch size (Figures 7 and 8).

As shown in Figure 7, the current average patch size ranges between 7 and 60 hectares. In 7 LMUs the average patch size does not reach 20 hectares. This contrasts with average patch sizes prior to 1960 (Figure 8). More importantly, the range of patch sizes in each individual LMU, as represented by the standard deviations, is considerably less in current landscapes from what the range used to be prior to the 1960s. These results indicate less variability in patch size in current landscapes and, hence, decrease habitat opportunities for interior-dependent wildlife species.

The historic average patch size shows also interesting differences among LMUs. For instance, while Baptiste, O'Chiese South, Elk River and Sand Creek have similar average patch size (40-45 ha), their standard deviations are significantly different. The landscape analysis results suggest that in the Elk River LMU there would naturally be larger patches (SD=848 ha) than, for instance, in the Sand Creek LMU (SD = 496 ha). These results will guide forest management planning with regard to the size of harvest sites within social and other environmental constraints.

Figure 7 – Current average patch sizes and Standard Deviation

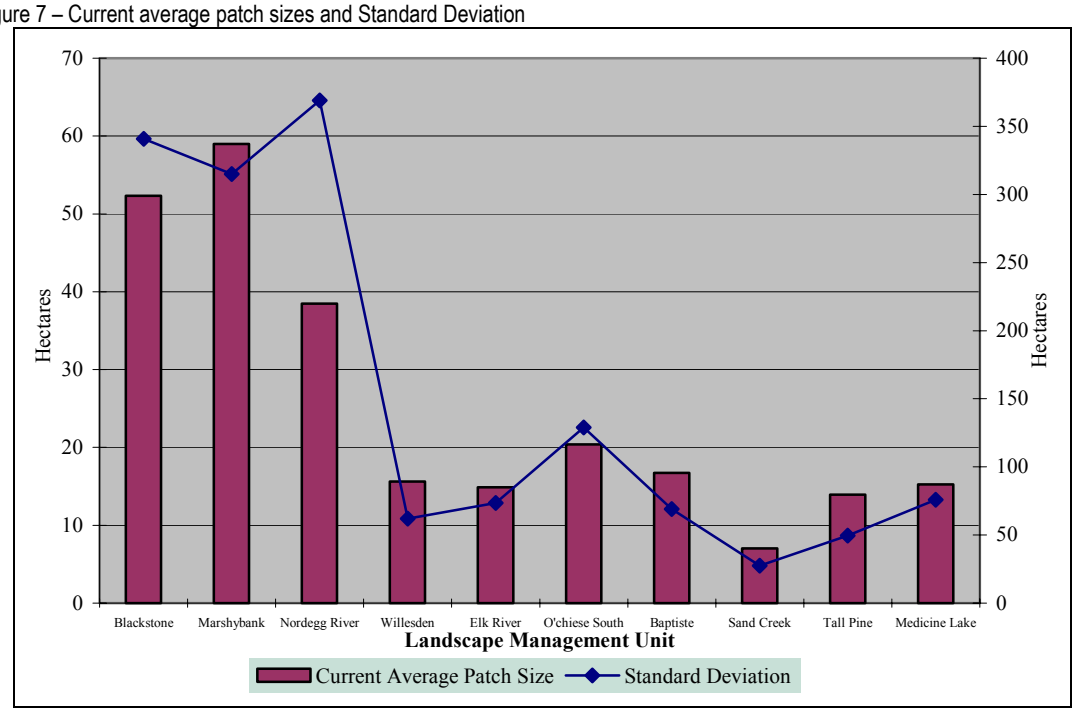
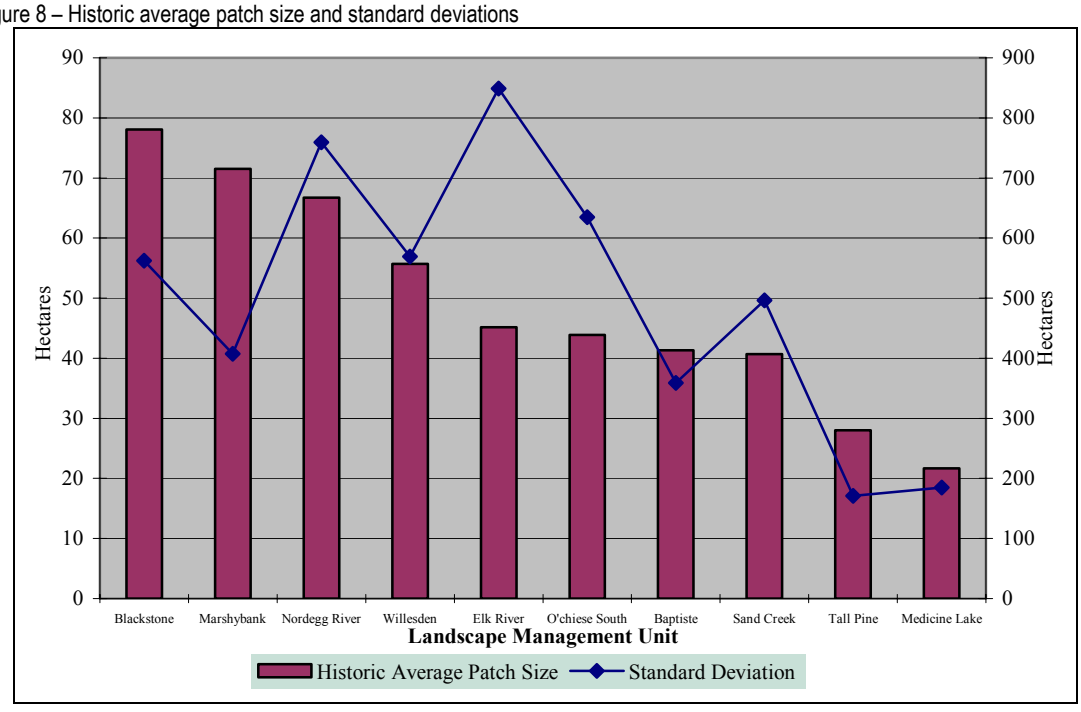


Figure 8 – Historic average patch size and standard deviations



The shift from large patches to small ones and the loss of large unfragmented expanses of forests is shown in Figure 9 with the Sand Creek LMU. The current landscape composition shows that 90% of the total 8017 patches are less than 10 ha in size and that no patches are larger than 500 ha. The loss in landscape diversity resulting from linear disturbances is further shown in Figure 10. There is very little difference in average patch size between seral stages, quite in contrast from historical conditions.

Figure 9 – Changes in patch size associated with linear disturbances in the Sand Creek LMU

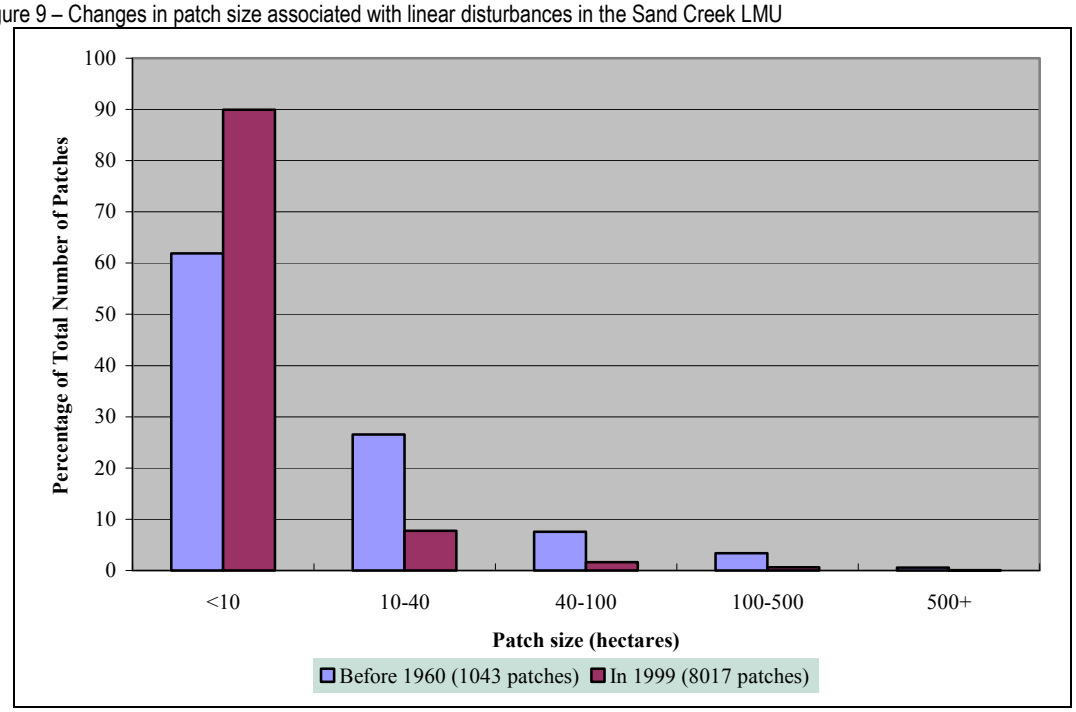
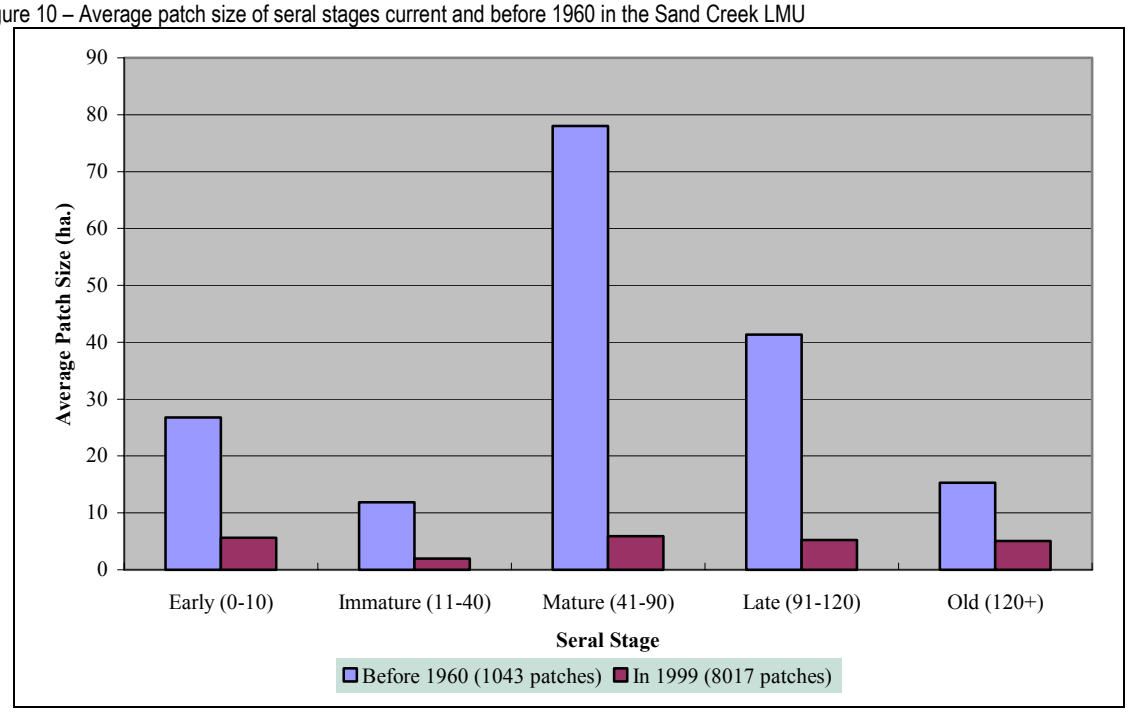


Figure 10 – Average patch size of seral stages current and before 1960 in the Sand Creek LMU



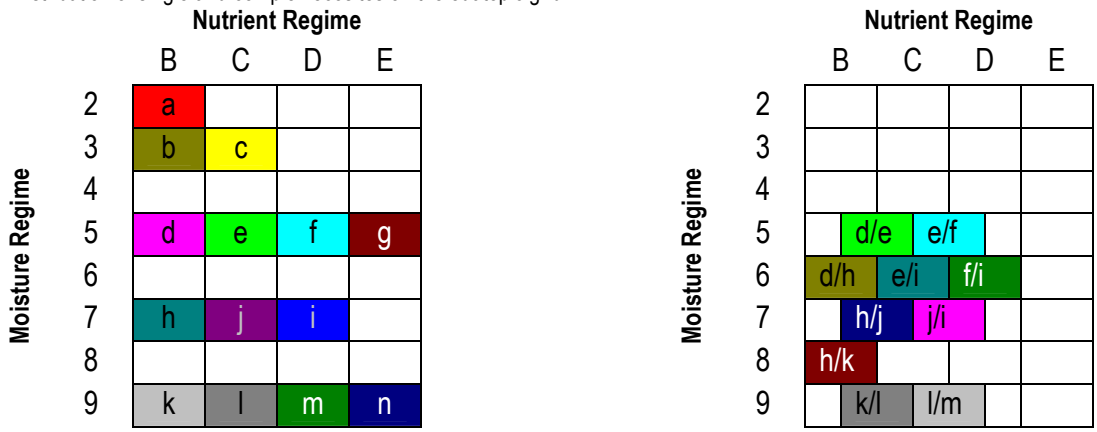
In view of the current human footprint within the Drayton Valley FMA Area, Weyerhaeuser's forest management practices will strive to minimize any further simplification of the forested landscape. The analysis of current and historic landscapes will assist in developing, through forest management, more diverse and heterogeneous landscapes that will provide a range of habitat opportunities for all wildlife species.

Ecosite Classification

A predictive ecosite classification of the FMA Area was completed during the summer of 1999. The *Predictive Ecosite Map* for the FMA Area, on page 10 of Appendix 4, was created through a series of steps that began with the development of a generalized ecosite model for west central Alberta. The knowledge base of the model was derived from information contained in the *Field guide to ecosites of west central Alberta* (Beckingham et al. 1996), the *Field guide to ecosites of northern Alberta* (Beckingham and Archibald 1996) and expert opinion. The model used to classify the FMA Area was SiteLogix, developed by Mr. Beckingham of Geographic Dynamics Corporation. The model assigned ecosites to the landscape by performing a "best fit" classification using various digital map sources as a basis for map assignment. Ecological field data was collected on the FMA Area in order to tailor the SiteLogix model to reflect the local ecological conditions.

Table 9 provides the area of each ecosite by LMU. Each ecosite map unit is defined as representing a single ecosite or a grouping of two ecosites. Sites strongly associated with one ecosite were assigned a single ecosite map unit label. For those sites with map information strongly correlated with two ecosites, a complex ecosite map unit label was assigned. The order in which the ecosites are named in a complex map unit does not necessarily indicate that the first ecosite has a higher probability of occurrence over the second. Figure 11 identifies the distribution of single ecosites and some of the complex ecosites on the edatopic grid. The edatopic grid is a moisture/nutrient continuum that displays the potential ranges of relative moisture (very dry to wet) and nutrient (very poor to very rich) conditions and outlines relationships between each of the ecosites.

Figure 11 – Distribution of single and complex ecosites on the edatopic grid



Some important ecosites and their forest management implications are provided below:

(1) The low-bush cranberry (LF-e) and the tall bilberry/arnica (UF-e) ecosite units represent the reference ecosites for their respective natural subregions, and account for over 43% of the FMA Area. The management implications for these ecosites include:

- Good timber productivity,
- Harvest operations possible during drier periods of summer, and
- Vegetation competition in reforestation is moderate to high.

(2) The bracted honeysuckle (LF/UF-f) ecosite tends to be moister and richer than that of the reference ecosite, and is represented on approximately 3% of the FMA Area. The management implications for these ecosites include:

- Good to excellent timber productivity,
- Harvest operations possible primarily during winter frozen ground conditions, and
- Vegetation competition in reforestation is very high.

(3) The bearberry/lichen (LF/UF/SA-b/c) and the hairy wild rye (LF/UF/SA-c) ecosites are characterized by the rapid to well drained soil types. The management implications on both of the ecosite types are similar in that:

- There is moderate to poor timber productivity,
- Harvest operations are possible at all times of the year, and
- They are often associated with steep, well drained slopes.

These two ecosites represent less than 3% of the FMA Area.

(4) The Labrador tea (LF/UF-d) ecosite unit represents approximately 7% of the FMA Area and is located mainly on upland and level or mid-slope landscape positions. The management implications for these ecosites include:

- Moderate to poor timber productivity,
- Harvest operations possible during drier periods of summer, and
- Low vegetation competition is expected during reforestation activities.

Table 9 – Ecosite classification by LMU (hectares)

	Landscape Management Unit										
Ecosite	**Baptiste**	**Blackstone**	**Elk River**	**Marshybank**	**Medicine Lake**	**Nordegg River**	**O'Chiese**	**Sand Creek**	**Tall Pine**	**Willesden Green**	**Total FMA**
a	1.5	9.7		5.1				33.7	9.5	30.0	89.6
b/c		49.9		95.4							145.3
c	784.6	5,227.6	10.6	4,356.9		124.2	5.4		16.6	8.7	10,534.7
d	5,600.0	8,839.1	5,006.4	401.8	1,359.2	2,431.2	749.7	1,163.1	1,597.0	2,440.4	29,588.0
d/e	3,612.1	3,644.5	5,263.9	2,618.5	524.9	2,521.1	607.1	214.3	728.6	782.4	20,517.5
d/h	1,326.6	22.2	1,016.8		148.3	1,040.4	76.3	291.6	426.1		4,348.3
e	30,452.8	17,208.0	18,342.5	10,551.4	9,569.8	20,832.9	15,204.2	21,805.0	19,257.1	22,024.3	185,248.0
e/f	3,983.6	5.5	273.7		271.4	469.8	1,770.9	6,328.3	3,058.0	9,216.6	25,377.8
e/h										1,115.9	1,115.9
e/i		195.8	49.3	35.2		6.2					286.6
e/j	508.0		406.8		142.4	434.5	139.6	569.3	605.8	778.5	3,584.8
f	889.3	51.9	926.8	132.5	114.0	788.3	363.8	3,862.6	1,696.0	3,520.5	12,345.8
f/g		9.8									9.8
f/i	242.8		794.1		4.0	954.0	127.8	378.8	381.4	544.6	3,427.4
f/j		146.0	19.6	56.3		2.8					224.7
g	355.4	295.7	42.7	14.8	30.1	111.1	16.8	113.3	105.5	179.4	1,264.8
h	270.1	40.6	304.4		169.0	138.5	117.4	198.3	141.4	389.0	1,768.7
h/i		10.5		18.6							29.1
h/j	10.1		6.7				0.7		31.3	28.1	77.0
h/k	2,611.0	233.7	887.9	236.1	300.4	591.3	622.2	331.2	550.4	297.5	6.661.8
i	291.0	426.8	209.8	435.8	293.7	228.7	162.6	262.2	354.9	625.8	3,291.3
i/j		305.4	1.9	250.3		5.2					562.9
j	831.4	44.1	397.1	78.5	349.3	742.0	658.9	761.3	888.3	931.6	5,682.4
j/i	191.5		132.4		67.0	388.3	202.7	233.1	451.7	176.8	1,843.4
k/l	5,587.6	815.8	7,519.3	261.7	3,983.5	5,762.2	1,948.5	2,797.7	3,002.7	4,157.4	35,836.3
l	962.3		567.9		168.7	439.6	681.1	310.0	269.0	551.7	3,950.2
l/m	10,975.7	557.4	5,295.3	195.2	1,609.7	5,835.6	3,804.5	2,452.5	3,457.4	3,912.7	38,096.0
m	1,889.9	5.7	1,259.2	40.9	730.7	1,461.6	734.8	221.7	871.5	700.7	7,916.8
n	5.8		15.1		7.8		2.3	32.4			63.3
w – water	1,138.9	13.7	732.0	7.1	581.1	146.2	1,990.1	702.1	1,032.2	883.5	7,226.8
x – unclassified		0.3	12.1	0.8		142.6					155.9
y – anthropogenic	3,225.5	157.4	1,563.6	6.1	174.4	385.0	407.1	3,001.5	1,201.8	2,265.9	12,388.3
z - mineral	84.5	1,865.8	16.3	259.2		942.5	326.9	124.9	277.5	146.6	4,043.9

3.2.4 Description of FMA Natural Disturbance

Natural Disturbance Patterns

Natural range of age class distribution

In northern forests, fire plays an important function in determining the variety of vegetation patterns observed on the landscape. The type, duration, severity and size of fire determine post-fire vegetational composition and succession (Johnson 1992)[10]. However, fires and fire regimes differ greatly across and within geographical regions, and are influenced by a number of factors including climate, weather, vegetation composition, stand age, topography and others (Rogeau 1996)[11].

The distribution of age classes across a landscape, and hence the amount of late seral stages, will vary depending on the length of time since the last fire disturbance and the fire cycle of the region.[12]

Based on the fire regime of a region, the relative contribution of stands of different ages on a landscape is believed to follow a theoretical negative exponential curve where the age-class distribution is represented by a high percentage of young age classes, and an exponentially declining percentage of older age classes and a relatively small percentages of very old stands (Johnson and Gutsell 1994).

However, while on a theoretical level the age-class distribution may approach a negative exponential distribution reflecting a long-term average, at any one point in time the relative amount of various age classes may vary significantly. As suggested by Andison (1997, 1998) in his research along the foothills of Alberta, the historical range of variation in age-class distribution is wide and there is not a "natural" age-class distribution representative of a landscape. In his simulations, Andison showed, for instance, that in the Upper Foothills Natural Subregion the percentage of young (0-40 year old) stands may represent with equal probability 0 to 70% of a landscape, while older forest stands (140-200 year old) could represent anywhere from 0 to 15%. Despite the wide range of probability of representation by individual age classes, older forest classes had a smaller range of representation in any simulated age-class distribution than younger stands, indicating the lower likelihood of older stands occurring on fire-driven landscapes.

In Alberta, fire regimes differ among natural subregions depending on climate, tree species dominance, and even historical lightning strikes (Andison 2000). Natural subregions with cooler, wetter climates and less lightning activity have longer fire cycles. This has been documented by Andison in his work on natural disturbance along the foothills of Alberta and is well described by the following table.

[10] Johnson, E.A. 1992. Fire and vegetation dynamics: studies for the North American boreal forest. Cambridge University Press. 129 p.

[11] Rogeau, M. P. 1996. Understanding age-class distribution in the Southern Canadian Rockies. M.Sc. Thesis. University of Alberta, Edmonton. 139 p.

[12] Fire cycle is defined as "the number of years required to burn over an area equal to the entire area of interest" (Merrill and Alexander 1987, Johnson and Gutsell 1994).

Merrill, D.F. and M.E. Alexander. 1987 Glossary of Forest Fire Management Terms. 4th Edition. National Research Council of Canada. Ottawa, Canada.

Johnson, E.A. and S.L. Gutsell. 1994. Fire frequency models, methods and interpretation. Advances in Ecological Research. 25: 239-283.

Table 10 – Overview of Characteristics of the Lower and Upper Foothills in the Foothills Model Forest and the Subalpine of Jasper National Park. (Andison 2000)[13]

	Lower Foothills	Upper Foothills	Subalpine
Fire Cycle (years)	65-75	80-90	130-190
% Area in Patches >2,000 ha	33	76	66
Lightning hits/1,000 ha	58	48	11
Growing degree days	1121	880	903
mm Rain / yr.	403	370	328
cm Snow / yr.	144	233	162

The differences in lightning strikes, growing-degree days and amount of rain and snow among the natural subregions are rough indications of the increased risk of ignition, fire growth, length of fire season and forest flammability (Beckingham et al. 1996)[14]. In this context, the Lower Foothills would appear to have a high ignition probability, since this subregion has the most lightning strikes and the highest number of growing degree days. This suggests that the Lower Foothills subregion burns fairly often, but in relatively small patches. This can be explained by the much greater lightning activity, which is known to produce more fire starts; however, higher levels of precipitation reduce the chances of any single fire becoming very large. The size of fires is also influenced by the nature of the vegetation dominant in the Lower Foothills. Deciduous forests, which are common here, tend to limit the spread of fires due to their high moisture content in the summer (Fechner and Barrows 1976)[15]. In the Upper Foothills and Subalpine natural subregions, fire activity tends to be more intense due to a combination of historical ignition probabilities, topography, vegetation and fire weather indicators.

Current forest conditions

The current age-class distribution (see Figure 3) in the Drayton Valley FMA Area is the result of an effective fire suppression program over the last 50 years. It is not an ecologically-sustainable age class distribution as it does not reflect the natural processes controlling plant association development in this region. The amount of forest stands greater than 100 year old in the Lower and Upper Foothills and in the Subalpine seems to be well beyond the natural range of variation that is expected to occur in these fire-driven ecosystems (Andison 1998)[16].

The current age of stands in this FMA Area varies from 0 to 280 years. As shown in Figure 12, a large amount of the forest (the peaks in the graph) in this FMA seem to have established in the years 1880 and 1930. The current age distribution of this FMA reflects the fire history back to pre-European settlement times.

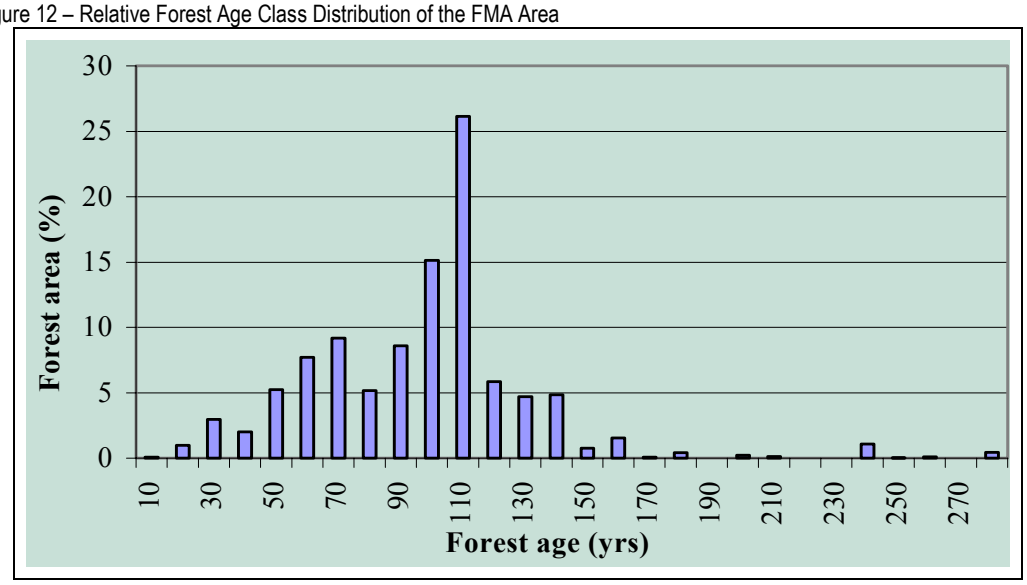
13 Andison, D. 2000. FMF Natural Disturbance Program Research. Quicknote No. 2 – May 2000Natural Sub-regions: Are They Meaningful? Unpublished note. 2 p.

14 Beckingham, J.D., I.G.W. Corns and J.H. Aarchibald. 1996 Field guide to ecosites of West-Central Alberta. Can. For. Serv., Northw. Resgion Special Rep. 9. UBC Press, Vancouver.

15 Fechner, G.H. and J.S. Barrows. 1976. Aspen stands as wildfire fuel breaks. Eisenhoover Consortium Bull. 4.

16 Andison, D.W. 1998. Temporal patterns of age-class distributions on foothills landscapes in Alberta. Ecography 21: 543-550

Figure 12 – Relative Forest Age Class Distribution of the FMA Area



Fire is an important environmental factor in the ecology of the Drayton Valley FMA Area. The FMA Area extends over three distinct natural subregions -- the Lower Foothills, the Upper Foothills and the Subalpine --, that differ due to climate, topography, soil and parent material. The environmental conditions and the resulting natural fire regime are also reflected in different forest landscapes.

The forests in the Lower Foothills natural subregion are a mosaic of aspen and poplar stands interspersed with white spruce and lodgepole pine. Further to the west, in the Upper Foothills and Subalpine natural subregions, forests are dominated by extensive stands of conifers -- lodgepole pine, Engelmann/white spruce or, at higher elevation or in wetter areas, fir. In the Lower and Upper Foothills subregions, large expanse of black spruce and tamarack forests are common in less drained areas.

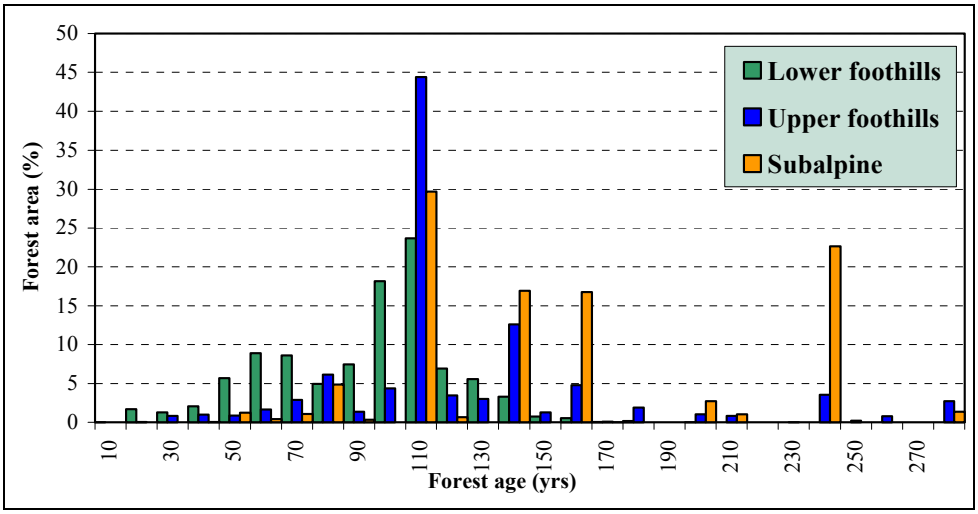
As previously described, due to the difference in topography and climatic conditions, the three natural subregions have historically experienced distinct disturbance regimes (Andison 1997)[17]. In the Lower Foothills, forests burned frequently (fire cycle approximately 50-75 years), but fires were rarely very large. In this region, forest stands rarely survived much beyond 120 years. Further to the west in the Upper Foothills, the forest burned less frequently (fire cycles approximately 60-90 years). In general, fires were more catastrophic, covering large areas that included stands of varying age. Closer to the mountains, in the Subalpine, fires were not common but were very catastrophic, extending over large areas (White 1985, Johnson and Larsen 1981, Rogeau 1996)[18]. In the Subalpine, forests older than 200 years are common (Rogeau 1996) and consist of stands that survived the latest fire.

The different disturbance regime among the natural subregions is evident in their specific age class distribution (see figure 13).

[17] Andison, D.W. 1997. Landscape fire behaviour patterns in the Foothills Model Forest. Foothills Model Forest Report. Hinton, Alberta. 63 pp.

[18] White, C.A. 1985. Wildland fires in Banff National Park, 1880-1980. Parks can., Nat. Parks Br., Ottawa, Ontario. Occasional Paper # 3
Johnson, E. A. and C.P. Larsen. 1991. Climatically induced changes in fire frequency in the Southern Canadian Rockies. Ecology 72: 194-201.
Rogeau, M. P. 1996. Understanding age-class distribution in the Southern Canadian Rockies. M.Sc. Thesis. University of Alberta, Edmonton. 139 p.

Figure 13 – Relative Age Class Distribution by Natural Subregion on the FMA Area



The Lower Foothills natural subregion shows a significantly younger age class distribution than the Upper Foothills or the Subalpine natural subregions. Forest stands older than 130 years represent 61% of the landscape in the Subalpine, 30 % in the Upper Foothills and only 5% in Lower Foothills natural subregions.

The amount of older forests in the Subalpine natural subregion suggests the occurrence of four major fire events in 1760, 1840, 1860 and 1890. The extent of the Subalpine region in the Drayton Valley FMA Area affected by these fires ranged from 30% in 1890 to 17% in 1840 and 1860. It should be noted that the percentage of area affected by older fire events might be underestimated by the current age class distribution because more recent events may have affected areas previously burned. Low severity or smaller fire events may have also occurred in 1720 and in 1790-1800, but to date have not been detected.

A fire event in the Subalpine would most likely travel long distances and also affect the Upper and Lower Foothills natural subregions. However, in these regions, and particularly in the Lower Foothills, there is the little evidence of fire having occurred in the 1700s and 1800s because more recent fires have erased their footprint. The presence of remnant older stands in the Upper Foothills in 1760, 1840 and 1860 provides supporting evidence to suggest those major fire events did affect the Subalpine natural subregion.

The last major fire event to occur in the Drayton Valley FMA Area was in 1890-1900. That fire affected 30% of the Subalpine natural subregion, at least 44% of the Upper Foothills and 34% of the Lower Foothills natural subregion. The fire in the 1890-1900 decade may have extended over a larger area in the Lower Foothills, but a shorter fire cycle in this natural subregion and smaller, more recent fires may have erased some of its footprint.

The total shortage of stands less than 40-50 year of age in the Upper Foothills and Subalpine natural subregions in fire-driven ecosystems is a serious concern not only in terms of ecological processes but also because it suggests limited habitat availability for wildlife species that depend on early seral stages (Lyons et. al. 2000) [19].

[19] Lyon, L.J., M.H. Huff, R.G. Hooper, E.S. Telfer, D.S. Schreiner and J.K. Smith. 2000. Wildland Fire in Ecosystems: effects of fire on fauna. USDA For. Serv. Gen. Tech. Rep. RMRS-GTR – 42 vol. 1, Ogden., UT.

Insect and Disease History[20]

There is no information specific to the FMA Area on the history of insect infestations or disease epidemics. As an informal assessment,[21] there have been no significant timber losses (mortality) identified on the FMA Area within the past 15 years. Moderate to severe defoliation of aspen from forest tent caterpillar, *Malacosoma disstria*, was experienced during the mid-1980s throughout the FMA Area, the impact of which is expected to be reductions in growth during those periods. In immature forests there is a concern with aspen twig blight, *Venturia macularis*, and balsam twig blight, *Venturia populina*. These pathogens cause a loss of growth, although the exact extent of damage is unknown in the FMA Area.

The following tables show the insects and diseases that are present and their impact on tree growth in the FMA Area.

[20] Forest insect and disease conditions in west central Canada (Northern Forestry Center) from 1985 to 1995
Bugs and Disease reports (Alberta Environmental Protection) from 1996-2000.
Forest tree diseases of the prairie provinces (Y. Hiratsuka)
Tree and shrub insects of the Prairie Provinces (W.G.H. Ives and H.R. Wong).

[21] Forest Insect and Disease Reports, Natural Resources Canada; pers. com. with James Brandt (Head of Forest Insect and Disease Survey with Forestry Canada) and Albert Sproule (Land and Forest Service).

Table 11 - Mature and Immature Stand Pests of Trembling Aspen (*Populus tremuloides*) and Balsam poplar (*Populus balsamifera*)

Damage Agent	Damage	History on FMA
Bruce spanworm (*Operophtera bruceta*)	There is typically a loss of radial increment during an outbreak, but no mortality directly attributable to the insect.	Some recent activity (1999-2000) noted within the Willesden Green LMU.
Forest tent caterpillar *(Malacosoma disstria)*	Two or more years of moderate to severe defoliation cause severe reduction in radial growth and considerable branch and twig mortality. Little mortality attributable to the defoliation of the tree.	Large outbreak in 1987 in the Willesden Green, Sand Creek, O'Chiese, and Baptiste LMUs. In 1989, there was moderate to severe defoliation in the Willesden Green LMU.
Large Aspen tortix *(Choristoneura conflictana)*	Defoliation causes a reduction in the radial increment of the tree, but outbreaks seldom last long enough to cause any appreciable tree mortality.	In 1992 there was moderate to severe defoliation reported in the Baptiste LMU.
Poplar borer *(Saperda calcarata)*	Trees are not usually killed by poplar borer attack, even when riddled with tunnels, but weakened stems are liable to break during windstorms and the wood is almost useless for lumber or other purposes.	Larval activity common in native aspen stands throughout the F.M.A.
Aspen leaf-roller *(Pseudexentera oregonana)*	Little damage is done to trees.	Present throughout the Eastern half of the FMA in small populations.
Hypoxolon canker *(Hypoxylon mammatum)*	Disease is considered to be more secondary in nature, usually occurring in trees already under stress. Trees with infections on the lower main stem usually die, due to weakening of the main stem.	Occurred throughout the Willesden Green, Sand Creek, Baptiste, and O'Chiese LMUs. Essentially all LMUs that have aspen present.
Armillaria root rot *(A. ostoyae)*	Small infected trees are usually killed quickly; large trees may have reduced growth but keep growing for a long time despite the presence of the fungus. This disease kills trees already weakened by other environmental factors.	Common throughout the FMA
Venturia leaf and shoot blight *(Venturia macularis)*	When most of the tender shoots of young trees are attacked, the trees are disfigured and growth is severely affected.	Most prevalent pest of young aspen. Present throughout the FMA
False tinder conk *(Phellinus tremulae)*	Damage to deciduous trees includes weakening of the stem due to reduction in structural integrity of the stem.	Common throughout the FMA.

Table 12 - Mature and Immature Stand Pests of Lodgepole Pine (*Pinus contorta*)

Damage Agent	Damage	History on FMA
Northern Pitch Twig Moth *(Petrova albicapitana)*	The feeding of the moth causes injury to the stem and can cause breakage or stem deformities.	High population observed attacking pine regeneration in 1995 in the Rocky-Clearwater forest.
Root collar weevil *(Hylobius sp.)*	Feeding kills young trees and is one of the most significant entry courts for root rot and other disease organisms on older trees.	Present throughout the FMA.
Pine needle cast *(Lophodermella concolor, Davisomycella ampla, Elytroderma deformans)*	This disease has not been proven to significantly affect the health of large trees, although extensive defoliation can affect the growth and shape of the trees.	Light infestations were reported in the Rocky Mountain House region in 1985. In 1991, severe discoloration of trees occurred in the same region.
Western Gall Rust *(Endocronartium harknessii)*	Main stem galls often kill young trees. Trees with main stem galls tend to be deformed and easy to break at the gall.	Common at a low incidence among most young regeneration within the Nordegg River, Blackstone, and Marshy Bank LMUs.
Atropellis canker *(Atropellis piniphila)*	Heavy resin flow results in a debarking problem that can increase costs of processing. Discoloration of wood caused by the disease degrades lumber, and stem deformities also degrade the worth of the tree for sawmills.	Present in the Nordegg River and Blackstone, and Baptiste LMUs. Commonly found on lodegpole pine near Rocky Mountain House.
Pine needle rust *(Coleosporium asterum)*	Generally, the disease does not cause significant damage, but repeated heavy infections year after year could significantly reduce the growth of small trees.	Light to moderate infections present throughout the Nordegg River, Blackstone, Baptiste, O'Chiese, and Marshy Bank LMUs.
Armillaria root rot *(A.ostoyae)*	Small infected trees are usually killed quickly; large trees may have reduced growth but keep growing for a long time despite the presence of the fungus. This disease kills trees already weakened by other environmental factors.	Present throughout most of the FMA in young regenerating stands and in overmature stands.

Table 13 - Mature and Immature Stand Pests of White Spruce (*Picea glauca)*

Damage Agent	Damage	History on FMA
Spruce budworm *(Choristoneura fumiferana)*	Short periods of defoliation cause a marked reduction in radial increment; prolonged outbreaks cause severe branch and, ultimately, tree mortality.	Very light populations reported on the Eastern side of the FMA.
Spruce beetle *(Dendroctonus rufipennis)*	Damage occurs from beetles attacking and killing standing timber, especially if large numbers of beetles are present following fires, windstorms, or logging operations. A blue-stain fungus is also transmitted by the beetle.	Small infestations have been reported, but nothing substantial.
Root collar weevil *(Hylobius sp.)*	Feeding kills young trees and is one of the most significant entry courts for root rot and other disease organisms on older trees.	Present throughout the FMA
Spruce needle rust *(Chrysomyxa sp.)* and Yellow witches' broom *(Chrysomyxa arctostaphli)*	Infection can lead to where almost all of the current year's growth is dropped off prematurely. Heavy infections seldom occur in successive years. No significant damage.	Moderate to light damage throughout the FMA
Armillaria root rot *(A. ostoyae)*	Small infected trees are usually killed quickly; large trees may have reduced growth but keep growing for a long time despite the presence of the fungus. This disease kills trees already weakened by other environmental factors.	Common throughout the FMA

Fire History

Fire history data was obtained from the Land and Forest Service (LFS) for the FMA Area from 1961 to spring of 2000 inclusive. All fires within the gross boundary of the FMA Area have been included. The reason for this is that some fires from outside the FMA Area have escaped onto the FMA Area, most notably the O'Chiese fire (DR 6-19-88). During this period, 602 fires have burned a total area of over 15,000 hectares. The following tables summarize the data by cause, class, and year. The *Fire History Map* on page 11 of Appendix 4 provides the spatial location of each recorded fire by fire class.

Table 14 – Fires on FMA Area by Cause

Cause	Number of Fires	Area (ha.)	% of Area Burned
Lightning	219	6,875.8	44.5%
Man	383	8,587.6	55.5%

Table 15 – Fires on FMA Area by Class

Fire Class	Number of Fires	Area (ha.)	% of Area Burned
1 – A = < 0.1 ha	417	41.2	0.3%
2 – B = 0.11 to 4.0 ha	167	250.7	1.6%
3 – C = 4.1 ha to 40.0 ha	12	282.7	1.8%
4 – D = 40.1 to 200 ha	2	109.6	0.7%
5 – E = > 200 ha	4	14,779.1	95.6%

Table 16 – Fires on FMA Area by Year

Year	Number of Fires	Area (ha.)
1961	27	127.9
1962	10	1.9
1963	13	11.0
1964	8	0.8
1965	5	0.5
1966	7	7.5
1967	6	10.3
1968	14	6.1
1969	16	2,964.8
1970	13	9.9
1971	11	23.0
1972	4	2.3
1973	12	5.0
1974	23	40.8
1975	25	12.4
1976	11	19.8
1977	25	57.2
1978	16	32.2
1979	42	3,708.7
1980	8	8.4
1981	11	4.0
1982	18	24.0
1983	11	4.0
1984	40	17.2
1985	21	10.9
1986	3	68.7
1987	32	26.2
1988	22	8,143.2
1989	15	3.8
1990	9	1.0
1991	10	1.2
1992	16	8.8
1993	9	15.2
1994	13	3.1
1995	15	9.2
1996	14	7.3
1997	16	45.7
1998	20	5.2
1999	11	14.2

Forest Fire Risk

In cooperation with Land and Forest Service, Weyerhaeuser has completed a Fire Behavior Prediction System data set for the FMA Area. The Canadian Forest Fire Behavior Prediction System provides quantitative estimates of head fire spread rate, fuel consumption, fire intensity, and fire description. With the aid of an elliptical fire growth model, it gives estimates of fire area, perimeter, perimeter growth rate, and flank and back fire behavior. Detailed descriptions of the fuel types can be found in Appendix 5, and a map of the FMA *Fire Risk (Fire Behavior Prediction) Map* is available on page 12 of Appendix 4.

Table 17 – Fire Behavior Prediction System relative proportions on the FMA Area

FBP code	Fuel Type	% of FMA Area
C-1	Spruce-Lichen Woodland	2.5%
C-2	Boreal Spruce	38.5%
C-3	Mature Jack or Lodgepole Pine	12.7%
C-4	Immature Jack or Lodgepole Pine	0.7%
C-7	Ponderosa Pine-Douglas Fir	<1.0%
D-1	Leafless Aspen	22.4%
M-1	Boreal Mixedwood-Leafless	5.6%
NF	Non Forested	5.4%
O1a	Grass	6.7%
S-1	Jack or Lodgepole Pine Slash	<1.0%
WA	Water	1.1%
Unknown	N/A	4.4%

3.2.5 Description of Other FMA Resources

Fish and Wildlife Resources

The FMA Area is known for its abundant wildlife resources and its value for hunting, as well as for non-consumptive forms of outdoor recreation, such as camping and hiking. Hunting by Treaty Indians in the Area is also a significant activity. The FMA Area lies within three natural subregions (Subalpine, Upper Foothills, and Lower Foothills). This diverse environment supports a wide range of forest types from pure aspen stands to mixedwood and pure conifer stands as well as muskeg and riparian areas. This diversity also supports a wide variety of wildlife and plant species. The North Saskatchewan, Brazeau, Blackstone and Wapiabi River valleys are an important feature for many of the species in the FMA Area.

Since the winter of 1994-95, Weyerhaeuser has undertaken an extensive field research program to provide baseline data that will be used as a benchmark for future monitoring. Some of the data is needed at the stand level of our ecologically-based forest management approach to assess relationships between species and stand structure. Other data provides fine-filter inventory information that will help Weyerhaeuser plan its forest management to deal with threatened wildlife species as well as species of recreational value.

Specifically :

In 1994-95, 75 transects totalling 41 km in length were established in representative forest types (stands). These transects were used for:

a) Winter bird counts to determine the number of bird species present and their relative abundance, and to assess species-specific relationships with stand structure and composition. These counts along transects were complemented by nocturnal counts using playbacks of owl vocalizations along predetermined vehicular routes.

b) Breeding birds surveys (neotropical birds) with the objective of identifying species-stand structure associations.

c) Winter track counts to assess the relative abundance and distribution of furbearers.

One hundred sixteen wetland communities were surveyed with audio strip transects to determine the presence, distribution and relative abundance of amphibians. The technique was supplemented by “flush transects,” traps, and visual sightings in high probability areas to determine the presence of reptiles and the status of species whose distribution and abundance might be restricted.

Winter aerial surveys were used to assess the status and distribution of ungulates over the FMA Area and in relation to vegetation types.

Breeding bird surveys were repeated in 1997 and 1998 and complemented by nocturnal raptor surveys in 1998-99. Furbearer surveys were repeated during the winter of 1999-2000. An amphibian research program by the University of Alberta was initiated in the summer of 2000. Its objectives are to provide additional information on species occurrence and distribution. In June 2000, amphibians and reptiles were surveyed primarily along small, free-flowing streams and streams dammed by beaver. Time was also spent in marshes, lakes, and bogs. Amphibians and reptiles were extensively searched throughout the FMA, including areas such as the Marshybank Ecological Reserve and surrounding FMA, Lodgepole region, Dismal Creek, Blackstone River and Chungo Creek drainage.

Over 140 individual sites were surveyed twice between June and September. At each site, two 200m transects adjacent and parallel to the aquatic habitat in question were visually surveyed. Weyerhaeuser has also undertaken other initiatives to further our understanding of wildlife species in the Drayton Valley FMA Area.

Avifauna

Bird surveys were conducted during the summers of 1997 and 1998 by Bighorn Environmental Services and Aspen Resources Consulting, respectively. A total of 139 different bird species were recorded, reflecting the size and diversity of bird populations in the Drayton Valley FMA Area.

a) Abundant Bird Species:

The six most abundant bird species found in the Drayton Valley FMA Area were the Pine Siskin (61 birds/km²), Yellow-rumped Warbler (24 birds/km^2), Chipping Sparrow (17 birds/km²), Ruby-crowned Kinglet (16 birds/km²), Dark-eyed Junco (12 birds/km²), and the Gray Jay (10 birds/km²). Within this group there appeared to be no common or definitive habitat associations. The Chipping Sparrow was found in mixedwood and conifer stands, where it occupied openings and edges of woodlands, and in open deciduous forests. The Gray Jay was another abundant species found in different habitat types. It is considered a permanent resident of the region, as it does not migrate and spends all year in a range of habitats. It can be found in mixedwood forests, and dense coniferous stands, especially those dominated by white spruce, and in black spruce lowland bogs. One of the more common bird species in the Drayton Valley FMA Area is the Yellow-rumped Warbler. It breeds in coniferous woods but prefers open, mature stands that have dead standing trees interspersed throughout. This warbler will occasionally nest in stands of black spruce or areas of muskeg. Another bird species that occurs in high density in a range of habitats is the Pine Siskin. This bird is both nomadic and irruptive, which makes it difficult to define specific breeding ranges. It was found throughout the FMA Area, primarily in pure coniferous and coniferous dominated mixedwood stands. The Pine Siskin is closely associated with conifer stands due to the high conifer seed content in its diet.

b) Raptors:

Diurnal - The Peregrine Falcon is on the provincial Blue list and is categorized as endangered by COSEWIC. Sightings are rare within the Drayton Valley FMA Area, but surveys indicate an active nest on the south side of the Brazeau reservoir. Peregrines prefer to nest on cliffs along major rivers and use nearby fields, swamps and marshes for hunting.

Nocturnal - Aspen Resources Consulting conducted nocturnal raptor surveys in the Drayton Valley FMA Area during 1998 and 1999. During the 1999 survey, the Northern Saw-whet Owl was the most frequently sighted owl, followed by the Boreal Owl. One of the more recognizable raptors within the FMA Area is the Great Gray Owl. This bird is listed as vulnerable by COSEWIC, and yellow-listed by provincial authorities. Sightings

within the FMA are very uncommon. The Great Gray Owl can be found in conifer, deciduous or mixedwood stands, but the preferred nesting sites appear to be mature poplar stands near muskegs and marshes.

The Northern Pygmy Owl is unique to the Rocky Mountain/Foothills natural region. It was observed twice during the 1998 bird survey, both times in mature white spruce stands, and once during the 1999 survey. This owl tolerates a broad range of habitats, but prefers conifer-dominated mixedwood stands with small openings that allow for hunting opportunities. These birds are non-migratory and nest in abandoned woodpecker cavities. Another raptor found in the FMA Area is the Short Eared Owl. This species is listed as rare or vulnerable with Alberta Environment and COSEWIC, and is uncommon in the Drayton Valley FMA Area.

c) Woodpeckers:

Woodpeckers are considered key species within a habitat. Their presence can serve as an indicator of the overall health of the ecosystem. Several different species of woodpecker occur in the Drayton Valley FMA Area: Three-toed Woodpecker, Pileated Woodpecker, Northern Flicker, Black-backed Woodpecker and Downy Woodpecker.

The Downy Woodpecker and the Northern Flicker were sighted more often than the other species. Both the Black-backed and the Pileated Woodpecker are on the provincial Yellow B list, indicating that they are either rare or experiencing declining habitat availability. The Black-backed Woodpecker requires mature conifer forests that have standing dead trees for nesting, perching and providing foraging opportunities. These woodpeckers are not exclusive to conifer stands however, and can be found in dense mixedwood forests. The Black-backed Woodpecker often chooses nest sites in the decaying trees of burned areas or areas that have been previously harvested. They do not migrate and will overwinter in their home range.

The Pileated Woodpecker is yellow-listed, and is uncommon in the Drayton Valley FMA Area. There were only two sightings in the 1998 survey and one during the 1997 survey, evidence of their scarcity. Pileated woodpeckers occupy dense, close-canopied forests that have large mature trees and decaying snags for nesting sites. Unlike other woodpeckers, this species rarely occurs in burns or other areas of downed timber. Pileated woodpeckers prefer dead deciduous trees for nesting and tend to excavate and occupy a new cavity every year. They are also non-migratory and overwinter in their home range.

The Northern Flicker is relatively abundant and can be found throughout Alberta and the Drayton Valley FMA Area. They prefer moderately open habitats in mixedwood, deciduous or coniferous forests, and will excavate cavities in decaying deciduous trees. Northern Flickers can be found at forest edges, in logged areas or burns. These birds are migrants and do not overwinter in Alberta. Although Northern Flickers are more abundant than some woodpecker species, there were only three recorded sightings during the 1997 survey.

d) Waterfowl:

Several bird species in the FMA Area require water as an essential part of their habitat, including the Harlequin Duck, American Dipper, Barrows Goldeneye, Trumpeter Swan, Sandhill Crane and Great Blue Heron. The Harlequin Duck requires fast flowing mountain streams as part of its breeding habitat. Forests or patches of willow and alder surround most of the streams they choose to inhabit. Because these colorful ducks require pristine stream conditions for successful breeding, they are susceptible to detrimental effects on stream ecology. They are also sensitive to human disturbance, including activities such as mining, logging or grazing. During the breeding bird surveys in Drayton Valley, Harlequin Ducks were observed on the Blackstone River in the Upper Foothills section of the FMA

Area. According to provincial wildlife guidelines, these ducks are Yellow-listed and considered rare.

Another Yellow-listed bird that has a strong association with clean, fast-flowing water, is the American Dipper. This bird will nest on ledges beside or near the water body. If streams remain open through the year, the American Dipper will often overwinter in the area. These birds, like the Harlequin Duck, are sensitive to water quality and may be negatively affected by pollution. During the 1998 survey, up to seven Dippers were observed along the Blackstone River. This bird is unique to the Rocky Mountain/Foothills natural region.

Two of the remaining species, the Great Blue Heron and the Sandhill Crane, have fairly specific habitat requirements. The Great Blue Heron is found in and about open, shallow water, including lake edges, streams, rivers, ponds, sloughs and marshes. They nest near the shoreline or on islands surrounded by water. Herons are colonial birds that return each year to the same breeding grounds, and prefer to nest high in aspen, black poplar or white spruce trees. Their populations are under pressure and consideration should be given to protecting their habitat from human disturbance.

The Sandhill Crane is another species that requires large marshes, bogs, and sloughs for successful breeding. They often feed in open areas adjacent to wetland, such as meadows or older harvested areas. This species returns to the same breeding ground each year, and requires secluded and undisturbed sites for nesting. There were only two recorded observations of the Sandhill Crane during the bird surveys, both in older harvest areas. Both the Great Blue Heron and the Sandhill Crane are on the provincial Yellow list and are considered rare species.

Trumpeter Swans are a migratory bird, and the few sightings in the FMA Area may be attributed to birds on route to their summer nesting grounds or on their way south for the winter. Although these birds are not generally found in the Drayton Valley area, their occasional presence is important.

The Barrows Goldeneye is a waterfowl species that is unique to the Rocky Mountain/Foothills natural region. They are commonly found throughout the FMA Area, occupying ponds, sloughs and small lakes.

e) Neotropical Migrants and Short Distance Migrants:

The Drayton Valley FMA Area contains a mixture of resident birds and neotropical migrants. Neotropical migrants breed primarily in Canada and the United States, and winter between the Tropics of Cancer and Capricorn.

The Black-throated Green Warbler is considered a species at risk by Alberta Environment, and is consequently Blue listed. This warbler prefers mature conifer stands or mixedwood stands that have a large amount of white spruce. The Cape May Warbler also appears on the Blue list. This species prefers to breed in dense, mature spruce stands or conifer-dominated mixedwood forests. Both birds have been observed in the FMA Area. The Clay-colored Sparrow is also found in mixedwood stands in the FMA Area. They breed in meadows, brushy openings in mixedwood stands, old burns, and thickets along waterways. The Cordilleran Flycatcher is a species considered unique to the Rocky Mountain/Foothills natural region. It can be found in open, somewhat shady, deciduous or conifer-dominated mixedwood stands, usually near stream ravines. This flycatcher is on the provincial Yellow B list and was only sighted twice during the 1998 bird survey.

The Olive-sided Flycatcher and the Lincoln's Sparrow are two neotropical migrants commonly found in the FMA Area. The Olive-sided Flycatcher habituates semi-open

coniferous or mixedwood forests that have standing dead trees throughout. They can be found along the edges of disturbances, such as those areas that have been recently logged or burned. Within the Drayton Valley FMA Area, the Olive-sided flycatcher was observed in both clearcuts and mixed deciduous and coniferous stands.

The Lincoln's Sparrow is another neotropical migrant commonly found within the FMA Area. These sparrows inhabit wetlands and forest edges along lakes, bogs and openings. Because harvested areas provide forest edges and early successional tree cover, the Lincoln's Sparrow may benefit from logging activity. Sixty-one of these birds were recorded during the 1997 survey and 45 in 1998. Most of the birds identified in the 1998 survey were found in meadows or along the edges of stand openings.

Another bird species unique to the Rocky Mountain/Foothills natural region is the Varied Thrush. During the 1998 survey, 100 of these birds were noted. The Varied Thrush is forest size-dependent and therefore may be sensitive to extensive harvesting. They prefer older conifer stands that have an abundant understory and a closed canopy. These migratory birds return to the Boreal forest each spring.

Both the American Pipet and the Townsend's Solitaire are migratory birds sighted within the FMA Area and both are considered species unique to the Rocky Mountain/Foothills natural region.

f) Resident Bird Species:

Resident bird species in the Drayton Valley FMA Area are important components of local ecosystems. Among the more familiar resident species are the Ruffed Grouse, the Boreal Chickadee and the White-winged Crossbill. The Ruffed Grouse is Alberta's most abundant grouse species. It is found primarily in aspen-dominated mixedwood forests, older clearcuts, and immature mixedwood stands. Habitat requirements for the Ruffed Grouse include dense understory and downed woody debris. Eight grouse were recorded during the 1997 survey, and only five in 1998. The White-winged Crossbill, on the other hand, depends entirely on closed canopy conifer-dominated stands. These birds rely on the conifer seed crops as a food source, and can exhibit population fluctuations when a cone crop fails. The majority of white-winged crossbills found in the Drayton Valley FMA were in over-mature white spruce stands.

Boreal Chickadees are another year round species that prefers white spruce-dominated conifer forests. They nest in cavities they have excavated themselves, either in stumps or branch holes. Within the Drayton Valley FMA Area, Boreal Chickadees have been sighted in a variety of habitats, including mature lodgepole pine and mature mixedwood stands.

Herpetofauna

Although not diverse, the herpetofauna in the Drayton Valley FMA Area represents a critical biotic element of the foothill ecosystem. In many wetlands, frogs and toads are among the most abundant vertebrates. They are vital to the food web and healthy amphibian populations drive many of the aquatic systems within the FMA Area. Initial information about herpetofauna comes from a 1995 inventory of the Drayton Valley FMA Area. Three species -- the Boreal Toad, Wood Frog, and Boreal Chorus Frog -- are locally abundant and regionally widespread. All three species prefer clear shallow wetlands as breeding areas, and all are found within various forest cover types.

Wood frogs are the most widely distributed amphibian reported in the Drayton Valley FMA Area. They occur in all types of aquatic systems but reach their highest relative abundance in ditches and borrow pits. Boreal Chorus frogs have their greatest numbers in marshes and sedge wetlands, and are not commonly found in areas with flowing water or in temporary wetlands. Boreal toads, on the other hand, are often associated with slow-flowing water such as creeks, streams and some river areas. They are also found in sparsely vegetated wetlands and shallow,

abandoned beaver ponds. There was one recorded sighting of a Northern Leopard frog in the early 1980s, but all west central Alberta populations have since disappeared. Garter snakes are known to occur in and around the Weyerhaeuser FMA Area, however these populations are small and widely distributed**.** Red-sided garter snakes have been recorded in Crimson Lake Provincial Park and along the North Saskatchewan River at the Drayton Valley water treatment plant. Tiger salamanders and spotted frogs may occur in isolated pockets within the FMA Area, but they are not currently prominent ecological components of this region.

During the recent surveys conducted by the University of Alberta as part of the just started research program, over 600 frogs and toads were counted, of which approximately 90% were wood frogs, 8% boreal toads, and 2% chorus frogs. Of the 600 seen, 400 of these amphibians were actually caught, either by hand or net. Only one case of parasitism and only a couple incidences where the amphibian may have had deformities (i.e. extra digit or disjointed appendage) were observcd.

With regards to the distribution of the 3 species caught, wood frogs and boreal toads were found throughout the FMA, while chorus frogs were primarily limited to the lower foothills or regions east of the Forestry Trunk Road. Some interesting patterns from this first preliminary field season were detected. In particular, wood frogs in the upper foothills were in high densities along mid-order stream (i.e. Lookout and Sturrock Creek) and around lakes with a grassy riparian zone (i.e. Marshybank Lake). Wood frogs along the mid-order streams were often missing appendages, eyes, or digits, which may be a result of fish predation. Future research may shed some light on this issue.

Ungulates

Elk populations in the Rocky Mountain House-Nordegg area are monitored by surveying designated winter ranges. Twenty-three ranges have been continuously monitored since 1974 by Natural Resources Service staff. Elk numbers on these 23 ranges have increased from 445 animals in 1974 to 2,243 in 1997. During the same time, elk numbers on three winter ranges on the western boundary of the FMA Area (George Creek, Brazeau River, and Job Creek) increased from 26 in 1974 to 77 in 1997. The regional population increased steadily, while the Nordegg elk appeared to peak in the early 1980s (at 142-144 elk).

Designated elk winter ranges that fall within Weyerhaeuser's FMA Area are O'Chiese, Brazeau Forks, and Horburg. Only the Horburg range has received continuous monitoring. Surveys conducted by Weyerhaeuser in 1995 show that elk were most numerous on the northern portion of the FMA Area with the highest numbers recorded on survey blocks near the Brazeau River. Overall density was reported as 0.11 elk/km².

Elk numbers on the Jackfish winter range, located near the North Saskatchewan River on the southern boundary of the FMA Area, were reported by Natural Resources Service to be 103 elk in 1996 and 78 elk in 1997. Some information on elk use of the Brazeau River valley west of the reservoir is available from various sources, but little is known about the distribution of specific herds. Weyerhaeuser is currently a supporting partner of the University of Alberta elk study in west central Alberta, together with the Alberta Environment, Alberta Conservation Association, the Rocky Mountain Elk Foundation and other local stakeholders. The objectives of the study are to study resident and translocated elk to:

1. Develop a reliable sampling protocol for surveying wintering elk in the east central foothills,
2. Determine the optimum sites to successfully release "conditioned" (Banff/Jasper) and "wild" elk (Black Diamond) into the central east slopes elk population, and
3. Model elk habitat selection and determine the effects of land management practices on elk habitat selection.

Weyerhaeuser's surveys in 1995 indicated that moose are the most abundant ungulate on the FMA Area (densities of 0.23 moose/km²). This density is comparable to the 1995/96 NRS-Fish and Wildlife Northern Moose Program survey of WMU 339, which reported 0.28 moose/km². In 1979 and 1982, moose densities in the Alder Flats area were reported as 0.58 moose/km². Densities and ratios reported in the 1979 and 1982 Alder Flats surveys were higher than those reported for the FMA as a whole in 1995 and for WMU 339 in 1989 and 1995/96.

Fish and Wildlife also carried out moose surveys in the Nordegg, Brazeau and Pembina areas in 1975. Portions of the Brazeau area fall within the Drayton Valley FMA Area. The estimated density was 0.27 moose/km². Other surveys throughout the region indicate similar densities. Densities of moose west of the Brazeau reservoir appear to have changed little between the 1975 and 1994 surveys although the techniques and areas surveyed were somewhat different. Little is known about moose populations in the Nordegg area west of the Forestry Trunk Road.

Both white-tailed deer and mule deer are moderately abundant in the area. The highest numbers of mule and white-tailed deer in Weyerhaeuser's Drayton Valley FMA Area are reported near the North Saskatchewan River. In 1995, densities were 0.15/km² and 0.21/km² for mule deer and white-tailed deer respectively.

There are six designated bighorn sheep winter ranges in the Rocky Mountain House region between the North Saskatchewan and Brazeau Rivers. These six ranges are: Chungo-Blackstone, First Range-Job Creek, Brazeau-Job Creek, Wapiabi, Windy Point and Cline Point. Survey results for these six ranges between 1973 and 1995 indicate yearly fluctuations in numbers, but total ewes remain at about 200. There are indications of bighorn sheep use of the south banks of the Brazeau River within the Drayton Valley FMA Area. Bighorn sheep will travel long distances through trees if they know their destination. Bighorn sheep on the Brazeau River could be travelling down to the river by way of the ridges extending Northeast from the Front Ranges. It is also possible that the sheep may be part of the Chungo-Blackstone herd.

Furbearers and Carnivores

Eleven species of furbearers and forest carnivores occur in the Weyerhaeuser Drayton Valley FMA Area. Based on the 1995 and the 1999/2000 surveys, Snowshoe hare is the most abundant mammal. It occurs in old pine stands and in mature and immature mixedwood stands and was found in conifer stands of all ages during the 1999/2000 survey. Red squirrels are the second most abundant furbearer. This species is associated with mature pine and immature mixedwood stands. Lynx track frequencies were low and associated with mature mixedwood and old pine stands. Coyotes were the second most abundant carnivore in the 1995 survey, and were generally associated with cutovers, upland burns, old and mature pine stands and mature mixedwood stands. Fisher were uncommon in the 1995 survey, and were recorded in only two stand types, old and mature mixedwood stands. They were detected more frequently during the 1999/2000 survey, and were significantly more abundant than expected in mid-seral coniferous stands. Marten was relatively common in the 1995 survey and were associated with mature pine stands and old mixedwood stands. The scarcity of Marten tracks in the 1999/2000 survey is difficult to explain. Weasels were the most common carnivore recorded in the FMA Area, associated with cutover/upland burns. Short tailed weasels were more abundant than expected in the early seral stages and in areas with limited overhead cover. Recently a wolverine was observed within the FMA Area. Trapline data from 1995 indicates that beaver, muskrat, fox, and otter occur in varying numbers throughout the FMA Area.

Wolves occur throughout the FMA Area. Most of the knowledge about wolves comes from a detailed study of wolf predation on ungulates near Nordegg. Natural Resources Service personnel investigated wolf pack densities, seasonal food habits and predation rates. Ranges of two of the wolves that were monitored, as a result of the wolf transplant to Yellowstone and Idaho, fell within the FMA boundary (Brown Creek and Chungo); ranges of two other wolves were found north of the Brazeau River.

The home ranges of a number of grizzly bears in the Cairn Pass and Brazeau areas of Jasper National Park extended into the province east of the Brazeau River to Chungo Mountain, and covered part of the FMA Area. One den site was located in the FMA Area. Black bears are also known to occur within the boundaries of the Drayton Valley FMA Area.

Small Mammals

Little is known about small mammals. The Wapiabi Cave is a known bat hibernaculum. Little Brown Bats (*Myotis lucifugus*) and Long-legged Bats (*Myotis volans*) are reported in the area. Between 1998 and 2000, Weyerhaeuser supported a University of Alberta research project aimed at providing basic inventory information, characterisation of roosting and foraging areas and recommendations about the spatial arrangement of roost structures and foraging/activity areas at stand and landscape scales. The project is still underway.

Fisheries

The FMA Area supports a diverse fish fauna, ranging from native cold water sport fish species such as arctic grayling, mountain whitefish and bull trout, to cool water species such as goldeye, burbot, northern pike, and walleye. Non-native brook, brown and cutthroat trout have also been stocked into many streams in the FMA Area in the past, to provide recreational fishing opportunities. Non-sport fish species known to exist in drainages throughout the FMA Area include: longnose dace, fathead minnow, pearl dace, finescale dace, Iowa darter, emerald shiner, lake chub, trout perch, longnose sucker, white sucker, mountain sucker, shorthead redhorse sucker, silver redhorse sucker, quilback, spoonhead sculpin, and brook stickleback.

In general, fisheries production in the streams and rivers in the FMA Area is limited by cooler, less productive water, and a shorter growing season. Sport and non-sport fish species are found in habitat ranging from large rivers to small tributary streams. Larger rivers are important for migration, overwintering, rearing, and spawning purposes and the smaller tributary streams are often important as spawning and rearing areas. Recreational angling is popular at lakes, rivers and streams located in the FMA Area. Most of the recreational fishing pressure on the flowing waterbodies occurs on the larger rivers and streams. Access to streams and lakes in the FMA is very good, due to the presence of many roads and cutlines.

Brook trout, brown trout, burbot, northern pike and mountain whitefish are sportfish species known to use the Baptiste River drainage in the southeast corner of the FMA Area. A number of large brook trout populations are present in this area. Brown trout, northern pike, mountain whitefish, goldeye, walleye and lake sturgeon are all known within the North Saskatchewan and the lower Brazeau River drainages (near its confluence). Data collected through the Co-operative Fisheries Inventory Program (CFIP), suggests that the lower sections of many small tributaries to both rivers are utilized by mountain whitefish and brown trout for spawning and rearing purposes. The extent to which the mainstem North Saskatchewan is used by lake sturgeon within Weyerhaeuser's FMA Area is unknown.

The upper section of the Blackstone River and the Wapiabi River drainages support mountain whitefish, bull trout, brook trout and cutthroat trout populations. Data collected through CFIP suggests that bull and brook trout are using the tributaries to the Blackstone and Wapiabi Rivers as well as the mainstem rivers. However, within Weyerhaeuser's FMA Area, cutthroat trout and mountain whitefish seem limited to the mainstems. Bull trout and mountain whitefish are common in the headwater reaches of the Brazeau River.

The Pembina River supports populations of sportfish such as northern pike, arctic grayling, burbot, mountain whitefish and walleye. Specifically, Dismal Creek a tributary to the Pembina, supports what is likely Alberta's southernmost arctic grayling population. Recent data collection through the CFIP Program has revealed that grayling are specifically using a number of tributaries to Dismal Creek for spawning purposes.

The Brazeau Reservoir and Power Canal provide an important sport fishery for northern pike, bull trout, brown trout, burbot and mountain whitefish. In addition, a number of ponds and small lakes have been stocked with rainbow trout to enhance recreational fishing opportunities within the FMA Area.

Water Resources

The highest priority in the overall management of the Eastern Slopes Region is placed on watershed management (A Policy for Resource Management of the Eastern Slopes Revised 1984). Consequently, the Integrated Resource Plans (IRPs) emphasize water and water resources for the FMA Area.

The watershed areas (in their entirety or portions of them) in the FMA Area are divided among three basins: the Athabasca River basin, the North Saskatchewan River basin, and the South Saskatchewan River basin. The Athabasca River basin is in the north portion of the FMA Area and includes the Pembina River and Dismal Creek. The North Saskatchewan River basin comprises the Nordegg, Baptiste, Brazeau, and Blackstone Rivers and numerous small permanent creeks including Rose, Wapiabi, Sand, Rundell, Chambers, and Sturrock. The South Saskatchewan River basin is a small portion of the most easterly part of the FMA Area. Medicine Lake and Medicine River flow into the Red Deer River and eventually into the South Saskatchewan River. The *Streams and Rivers Map* on page 13 of Appendix 4 provides a visual representation of the main watercourses in the FMA Area.

Ecological and Historic Resources

Natural Areas and Ecological Reserves

The Rocky - North Saskatchewan IRP identified an ecologically significant area immediately west of the O'Chiese Indian Reserve. The area is representative of the forested upland terrain of the eastern foothills. This area has now been defined and placed under an Order in Council as the O'Chiese Natural Area (Twp 44 Rge 10 W5M). Weyerhaeuser has agreed to act as volunteer steward for the area. The Company's duties will be to observe, record and report any activities within the Natural Area and to assist the Province in management and promotion.

Likewise, the Coal Branch IRP notes the creation of the Marshybank Ecological Reserve established in July 1987 by Order in Council. "The Marshybank Reserve is split into two portions by a half mile strip of land that provides for future access to other resources."[22]

There is also a small day use site, Jack Knife Springs, in township 46 range 9 which encompasses a tufa (PNT). Jack Knife Springs Picnic Area is maintained and has good access off the Power House Road.

All these ecologically significant and protected areas have been excluded from the eligible landbase for the FMA Area.

Archaeological and Historical Resources

The IRPs have also identified a high archaeological / palaeontological potential on the lands adjacent to the major watercourses within the FMA Area. As well, a specific historical resource site has been identified at the confluence of the North Saskatchewan and Brazeau Rivers.

In township 42 range 8 along the Baptiste River there is a *Provincial Historic Resource*, which is managed by the Metis Nation of Alberta Association (PNT 950134 - cancelled). The Baptiste River Metis Settlement site was occupied by an extended family of Metis who lived in at least

[22] Coal Branch Sub-Regional Integrated Resource Plan 1990

four separate dwellings between c. 1930-1935. The site has been inspected by the Staff Archaeologist from the Provincial Museum.

Prime Protection

The Nordegg-Red Deer River and Coal Branch IRPs have identified areas of "Prime Protection" as defined by *A Policy for Resource Management of the Eastern Slopes Revised 1984*. The intent of the prime protection zone is to preserve environmentally sensitive terrain and valuable ecological and aesthetic resources. Regional objectives that are considered compatible with the intent of this zone include watershed, fisheries and wildlife management, and extensive recreational activities such as hunting, trail use (non-motorized) and primitive camping.[23] Timber harvesting is not considered a compatible activity. The Eastern Slopes Policy does, however, recognize the need to consider, under strict operating guidelines, essential management programs thatwhich may include activities such as wildlife habitat improvement, fire control, and timber sanitation cutting to protect merchantable timber in other zones.

A map of the ecological and historic resources is on page 14 of Appendix 4 (*Ecological and Historical Map*).

3.2.6 Description of FMA Anthropogenic Uses

Oil and Gas

One of the most prominent land uses on the FMA Area is oil and gas development. The area overlaps, in whole or in part, six defined oil and gas fields. Development is intensive in some portions of the area and can have a significant impact on forest management, as well as contributing to the cumulative impact on other resources. Continuing development for oil and gas resources is expected.

To the spring of 1999, the Drayton Valley FMA Area had a total of 2,178 wellsites either in production or suspended, and 355 other industrial sites (battery, compressors, valve sites, etc.). The total area affected by these site-specific developments amount to 10,000 ha (Table 18). In addition, the FMA Area is intersected by a large number of roads, powerlines, pipelines and seismic exploratory lines that extend over a total of 16,665 km, for an average of 4 km/km^2 (Table 19). Roads amount to 2,047 km; powerlines, pipelines and other industrial linear disturbances amount to 4,538 km; and seismic lines (wider than 6 m) totaled 10,078 km.

As shown in Tables 18 and 19, the intensity of industrial development varies significantly across Landscape Management Units with fewer developments and less linear disturbance in the western part of the FMA Area. The variation is graphically described in Figure 14. The intensity of oil and gas development in the LMUs will influence the forest management practices that will be implemented.

Table 18 – Oil and Gas developments on the FMA Area

LMU	Wellsites		Public Facilities		Other Industrial Sites	
	No.	Total Area (ha)	No.	Total Area (ha)	No.	Total Area (ha)
Baptiste	367	527.8	3	766.3	78	3,856.0
Blackstone	11	20.4	2	16.7	6	219.9
Elk River	287	447.5	2	10.0	59	1,208.5
Marshybank	3	61.9	2	191.3	0	0.0
Medicine Lake	30	40.7	2	138.7	4	334
Nordegg River	27	56.5	2	21.5	12	1,181.2
O'Chiese	44	65.0	1	0.6	15	49.0

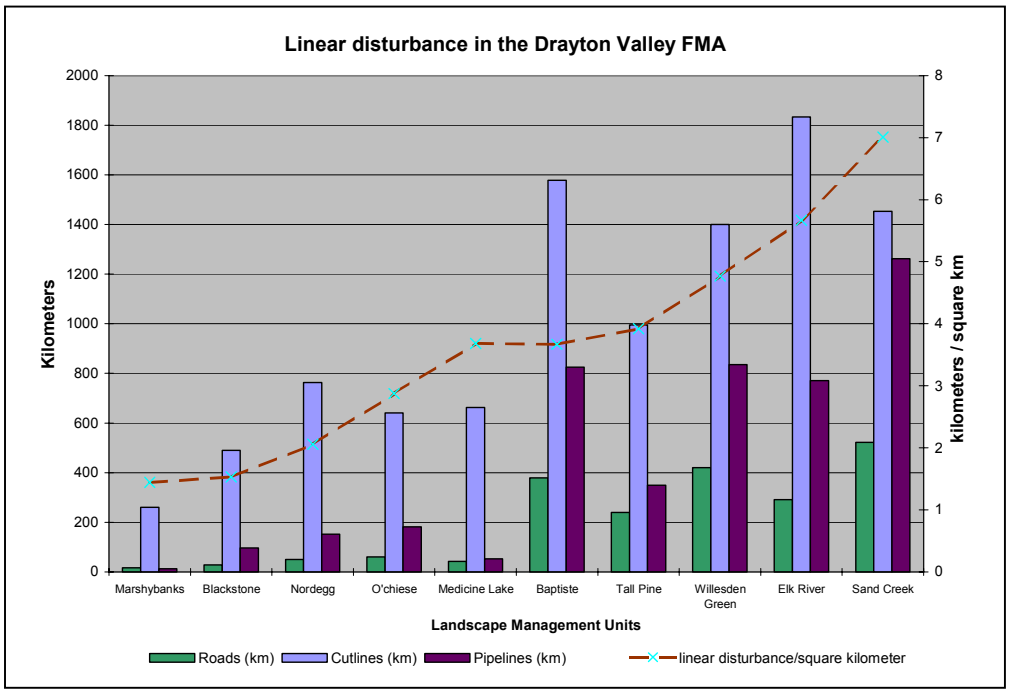
[23] A Policy for Resource Management of the Eastern Slopes, Revised 1984

Sand Creek	739	985.2	72	168.6	83	1,345.2
Tall Pine	227	661.5	1	2.1	27	870.8
Willesden Green	443	571.9	5	164.7	71	948.9
ENTIRE FMA	2178	3,438.4	92	1,480.5	355	10,013.5

Table 19 – Linear disturbance on the FMA Area

LMU	Roads (km)	Cutlines (km)	Pipelines (km)	Total linear disturbance	linear disturbance/km²
Baptiste	378.8	1,578.0	825.3	2,782.1	3.67
Blackstone	28.4	490.0	95.9	614.3	1.53
Elk River	291.2	1,833.0	771.3	2,895.5	5.67
Marshybank	16.9	260.0	12.1	289	1.44
Medicine Lake	41.4	663.0	52.9	757.3	3.68
Nordegg River	49.6	762.9	151.6	964.1	2.05
O'Chiese	61	641.0	181.3	883.3	2.88
Sand Creek	521.5	1,454.0	1,262.6	3,238.1	7.01
Tall Pine	239	996.0	349.4	1,584.4	3.92
Willesden Green	420	1,401.0	836.1	2,657.1	4.77
ENTIRE FMA	2,047.8	10,078.9	4,538.5	16,665.2	4.02

Figure 14 – Linear disturbance on the FMA Area



Grazing

Forty-three grazing dispositions are contained within the gross boundary of the FMA Area, encompassing 14,220.2 hectares. Grazing Leases, Permits and Allotments are included in the FMA Area landbase for this Plan submission. Forest Grazing Licences issued after the signing date of the Forest Management Agreement represent integrated landbase. Table 20 below summarizes the delineation of grazing dispositions recognized for this submission, by Landscape Management Unit. The *Private Land and Grazing Map* (page 15 of Appendix 4) shows that the grazing dispositions are concentrated primarily in the eastern portion of the FMA Area. All grazing dispositions are eligible landbase for the Quotas, Community Timber Program, and Local Timber Permit programs within the FMA Area.

Table 20 – Grazing Dispositions on the FMA Area by LMU

Disposition Number	Status[24]	LMU	Area (ha)	Comments
FGL 800007	out	BT	60.9	
FGL 800011	out	WG	244.8	
FGL 810024	out	BT	206.9	
FGL 860001	in	BT	145.0	
FGL 860017	in	WG	49.5	
FGL 860021	in	BT	144.1	
FGL 920008	out	BT	2296.3	Use to be the Diamond Hill Allotment
GRL 15897	out	WG	397.6	
GRL 34501	out	SC	107.4	
GRL 37238	out	WG	295.4	
GRL 37902	out	BT	1308.6	
GRL 37912	out	WG	266.2	
GRL 38084	out	BT	637.0	
GRL 38175	in	BT	210.6	Cancelled, to be re-issued as an FGL
GRL 38204	out	SC	39.3	
GRL 38338	out	BT	165.7	
GRL 38690	out	WG	1704.2	
GRL 39926	out	WG	168.7	
GRL 40215	out	WG	369.2	
GRL 40272	out	BT	132.5	
GRL 40286	out	SC	307.5	
GRL 40351	out	BT	392.7	
GRL 40411	out	WG	197.9	
GRL 40502	out	BT	64.6	
GRL 40522	out	BT	599.3	
GRL 40583	out	WG	257.0	
GRL 40656	out	WG	195.6	
GRL 40708	out	BT	198.5	
GRL 780044	out	BT	231.8	
GRL 800225	out	ML	267.1	
GRL 800250	out	WG	260.0	
GRL 800251	out	WG	393.5	
GRL 800698	out	ML	410.9	
GRL 890071	out	WG	264.1	
GRP 787429	in	BT	24.6	Cancelled, to be re-issued as an FGL
GRP 787968	out	WG	59.0	
GRP 787969	out	WG	33.6	
GRP 787970	out	WG	62.7	
GRP 787973	out	WG	34.0	
GRP 788193	out	BT	67.6	
GRP 830062	out	BT	131.2	
GRP 830085	out	WG	61.8	
PNT 880286	out	BT	756.2	The Omni Allotment

BT = Baptiste, ML = Medicine Lake, SC = Sand Creek, TP = Tall Pine, and WG = Willesden Green

[24] All grazing dispositions are included in the timber harvesting landbase for the FMA Area to calculate the AAC for the embedded quotas, Community Timber Program and Local Timber Permit program. The "in/out" status refers to integrated landbase as per the Forest Management Agreement.

Private Land

Private land on Weyerhaeuser's FMA is found primarily on the east and south FMA boundaries, adjacent to the agriculturally developed land (see *Private Land and Grazing Map* on page 15 of Appendix 4). There are 283 parcels of land registered within the gross boundary of the FMA Area, for a total area of 7,701.7 hectares.

Table 21 – Patent Land on the FMA Area by LMU

LMU	Area (ha.)
Baptiste	4379.5
Blackstone	0
Elk River	0
Marshybank	0
Medicine Lake	324.6
Nordegg River	2.0
O'Chiese	120.3
Sand Creek	1576.6
Tall Pine	142.1
Willesden Green	1156.5

Trapping

The entire FMA Area is overlapped by registered trap lines, 42 of which are contained in whole or in part within the FMA Area (see *Registered Fur Management Areas Map* on page 16 of Appendix 4). This data set is based on Natural Resources Services (Fish and Wildlife) report No. LFWE0006 "Fur Trapping System-Licenced Trappers by Trapping Area," which details ownership by primary and secondary holders.

Recreation and Tourism

The Integrated Resource Plans, the M.D. Brazeau report on the Brazeau Reservoir Region Tourism and Recreation Potential, and Provincial base maps are the sources of information on which Weyerhaeuser has relied to identify recreation areas in the FMA Area. There are no major recreation plans or developments other than those identified in the IRPs. A synopsis of the IRP recreational resources assessment as it pertains to forest management on the FMA Area is as follows:

- Overall recreational use and potential is moderate to low due to demand for areas outside of the FMA Area and to relatively poorer access (although it should be noted the Brazeau Road from Lodgepole to the Brazeau Reservoir has been upgraded since the IRP was done).
- Areas with high recreational use and potential include the Brazeau Reservoir, Medicine Lake, North Saskatchewan River, staging areas at the Blackstone and Wapiabi gaps, the Forestry Trunk Road, the Chungo road and Highway 11 corridor for water based activities, camping facilities and scenic resources.
- Two Zone 4 General Recreation Areas lie within the FMA Area, at the Brazeau Reservoir and Medicine Lake. As well, the FMA Area is adjacent to Zone 4 areas at Crimson Lake Provincial Park.
- A designated vehicle route pilot project for recreational vehicles was proposed for the Brazeau-Pembina Sub-Region but has not been carried out.
- Land and Forest Service has prepared a self-guided vehicle tour of the forest area southwest of Drayton Valley – the *Brazeau Natural Resources Tour*.

- There are three maintained campgrounds (Chamber Creek, Medicine Lake, and Blackstone River) and one day use site at the Jack Knife Springs Natural Area south of Lodgepole in the FMA Area.
- Weyerhaeuser appreciates the current tourism and recreation levels occurring in the western portion of the FMA Area and will work to maintain those opportunities.

There are two Recreational Leases within the FMA Area:

1. REC 2818, which is located west of Rocky Mountain House and is a gun club operated by the Town of Rocky Mountain House, and
2. REC 810013, which is the Open Creek Dam, located south of highway 53 in the Medicine Lake LMU and is operated by the Rimbey Fish and Game Association.

Timber Harvesting

Timber harvesting has a long history in the FMA Area. Logging and saw milling operations were in the area as early as 1900. Much of this early activity was restricted to forested areas that were easily accessible along major watercourses. These same watercourses were also used as the main transportation method for getting logs to the sawmill. The last river run on the North Saskatchewan occurred in 1926.

In the 1960s, the boom in oil exploration and subsequent development meant many of the previously inaccessible areas became accessible to the forest industry. This decade also saw the introduction of a timber quota system that provided long-term security of timber supply as well as legal responsibility for prompt reforestation of cut over areas.

The following tables and the *Timber Harvesting Map* on page 17 of Appendix 4 represent the recorded harvesting that has occurred on the FMA Area. The older harvest areas, going back to the early 1900s, had not been recorded and have consequently been interpreted into the forest inventory as per AVI version 2.1 standards. Of the over 2,000 cutovers identified by Weyerhaeuser from inventory updates and enhancements, all but approximately 30 have been associated with a silviculture opening number and activities (e.g., planting). Weyerhaeuser will continue to investigate the logging history for the FMA Area to ensure accurate and complete records for subsequent Plan submissions.

Table 22 – Timber Harvesting on the FMA Area by LMU

LMU	Number of Blocks	Area (ha.)
Baptiste	368	4,473.9
Blackstone	14	368.8
Elk River	249	4,751.5
Marshybank	23	662.8
Medicine Lake	2	74.2
Nordegg River	319	4,427.7
O'Chiese	342	4,763.9
Sand Creek	260	5,193.6
Tall Pine	221	4,237.6
Willesden Green	220	3,864.6

Table 23 – Timber Harvesting by reforestation transition dates by LMU

LMU	Pre 91		Post 91 FMA		91-95 Quota		Post 95 Quota	
	Block	Area	Block	Area	Block	Area	Block	Area
Baptiste	138	1,914.7	213	2,431.0	12	55.9	1	3.6
Blackstone	13	368.8						
Elk River	211	3,800.5			16	314.2	19	372.0
Marshybank	22	628.1						
Medicine Lake	2	74.2						
Nordegg River	153	2,122.4	33	259.7	53	944.3	79	1,048.6
O'Chiese	71	1,216.9	156	2,013.5	57	764.1	57	749.9
Sand Creek	150	3,112.3	51	1,044.6	23	461.4	33	405.3
Tall Pine	169	3,297.5			35	679.4	16	250.4
Willesden Green	86	1,658.8	122	1,946.6	6	25.2		
FMA Totals	1015	18,194.2	575	7,695.4	202	3244.5	205	2,829.8

Pre 91 blocks refers to the blocks harvested prior to March 1, 1991, as per the Timber Management Regulations, and also includes blocks harvested prior to the establishment of the timber quota system in 1966. Thirty percent of the Pre 91 area was harvested and reforested as deciduous blocks.

Post 91 FMA includes all blocks harvested under authority of FMA8500023 since the transition date of March 1, 1991. Weyerhaeuser has the legal responsibility on all of these blocks to meet or surpass the requirements for stocking, species composition, performance and free to grow requirements where required (conifer blocks).

91 – 95 Quota blocks are all blocks harvested on the FMA Area under authority of a timber quota, CTP, or LTP (e.g., Tall Pine Timber's CTQ R010004) between March 1, 1991 and April 30, 1995. Reforestation of all these blocks to the establishment survey was the responsibility of either the forest product company or the Land and Forest Service. Responsibility for meeting the regulated free-to-grow requirements on the conifer landbase (2,849.2 hectares) was strictly with Land and Forest Service.

Post 95 Quota blocks are all blocks harvested on the FMA Area under authority of a timber quota, CTP or LTP after April 30, 1995. The reforestation responsibility for the establishment and free-to-grow requirement, where necessary, rests solely with the company that harvested the cutover. The exceptions to this are the Community Timber Program and Local Timber Permits that remain the responsibility of Land and Forest Service.

Facilities

Weyerhaeuser Company Limited

Weyerhaeuser Company Limited's processing facilities at Drayton Valley are an Oriented Strand Board (OSB) plant and a dimensional lumber sawmill-planer complex. Both facilities are located within the town limits of Drayton Valley along highway 22 (sections 5 and 8, township 49, range 7, west of the 5th meridian). The OSB plant and sawmill-planer complex share common forestlands, a weigh scale and log yard.

OSB Plant

The OSB plant started up in March 1987, and currently employs 187 full time people for 12 months on a four on / four off shift schedule. The plant's annual production capacity is 355,000,000 square feet of board on a $^{3}/_{8}$" thickness basis: enough to build approximately 30,000 homes. About 60% of the production is used in the secondary manufacture of structural I beams.

Table 24 lists the tree species used by the OSB plant; aspen comprises 75% of the total volume and three other species make up the rest. Wood for the OSB plant is hauled to Drayton Valley

as shortwood with most of it bucked to lengths of 2.6 metres. Logs of good quality are essential to obtain the high board quality that is associated with Weyerhaeuser's *Sturdi-wood* and *Struc-one*. After the bark is removed, a series of specially designed knives (called a waferizer) transforms the logs into engineered strands of precise size and thickness. For strength, the grain of each strand matches the original grain of the log. The strands are dried in the three-pass dryer system. The dried strands are then sent through a series of cyclones and screens to remove unwanted fine particles. All unwanted fine particles generated by the dryers are sent to an electrified filter bed and baghouse to reduce the amount of fine particulate released to the atmosphere. In turn the collected fine particulate is sent to a thermal energy unit for incineration and heat recovery (the volcano). A liquid or powder phenolic and/or a liquid methyl di-isocyanate resin, applied in blenders, coats each strand to provide uniform bonding and resistance to moisture. The strands are oriented in parallel and perpendicular layers to maximize panel strength and stability before going to a press. The press is computer controlled to ensure that each panel is 100% uniform and consistent, and precisely engineered for its end use. Press emissions are captured in a cupola at roof level and exhausted through a 45 metre stack for improved ambient air dispersion. There are two sawlines: the grade line with a four-foot wide board sander, and a specialty line with an eight-foot wide board sander. Each sander is connected to a baghouse filter that collects fine sawdust. This effectively removes the material from the exhaust stream and it is then incinerated for heat recovery. With the combination of the sawlines, the plant manufactures OSB panels from ¼ inch to 1¼ inch thick, and panel sizes of 2 by 3 feet to 8 by 24 feet with sanded and tongue-and-groove board available. A quality control lab ensures that the OSB panels meet or exceed plywood quality ratings thickness for thickness.

Table 24 – Species utilized by the OSB Plant

Species	% of wood supply
Aspen	75%
Balsam Poplar	20%
Birch	2.5%
Conifer	2.5%

The OSB plant utilizes hog fuel from the de-barkers and slasher decks to provide energy for the volcano. The volcano provides heat, by incineration, to the building, log ponds, wax tanks, resin tanks and the press. Wood fuel from the sawlines is used to fire the natural gas assisted dryers. Ninety-eight percent of the heat required for the dryers is provided from the burning of the wood fuel.

All off-grade OSB is sent to Sawn Wood Products in Drayton Valley for the manufacture of dunnage, which is placed under each bundle of OSB. The dunnage is strapped to each bundled, effectively lifting the bundle off the ground for forklift access and protection against moisture. Dunnage made from OSB has replaced traditional 2 by 4 lumber.

Sawmill-Planer Complex

The sawmill-planer complex started up in December 1987 and has 165 full time employees. The sawmill's annual capacity is 130,000,000 board feet: enough to build approximately 42,000 homes. The sawmill-planer complex also produces approximately 75,000 dry tonnes of chips. In 1997-98 a planer shavings bin was installed to remove 10,000 tonnes of material from the waste process for sale into a Medium Density Fiber Board plant in Whitecourt, Alberta.

The sawmill complex uses chip-and-saw technology on both the small log line and the large log line. An edging optimizer increases the mill's production and utilization. A 45-bin computer-controlled J-bar sorter is used for rough, green lumber. The planer mill complex dry kilns 100% of the lumber manufactured, and over 98% of the lumber is planed. The planed lumber is sorted with a 22-bin computer controlled J-bar sorter. With the chip-and-saw technology and the edging optimizer, the sawmill manufactures finished lumber (appearance J grade and

dimensional) from 1 by 4 inches to 2 by 12 inches and from 8 to 24 feet long. The sawmill-planer complex utilizes spruce (mostly white, but some black and Engelmann), lodgepole pine and a small to insignificant portion of balsam fir, larch and alpine fir.

In 1999 the Planer Mill started up a "dry trim block recovery system" to capture blocks 12"-23" in length. It produces both a rip grade and "2 & better" block, which are sold to a secondary manufacturer for door and trim production.

The sawmill utilizes hog fuel from the cut-off saw and the de-barker to provide energy to the volcano, which generates heat for the building and the dry kilns.

Log Yard

The shared log yard stores a variety of tree species and log lengths that created some natural wood leachate issues for a nearby drainage called West Park Creek. To reduce the impact of the release of these natural leachates to the surrounding environment, a surface run-off management system has been built to collect and store all site run-off. The collected run-off is then pumped to a constructed wetland where the toxicity of the leachate is reduced using natural wetland vegetation. Once the leachate toxicity has been reduced, the water is released into West Park Creek under approval of Alberta Environment.

Power Plant

The Drayton Valley Power Plant started operations on April 11, 1996. Under a 21-year agreement, Weyerhaeuser will provide 180,000 green tonnes per year (90,000 oven-dry tonnes) of hog fuel from the OSB Plant and Sawmill operations. This amount of hog fuel will generate 12 megawatts of power. Of this, 10.5 megawatts of utility grade power are sold to the local power grid at an established rate, and the remaining 1.5 megawatts are used by the power plant to operate its internal equipment.

Using a waste transfer system at either the OSB Mill or Sawmill, two company-owned 53-foot live floor vans transport the material to a power plant scale for measurement. After each load is weighed, the raw material is placed in a grinder for immediate processing or into a temporary raw pile for future use.

At present there is a surplus of hog fuel to operate the power plant, so this excess is moved into several different programs, including composting, mulching, oil and gas lease reclamation, road reclamation, decorative bark, incineration and public events. This has avoided direct landfilling of wood debris that may still have some secondary manufacturing benefit.

Tall Pine Timber Co. Ltd.

Since 1958, Tall Pine Timber Co. Ltd. has operated a sawmill-planer complex, located along secondary highway 620 (section 28, township 46, range 11 west of the 5th meridian) southwest of Lodgepole. The sawmill's annual capacity is 10,000,000 board feet and 50,000 dry tonnes of chips. Tall Pine Timber Co. Ltd. employs 15 full time staff and has five contract positions.

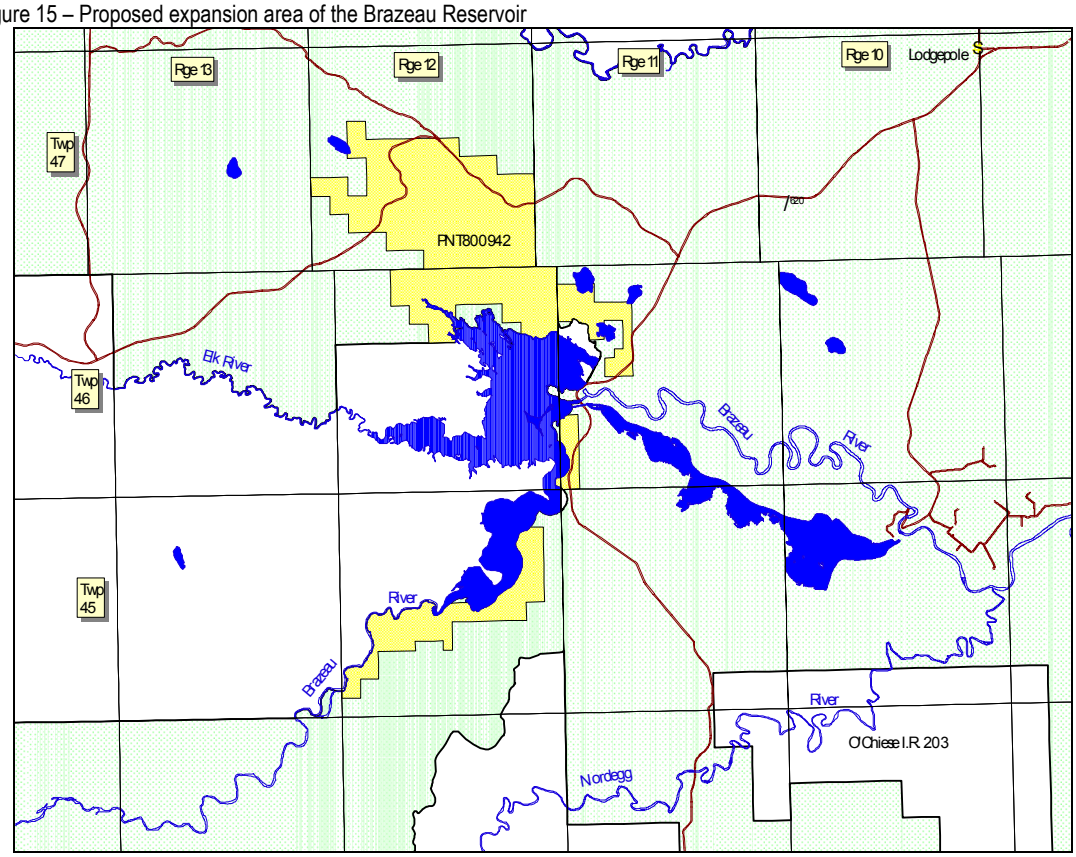
The sawmill has two log lines. The small log line utilizes chip-and-saw technology, and has a capacity of up to 18 inches. The large log line is made up of a 30-inch de-barker, QM head rig, and 24-inch sash gang saw. All green lumber is sorted with an edge sorter. The mill uses spruce, pine and fir in the production of imperial and metric sized dimensional dressed and rough lumber, and timbers up to 16 feet long. The sawmill waste is burned on site in the teepee burner.

3.2.7 Description of FMA Landscape Resource Dynamics

Hydrology

The Forest Management Agreement identifies PNT800942 for future water resource development. This PNT is around the Brazeau Reservoir and is for possible future expansion of the Reservoir (see Figure 15).

Figure 15 – Proposed expansion area of the Brazeau Reservoir



Recreation and Tourism

Weyerhaeuser is aware of the desire of the Clearwater County and the residents of Nordegg to increase the recreation and tourism for the area of the FMA west of the Forestry Trunk Road. Weyerhaeuser is committed to working with all stakeholders of the area to ensure the Provincial policy of multiple use is applied to the utmost satisfaction of all parties.

There has also been a request from the campground operator at the Brazeau Reservoir to expand the services provided. Weyerhaeuser will wait for direction from the Province on future initiatives.

Special Places

Currently there are two Special Places nominations (SPN) on the FMA Area: the Wapiabi SPN in the Blackstone LMU, and Thunder Lake SPN in the Marshybank LMU. Both nominations are within the Foothills natural region. The Wapiabi SPN is based in large part on the presence of valley bottom landforms and riparian habitat complexes along the Wapiabi Creek and associated stream channels. The Thunder Lake SPN is based on "unique landforms and strongly rolling wetland topography."[25] Weyerhaeuser has supported the Minister on both nominations.

[25] Yellowhead Suite Local Committee; Recommendations to the Minister of Alberta Environment; June 2000

Timber

Tall Pine Timber Co. Ltd.

With the approval of the Detailed Forest Management Plan, Tall Pine Timber Co. Ltd. will be working in cooperation with Weyerhaeuser and Land and Forest Service on a number of forest management issues and products for the FMA Area, including:

- their quota certificates amended to be expressed as a percent of FMA 8500023,
- annual reporting of reforestation activities to maintain the silviculture database of the FMA Area,
- annual cooperation of inventory enhancement for cutover updates,
- sequencing on the FMA Area as determined by the Timber Supply Analysis and subsequent sequencing model output, and
- development of the Timber Harvest Planning and Operating Ground Rules for the FMA Area

FMA Boundary Changes and Expansion

Weyerhaeuser is working with Sunpine Forest Products Ltd. to determining what portion of the R-2 forest management unit is needed to support the company's AAC share from that unit. Then Weyerhaeuser will request that the Province amalgamate that quota area into the FMA Area. With the completion of this task Weyerhaeuser will request cancellation of their R-2 quotas.

The Province has also initiated an exercise to improve the accuracy of the existing FMA boundary from the current +/- 500 metre accuracy to +/- 20 metre accuracy. Many of the proposed changes are along the major watercourses and are adjustments to the high water mark. Weyerhaeuser will continue to work with Alberta Environment to determine a more accurate boundary location. In the meantime, the Company will not harvest within the area that may be removed from the FMA Area due to the boundary change.

Both of these will require an amendment to the existing Agreement through Order in Council.

Community Timber Program and Local Timber Permits

With the approval of the Detailed Forest Management Plan, Land and Forest Service, on behalf of the Community Timber Program (CTP) and the Local Timber Permit programs (LTPp), will commit to accept this Plan as the forest management plan for the FMA Area and to work with Weyerhaeuser to contribute to the success of meeting the stated goals and objectives. Some key deliverables to the CTP and LTPp for the FMA Area, include:

- annual reporting of reforestation activities to maintain the silviculture database of the FMA Area,
- annual cooperation of inventory enhancement for cutover updates,
- sequencing on the FMA Area as determined by the Timber Supply Analysis and subsequent sequencing model output, and
- implementation of the Timber Harvest Planning and Operating Ground Rules for the FMA Area.

Environmental Management System

In response to customer demand and to build confidence that Weyerhaeuser is properly managing the forest resource entrusted to us by the Province with our customers, communities and stakeholders, Weyerhaeuser has initiated the development of an Environmental

Management System. Weyerhaeuser-Drayton Valley will be seeking certification from the International Organization for Standardization (ISO 14001) by the fourth quarter of 2001.

The company has also made the decision to achieve Canadian Standards Association's Sustainable Forest Management Standard by the end of 2002. To achieve this standard, the Drayton Valley Forestlands will be developing a mechanism for public involvement and reporting. This process is expected to increase the Forest Advisory Committee's scope and role for the FMA Area.

SECTION II
FOREST MANAGEMENT STRATEGIES AND OBJECTIVES

1. FOREST MANAGEMENT STRATEGIES AND OBJECTIVES

In developing the Detailed Forest Management Plan (DFMP), Weyerhaeuser's stewardship of the FMA Area was guided by a clear set of DFMP goals (see Section I). Measures have been provided in this section for each goal. These *measures* allow for the determination of whether the goal was achieved.

Also, a number of resource management activities are required to meet these goals, and appropriate management strategies were subsequently developed. For the purpose of this planning process, a *management strategy* is:

> *The framework or approach used to coordinate a series of activities designed to fulfill the goals of management.*

The management strategy for each DFMP goal is presented on the following pages.

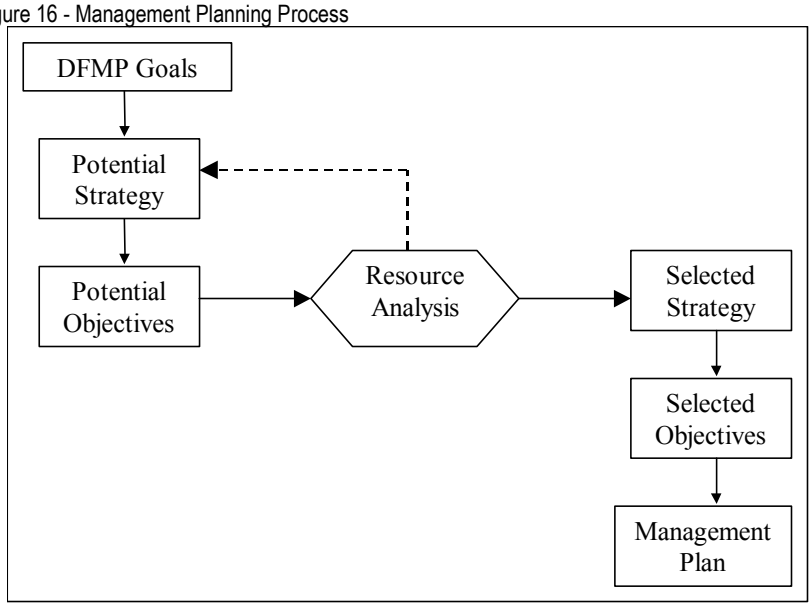
Each management strategy will be implemented by achieving a set of objectives, which are provided in tables throughout this Plan. For the purpose of this planning process, an *objective* is:

> *A clear, specific statement of expected quantifiable results, related to one or more strategies, to be achieved within a defined period of time.*

The management strategy and objectives were a product of an iterative resource analysis process (Timber Supply Analysis). In this process, alternative strategies and objectives were applied, adjusted and reapplied in order to meet the goals. The result was a strategy and a set of objectives that best met the intent of the goals.

Figure 16 demonstrates the role of resource analysis in the management planning process.

Figure 16 - Management Planning Process



1.1 Detailed Forest Management Plan Goals and Strategies

Goal

Ensure that Weyerhaeuser's Drayton Valley facilities remain globally competitive with respect to fibre supply from the FMA Area.

Measure

- Proportion of wood supply secured (i.e. from the FMA), financial performance, utilization levels (land and timber), public opinion surveys, rank in benchmarking

Strategies

- To be the forest products industry leader in forest stewardship – as judged by our employees, customers, communities and shareholders.
- Provide for low cost / good value timber.

Goal

Maintain forest diversity at the stand and landscape level in terms of structure, composition, and function.

Measures

- Forest age class distribution over time, presence of late seral forest stages (amount, distribution and size), stand level retention (trees, snags, patches, woody debris), research and inventory of non-timber resources, disturbance patterns, presence of rare & endangered species.

Strategies

- Conserve habitat for rare and endangered species.
- Provide habitat for all species (e.g., biodiversity).
- Improve our knowledge of the response of fish and wildlife to our forest management activities.
- Maintain a forest of all different age classes over time.

Goal

Maintain the productive capacity of the forest.

Measure

- Amount of area disturbed or reclaimed, amount of area afforested, amount of area removed from the FMA

Strategy

- Maintain soil productivity by minimizing disturbance, and by reclaiming and restoring potentially productive sites.

Goal

Improve public acceptance of Weyerhaeuser's – Drayton Valley forest management activities.

Measure

- Demonstration of public involvement and education opportunities (including responses), number of stakeholder issues unresolved by Weyerhaeuser, environmental certification (e.g. ISO, CSA), public opinion surveys, number of penalties, participation in research.

Strategies

- Obtain meaningful input from the public on our forest management activities.
- Ensure ongoing consultation with stakeholders, including an issue resolution process.
- Educate and communicate with the public about the forest, and Weyerhaeuser's forest management activities
- Demonstrate commitment to and progress towards continuous improvement of Weyerhaeuser's skills in forest management and knowledge of ecosystem processes.
- Manage and conduct our forest management activities in a socially acceptable manner.

Goal

Integrate with the management activities of other resource users.

Measure

- Changes to FMA AAC or sequencing, number of stakeholder issues unresolved by Weyerhaeuser, alignment with Provincial Integrated Resource Plans, amount and effectiveness of stakeholder consultation, stakeholder opinion

Strategies

- Manage access issues resulting from Weyerhaeuser's forest management activities.
- Work cooperatively with other resource users such as: other timber operators, the oil and gas industry, the grazing disposition holders, etc.
- Work cooperatively with recreational, and tourism stakeholders.
- Minimize visual impacts in sensitive areas.
- Cooperate with all land neighbors in the implementation of Weyerhaeuser's forest management activities.
- Work proactively to build mutually beneficial relationships with First Nations.

Goal

Protect unique archeological and ecological sites.

Measure

- Currency of knowledge and expertise of Weyerhaeuser on the topic, list of unique sites

Strategy

- Identify important archeological and ecologically sites during operational planning and consult appropriate authorities for protection requirements.

Goal

Maintain the integrity of watersheds.

Measure

- Monitoring activities and results, improvements to standards, research.

Strategy

- Comply with current legislation and Ground Rules for road and crossing construction to minimize the impact on water quality, quantity, and timing.

Goal

Increase the sustainable harvest level of deciduous and coniferous timber from the FMA Area.

Measure

- Utilization levels (timber, species, land), adherence to sequencing, enhanced forest management program delivery, amount of timber lost to natural causes.

Strategies

- Improve timber utilization.
- Improve the utilization of lands for forest production.
- Decrease loss of timber from natural causes.

2. OTHER (NON-TIMBER) RESOURCES

Weyerhaeuser is committed to applying the multiple use concept to ensure that the timber harvesting landbase from the FMA Area is sustainable over the long term. The DFMP goal of **integrating with the management activities of other resource users** will be achieved by the continued commitment to the Province's policy of integrated resource planning. In essence, this policy recognizes that managing one resource affects the management of other resources.

The FMA Area lies within portions of the Rocky-North Saskatchewan, Brazeau-Pembina, Coal Branch and Nordegg-Red Deer River Integrated Resource Planning Areas. The Integrated Resource Plans (IRPs) reflect the resource management "intents" from "A Policy for Resource Management of the Eastern Slopes Revised 1984" for their respective planning areas. The three broad areas of intent from the Eastern Slopes Policy are protection, management and development. These intents are implemented by establishing resource objectives that can be achieved within the planning areas under a multiple-use policy. These are defined geographically on the FMA Area by the IRP land use zones (see *Integrated Resource Plan Map* on page 18 of Appendix 4).

The Integrated Resource Planning process determines how the resource management objectives are to be achieved by establishing resource management guidelines. The Company's land use strategy for the FMA Area is to incorporate the IRP resource management guidelines at all levels of planning.

Sections I and III of this Plan estimate landbase area reductions required to meet other resource needs. The following sub-sections review integration guidelines for each major resource on the FMA Area and describe how the guidelines will be implemented or integrated into the Company's forest management operations.

2.1 Watershed

The highest priority in the overall management of the Eastern Slopes Region is placed on watershed management (A Policy for Resource Management of the Eastern Slopes, Revised 1984). Consequently, the Integrated Resource Plans emphasize water and water resources for the FMA Area. Aligning with the IRPs' emphasis, the Company has a goal to **maintain the integrity of watersheds** by complying with current legislation and Ground Rules for road and crossing construction to minimize the impact on water quality, quantity, and timing. The IRP guidelines that can be integrated with forest management are summarized as follows:

- seasonal restrictions will be considered in poorly drained and highly erodible areas;
- erosion, which is associated with surface disturbance and vegetation removal, will be minimized, particularly in close proximity to watercourses;
- greater coordination and management of linear developments is required to reduce problems with erosion and water quality (see Section II 2.8 *Road Development and Access Management*);
- the number of stream crossings will be minimized;
- emphasis will be placed on erosion control and reclamation; and
- specific concerns have been identified in three drainages: Rose Creek (water quality), Buster Creek (slumping), and Rundell Creek (bull trout habitat and slumping).

The IRPs stated that "increasing land use activities and identified problem areas are raising overall watershed management concerns." To address watershed concerns, Provincial watershed protection guidelines for timber planning and harvesting operations specify the following:

- watercourses are evaluated and classified (type and class) in order to determine protection requirements;
- where necessary, buffers are established to prevent soil disturbance and maintain a protective cover of vegetation;
- operations in water source and poorly-drained areas are restricted to dry or frozen periods; and
- extensive guidelines for planning, construction, maintenance, and abandonment and reclamation of roads and stream crossings are provided, all of which are designed to minimize soil erosion, sedimentation and impediment of watercourses.

All phases of forestry operations – from cutover design to reforestation – are conducted with the general intent of minimizing soil erosion and watercourse sedimentation. The primary objective in watersource areas is to maintain surface stability to prevent increased stream sedimentation.

As described in Section III 2 (*Landbase Determination*) an estimate of the landbase withdrawn for watercourse buffers has been accounted for in the annual allowable cut (AAC) calculation.

2.1.1 Provincial Water Act

The company, with the guidance of Alberta Environment, will adhere to the new Provincial *Water Act* and the corresponding regulations. The following table, from *Guide to the Code of Practice for Watercourse Crossings*, outlines the applicability of the *Water Act* to Weyerhaeuser's operations.

Table 25 – "Green Zone" Code of Practice for Watercourse Crossings

Situation	Exemption in Water Act	Code of Practice Applies	Other Requirements
Culvert crossing where culvert size is less than 1.5m in diameter and does not alter water body characteristics below the 1 in 25 year flood event.	Yes (Exemption applies)	N/A (Code does not apply)	Annual Operating Plan approval
Single span bridge crossing where bridge does not alter water body characteristics below the 1 in 25 year flood event.	Yes (Exemption applies)	N/A (Code does not apply)	Annual Operating Plan approval
Culvert crossings where the culvert size is greater than 1.5m in diameter	N/A (No Exemption provided for)	Yes (Code requirements apply)	Annual Operating Plan approval
Bridge crossings greater than one span	N/A (No Exemption provided for)	Yes (Code requirements apply)	Annual Operating Plan approval

The following map, from the *Code of Practice for Watercourse Crossings* provides the restricted activity period for coded watercourses. According to the map and the *Code* there are no class "A" or "B" watercourses in the FMA Area. The *Code* also outlines the rule for uncoded and unmapped watercourses on the FMA Area:

- Where an uncoded watercourse enters a class C watercourse, the portion of the uncoded watercourse for a distance of two kilometres upstream from the mouth of the uncoded watercourse is class C (e.g., Sand Creek), otherwise the watercourse is a class D.

- An unmapped watercourse that enters a mapped class C or D watercourse is labelled class C or D respectively for all unmapped portions. If an unmapped watercourse enters a fish-bearing lake, the unmapped watercourse is class C, whether or not the fish-bearing lake appears on a map.

Weyerhaeuser will strive to eliminate work during restricted activity periods so as not to disrupt the bed or banks of a water body or disturb fish or fish eggs during sensitive periods of their reproductive cycle. In the event that work is conducted during the restricted activity period the Company will, prior to commencement of work:

- obtain the recommendations and instructions of a qualified aquatic environment specialist; and
- provide this information to Alberta Environment for review and approval.

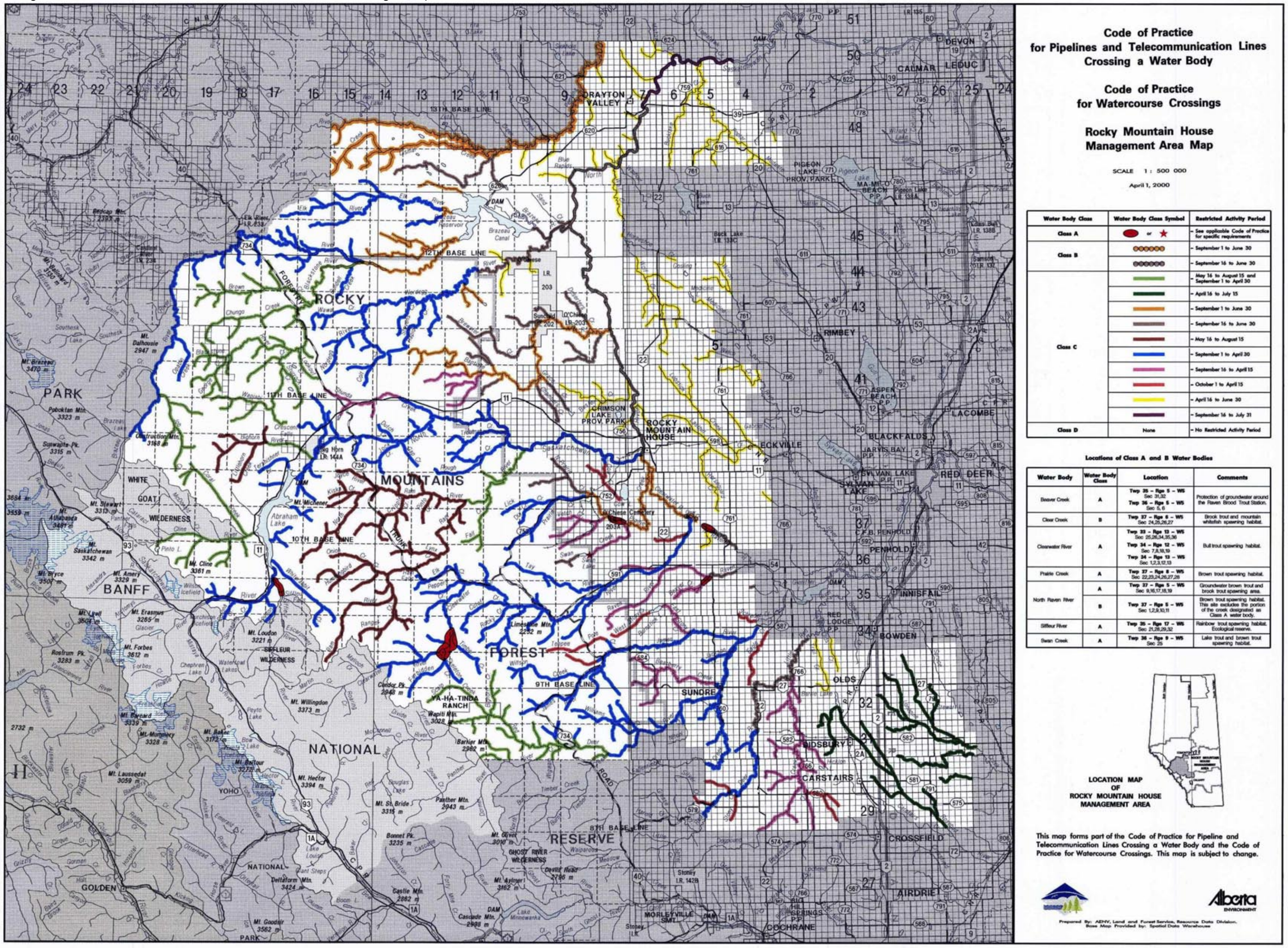
Weyerhaeuser will be seeking approval within the Annual Operating Plan for:

- classification of uncoded and unmapped watercourses;
- selection of watercourse crossing types;
- construction of watercourse crossings as outlined in table 25;
- work to commence on or near a watercourse during the restricted activity period (if necessary); and
- extension for temporary crossings beyond the six month period, if necessary, to allow for hauling and reforestation activities.

In compliance with the *Water Act* the Company will monitor the construction of watercourse crossings. For all crossings that occur on watercourses designated as class C, the Company, prior to commencement of work, will provide photographs of:

- the watercourse and its banks upstream from the watercourse crossing site;
- the watercourse and its banks downstream from the watercourse crossing site; and
- the banks at the watercourse crossing site, one of each bank taken from the opposite bank.

Figure 17 – Code of Practice for Watercourse Crossings Map



2.1.2 Road Development

Road construction can significantly increase erosion from exposed mineral soil and thereby increase suspended sediment loads and deposition in stream channels. However, careful construction, prompt re-vegetation, and sediment control measures at stream crossings will mitigate any potential impact. Weyerhaeuser uses the existing road network in the FMA Area wherever possible (see Section II 2.8 *Road Development and Access Management*), and new roads are sited to minimize impact by avoiding unstable areas and following natural contours and gentle slope to minimize the need for cut and fill. Cross-drainage is provided on permanent roads, and bridges or culverts of appropriate size are installed during road construction with adequate erosion protection at out-falls. Re-vegetation and erosion control on roads is an integral part of the construction process. Erosion control devices are installed, and disturbed areas along rights-of-way are re-vegetated to ensure establishment of a vegetation mat capable of resisting erosion. Small bridge structures will be considered as an alternative to culverts where feasible and if they are deemed to reduce the impact of the crossing.

In addition to the Ground Rules, the following Company procedures will be used:

- In the process of harvest design development the Company will determine if there are any existing watershed crossing liabilities within the plan area and will work cooperatively with government agencies and other companies to correct the problem.
- All approved cutovers will require a road plan to determine the minimum amount of road required. The amount of area cleared for haul road and landings will be minimized.
- To accommodate reforestation activities, temporary roads will remain open for one year after completion of hauling operations. Temporary earth berms may be constructed prior to roll back in sensitive areas to restrict access.
- Whenever feasible, existing roads and linear developments will be utilized for access in harvesting operations.
- Annual inspections of watercourse crossings on Weyerhaeuser's permanent roads will be conducted, and records of such inspections will be reported in the Annual Performance Report to Land and Forest Service.

Watercourse crossing design is incorporated into road planning and design, and complies with detailed specifications given in the Water Act, Ground Rules, the NRS and LFS Guidelines, and other government guides, such as "Stream Crossing Guidelines – Operational Guidelines for Industry" (E.N.R. Report T/80). Adequate provision is made for fish passage on permanent and semi-permanent crossings of fish-bearing streams. This will involve design and sizing of culverts to allow upstream or downstream migrations, preferential use of bridges, locations of crossing to avoid critical habitat, timing of in-stream activities to avoid increased siltation during spawning periods, and provision of adequate winter flow to over-wintering areas. There is an extensive body of information on crossing and culvert design for fish-bearing streams, and consultation will be undertaken with Alberta Environment prior to construction.

2.1.3 Harvesting Practices – Riparian Forest Procedures

In development of the Ground Rules, Weyerhaeuser will implement the following procedures:

- On sensitive watersheds, the Company, in consultation with Alberta Environment, will determine if a watershed analysis is needed prior to logging. The consultation will confirm the extent of sensitive sites within the watershed, identify other factors (ecological or social constraints), and determine next steps.

- Watercourses will be the preferred block boundary in harvest designs, and the extent of harvesting following any watercourse will be minimized.
- Harvesting patterns will ensure that only one side of the riparian area of permanent creeks is harvested in one pass.
- All harvest designs will include (if necessary) a table that outlines which blocks and roads in the design do not meet Ground Rules guidelines for buffer and crossing requirements, why the proposed deviation is being recommended, and how any possible impact to the watercourse will be mitigated.
- In developing harvest designs, the Company will determine if there are any existing watershed crossing liabilities in the plan area and will work cooperatively with government agencies and other companies to correct any problem.
- All operating plans will indicate those areas deemed suitable for summer harvesting or access. Detailed block plans will be provided for all summer blocks where watershed sensitivity is high.
- Logging and crossing of watercourses in sensitive areas will be limited to winter when ground surface is frozen and the watercourse is frozen or dry.

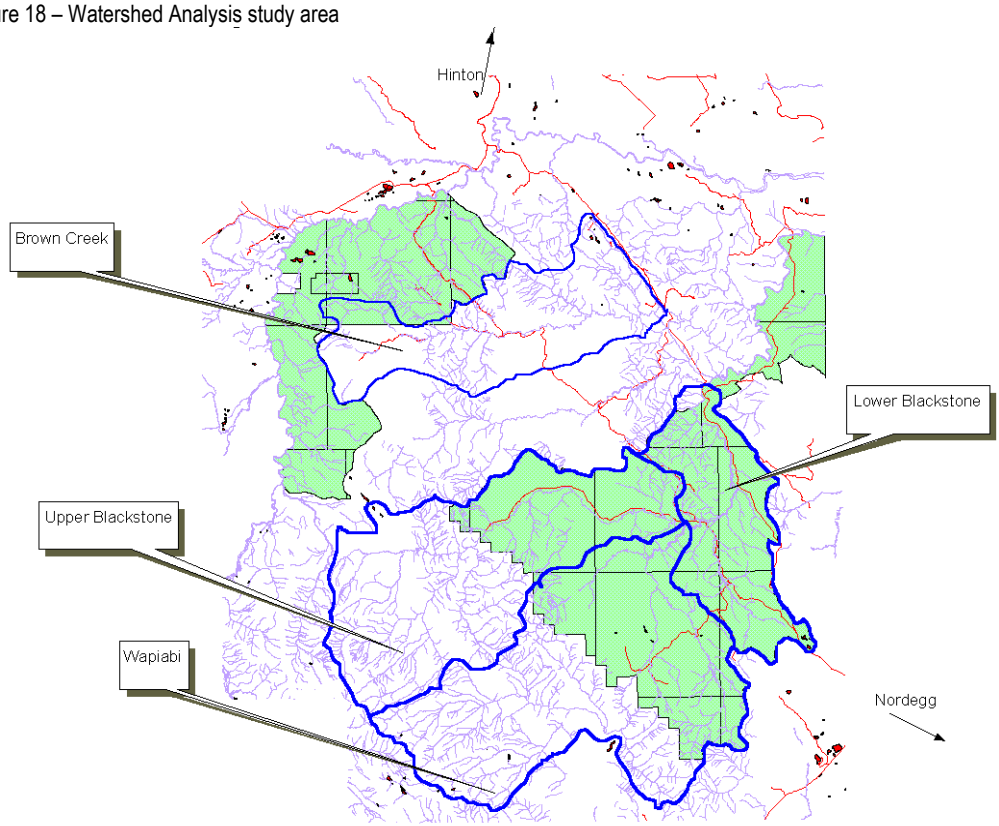
2.1.4 Watershed Analysis of the Blackstone and Wapiabi Region[26]

For the development of this Plan Weyerhaeuser assessed the hydrologic effects of proposed timber harvesting in the Blackstone and Wapiabi watersheds, which are located 30-km northwest of the town of Nordegg, Alberta. These watersheds are part of Weyerhaeuser's Forest Management Agreement area.

The area was divided into three watershed areas for analysis. The Wapiabi watershed upstream of its confluence with the Blackstone River is 299 km^2 in area. The Blackstone watershed was divided into the Upper Blackstone, 216 km^2 in area, and the Lower Blackstone, 132 km^2 in area (Figure 18). All three watersheds are well forested with lodgepole pine being the dominant species. Very little of the area has been harvested. Average annual precipitation and streamflow for the region were estimated based on available data as 587 mm and 276 area mm respectively.

[26] Watershed Analysis: Wapiabi and Blackstone Watersheds - Phase II: Hydrological Impacts of Forest Harvesting on Water Yield and Regimen, by: Watertight Solutions Ltd., August 2000

Figure 18 – Watershed Analysis study area



Hydrologic simulation of the effects of timber harvesting in the watersheds was done with the WRENSS Procedure which, provides an estimate of change in annual water yield and change in peak flows for the 2, 5, 10, 20, 50 and 100 year events. Simulations were done for basins ranging in size from 6-15 km^2 (small) to 15-100 km^2 (medium) and > 100 km^2 (large).

Four timber harvesting scenarios were tested. The first was a progressive clear cut with annual harvests of 200-400 ha/year. Harvesting was done until basins were fully harvested (80-90% timber removal). Harvesting in small watersheds was done in 2-3 three years, while 10-20 years was required in the large basins. The second scenario was a 2-pass harvest with approximately one-half of the merchantable timber removed in two 3-5 year periods separated by 15 years of no harvesting. The third and fourth scenarios were harvesting dispersed over 80 and 120-year "rotation" periods.

The simulations demonstrated small to modest increases in annual flows and peak flows following forest harvesting. Maximum increases in annual water yield were greatest for the clear-cut and 2-pass harvesting scenarios, averaging 13.2% and 11.4%. Average increases for the 80 and 120-year rotation harvests were 6.9% and 6.0%. Increases in annual water yield were in general greater for small watersheds than for large watersheds. Average increases in annual water were 11.6% and 10.7% for small and medium sized basins and 4.5% for large basins.

Increases in peak flows occurred in all of the harvesting scenarios. Increases were greater for the smaller return period events. Average increases for the 2-year to 10-year events ranged from 4.9% to 10.9% compared to 2.6% to 5.7% for the 20-year to 100-year events. The largest increases in peak flows occurred with the clear-cut and 2-pass harvesting scenarios, with averages ranging from 7.8% to 10.9% for the 2-yr and 10-year events. Average increases for the same events for the 80 and 120-year scenarios ranged from 4.9% and 6.5%.

Increases in peak flows by watershed size were similar to those of the harvesting scenarios. The greatest increases occurred with the clear-cut and 2-pass scenarios on the small watersheds, followed by the medium and large basins. Average increases in peaks for the 2 to 10-year events on small watersheds ranged from 5.9% to 13.5% compared to 5.4% to 11.9% on medium watersheds and 2.9% to 7.2% on large watersheds.

Table 26 – Percent change in peak flows by return period

Harvesting Scenario:	2-yr	5-yr	10-yr	20-yr	50-yr	100-yr
Clear-cut	10.9	10.2	7.8	5.7	4.0	3.1
2-Pass	9.6	9.5	7.8	5.7	4.0	3.1
80-year rotation	6.1	6.5	6.3	5.6	4.0	3.1
120-year Rotation	5.0	5.3	4.9	4.4	3.4	2.6
Watershed Size:						
Small Basins < 15 km²						
Clear-cut	13.5	12.8	9.8	7.4	5.4	4.4
2-Pass	9.8	9.9	8.3	6.3	4.6	3.8
80-year rotation	7.5	8.0	7.6	7.1	5.5	4.4
120-year Rotation	6.4	6.8	5.9	5.2	4.4	3.5
Medium Basins 15 – 100 km²						
Clear-cut	11.9	9.3	6.4	4.7	3.3	2.5
2-Pass	11.1	9.3	6.4	4.7	3.3	2.6
80-year rotation	6.5	7.1	6.4	4.7	3.3	2.5
120-year Rotation	5.4	5.8	5.4	4.4	3.1	2.4
Large Basins > 100 km²						
Clear-cut	6.6	7.2	6.2	4.1	2.5	1.8
2-Pass	6.6	7.2	6.1	4.2	2.5	1.8
80-year rotation	3.8	4.2	4.4	4.2	2.6	1.8
120-year Rotation	2.9	3.1	3.3	3.3	2.3	1.6

The simulations showed two general patterns to forest harvesting in the scenarios tested. The clear-cut and 2-pass harvests characterize the first pattern, where harvesting was concentrated spatially and temporally. In this situation, water yield increases occurred earlier and at relatively higher levels and higher peaks and then steadily decreased. The second pattern is characterized by the 80 and 120 year rotations, where harvesting is dispersed or spread out spatially and temporally. In this situation, water yield steadily increases with harvesting, with maximum flows occurring towards the middle or end of the harvesting pattern. Flow changes with the clear-cut and 2-pass scenarios are higher than in the 80 and 120-year scenarios, but are of a shorter duration.

Increases in annual water yield were modest and, in most situations, will fall within the range of natural variability for the region. Application of a 13% increase to the seasonal flows of nearby Brown Creek did not cause them to exceed the long-term average flow plus one standard deviation (i.e. upper limit for natural variability). In contrast, application of a 23% increase to seasonal flows caused 5 years out of 22 years of flow record to exceed the upper range of natural variability. Regression analysis of flow increases on area harvested showed a gain of 5.5 mm for each 10% increase in harvest area.

Application of simulated increased peak flows to Brown Creek also suggested these changes will fall within the range of normal variability. Simulated changes in peak flow varied from 1-13%. The coefficient of variation of daily maximum flows in Brown Creek is 104%. Analysis of the results also indicates a small increase in the frequency of maximum flows following harvesting. With the application of a 13% increase to the 2-year event in Brown Creek, its magnitude increased from 12.88 m^3/sec to 13.9 m^3/sec and its frequency was increased by 6%.

In conclusion, to minimize the impacts of forest harvesting on water flows and to have changes in flow not exceed the limits of normal variability, timber harvesting should be well distributed spatially and temporally over a watershed. This will allow for a good mix of harvested and unharvested areas, which will minimize flow changes and facilitate hydrologic recovery. Limiting annual yield increases to less than 20% should minimize impacts and insure changes fall within the limits of natural variability for the region. This is especially the case for small and medium sized sub-watersheds where impacts of harvesting will be greatest. Impacts on the main stem channels of the Upper Blackstone and the Wapiabi watersheds will be small, largely because of the moderating effect of no harvesting in the upper parts of these basins.

2.1.5 Watershed Objectives

Table 27 – Watershed Objectives

Objective	Target
Comply with the provincial Water Act	• Work with Alberta Environment to ensure no penalty actions.
Follow provincial guidelines for road and crossing construction	• Follow the Provincial *Stream Crossing Guidelines.* • Prompt re-vegetation and sediment control measures at stream crossings. • Annual inspections of watercourse crossings on the Company's permanent roads.
Minimize erosion potential from temporary inter and intra block roads	• Roll back the Company's temporary roads within one year of completion of hauling. • Prompt re-vegetation and sediment control measures at stream crossings.
Minimize the amount of new road construction by the Company	• Use existing roads. • Develop road plans for all harvest blocks to determine the minimum amount of road required. • An average of less than 5% of the block area to be disturbed for roads and landings.
Complete a watershed assessment for all harvest designs	• Follow the Provincial *Predisturbance Watershed Assessment Manual.* • Assess the harvest design area for existing watercourse crossing liabilities.

Table 28 – LMU Specific Watershed Objectives

LMU	Objective
Baptiste	• Objectives common to all of FMA Area
Blackstone	• Analyze the watershed assessment completed for the Blackstone watershed to establish guidelines for acceptable levels of timber harvesting on a watershed.
Elk River	• Objectives common to all of FMA Area
Marshybank	• Complete a watershed analysis for the sub-watershed basins in the LMU to establish guidelines for acceptable levels of timber harvesting on a watershed.
Medicine Lake	• Objectives common to all of FMA Area
Nordegg River	• Objectives common to all of FMA Area
O'Chiese	• Objectives common to all of FMA Area
Sand Creek	• Objectives common to all of FMA Area
Tall Pine	• Objectives common to all of FMA Area
Willesden Green	• Objectives common to all of FMA Area

2.2. Biodiversity, Wildlife and Fisheries Resources

Weyerhaeuser's goal to maintain forest diversity at the stand and landscape level in terms of structure, composition, and function will be achieved by:

- providing habitat for all species;
- improving our knowledge of the response of fish and wildlife to our forest management activities;
- conserving habitat for rare and endangered species; and
- maintaining a forest of all different age classes over the period of the Plan.

2.2.1. Biodiversity

In a general sense, the term "biological diversity" refers to the variety of life and the processes that support it. However, the term encompasses concepts that differ in context and scale. Biological diversity may refer to genetic diversity within a species, to the diversity of species within communities, or to the diversity of communities across landscapes and regions. At different spatial scales, the diversity of species and communities reflects a complex set of environmental conditions (topography, climate, soil, etc.) that change over time. Forest ecosystems are complex and dynamic mosaics of vegetation patches varying in size, composition, age structure and distribution. Their dynamic heterogeneity is driven by natural processes (e.g., succession), by stand-replacing events (e.g., fire, insect outbreaks, or disease epidemics), and by disturbances that occur at smaller scales (e.g., mortality of individual trees).

Depending on site-specific environmental conditions (e.g., soil, topography, climate), plants and animal species occur in different assemblages (communities) according to the stage of succession, the time since disturbance, and the scale (i.e., extent, intensity) of that last disturbance. To some degree, species are adapted to the disturbance regime of the region they inhabit. Hence, it is widely believed that the long-term sustainability of the forest ecosystem and the ecological requirements of most species can be addressed by emulating the inherent natural processes of disturbance and succession characteristic of a site and/or a region. Natural disturbance processes result in the maintenance of a variety of stand sizes, seral stages and stand attributes and structures across landscapes (*coarse filter* approach), within the range of natural variation in the system (i.e., the "*natural disturbance model*").

In accordance with the principles espoused by the Alberta Forest Legacy and the Canadian Biodiversity Strategy, Weyerhaeuser will address concerns about the conservation of biodiversity by adopting a coarse filter approach. This requires managing forest ecosystems as a whole, recognizing their dynamic nature, the autecology and successional patterns of the major tree species, and the dependence of all biota on the presence of a variety of structures and seral stages widely distributed over a forested landscape. The coarse filter approach requires:

1. planning and operating over large landscapes;
2. maintaining landscape interspersion, diversity, and connectivity, and minimizing fragmentation; and
3. retaining structural diversity at the stand level.

Consistent with the above concepts, in its progress towards ecologically sustainable forest management practices in Alberta, Weyerhaeuser has developed operationally-based ecological guidelines. These guidelines will be integrated with timber supply analysis, operational considerations, and societal values, within the forest management planning process.

The approach to maintaining biodiversity in FMA Areas in Alberta managed by Weyerhaeuser is outlined in Appendix 2**.**

The coarse filter approach will be complemented by a fine filter component to address the habitat needs of feature species[27] and both approaches will be integrated in Weyerhaeuser's forest management plans.

2.2.2 Fish and Wildlife

The main strategy to address specific wildlife and fisheries concerns will follow the guidelines contained in the Integrated Resource Plans for the region. These Plans identify primary fisheries and wildlife resource concerns for the FMA Area, and outline critical wildlife habitat (Zone 2 areas). The IRP management guidelines reflect potential concerns and benefits from forest management activities. The general guidelines are summarized as follows:

a) Sportfish populations and habitat will be protected by minimizing contact between resource developments and streams, by maintaining water quality and by reclaiming disturbed sites.

b) Disturbance of wildlife populations during sensitive time periods will be minimized.

c) Natural Resources Service (Fish and Wildlife) will continue to review and provide input to government referrals on land use activities with potential for impact on wildlife and fisheries resources. Emphasis will be placed on avoiding unnecessary negative impacts and on working cooperatively with resource users to take advantage of opportunities for habitat enhancement.

d) Harassment and habitat destruction around colonial nesting sites, aeries, den sites and mineral licks will be minimized.

e) Disturbance of wildlife will be reduced by managing access.

IRP management guidelines more specific to the Drayton Valley FMA Area related to forest management are summarized below. Some of these guidelines are consistent with Weyerhaeuser's coarse filter approach to maintain biodiversity.

a) A number of Zone 2 Critical Wildlife areas are defined on the FMA Area (see *Integrated Resource Plan Map* on page 18 of Appendix 4). These are intended to protect winter ranges and migratory routes for ungulates.

b) The forest should be managed to maintain a broad range of species and age classes, which will optimize wildlife productivity (and hence biodiversity).

c) Existing and proposed timber harvesting operations dictate that watershed protection and water quality must be carefully maintained. Problems resulting from timber harvesting must be corrected.

d) Habitat areas that are critical for the indicated fish populations must be protected. These areas are expected to occur in the major watercourses of the FMA Area, however the IRPs acknowledge that more specific information on key habitat areas is needed.

2.2.3 Operational Planning Considerations

Timber Harvest Planning and Operating Ground Rules on planning, harvesting and reclamation are implemented to protect fish and wildlife habitat during timber harvesting operations. These Ground Rules are established by Alberta Environment jointly with the forest industry and, in

[27] "Feature" species are those that are rare, threatened, endangered or of social value.

addition to protecting habitat, they also support the broader IRP guidelines and integrate with forest management objectives. All levels of planning activity by the Company are reviewed by Alberta Environment to ensure the Timber Harvest Planning and Operating Ground Rules are incorporated appropriately in timber harvesting operations. In implementing these Timber Harvest Planning and Operating Ground Rules, Weyerhaeuser has developed "Stand Level Ecological Guidelines" (Appendix 6) that provide strategies and targets for Company operations.

Several factors are particularly important in operational planning considerations:

a) stand retention;

b) old growth strategy;

c) harvest patterns;

d) harvest area design;

e) recognition of areas of special importance to plants and wildlife species;

f) timing of operations; and

g) fisheries habitat.

Each of these factors is discussed below.

a) Stand retention

The retention of trees, snags and woody debris in cutovers is a very significant component of ecologically based forestry and is also consistent with the goals, strategies and objectives outlined in the Plan.

a) Retaining trees within cutovers creates harvest designs that more closely mimic post-disturbance conditions and therefore lessen the impact of logging on ecosystem structure and function. Tree clumps and snags increase the structural diversity of the regenerating stand, retain some later seral conditions such as a multi-layered canopy, provide a future supply of large snags and down logs, and increase micro-site variability for a more diverse plant understory. They also provide ecological sites (refugia) from which unaffected plant and animal species can disperse onto the surrounding cutover.

b) Snags (dead trees) play a very important role in a functioning forest ecosystem. In addition to their value in recycling nutrients, snags provide habitat for many species of plants, invertebrates, birds and mammals. The presence of snags is a major limiting factor for cavity nesting birds, influencing their occurrence and distribution. Retention of large snags on cut-over areas may be prescribed to provide habitat for cavity nesters.

c) Woody debris left in piles and dispersed over the block provides valuable hiding and nesting cover for a variety of small mammals.

In order to achieve or maintain stand level structural diversity, the following general principles will be followed:

a) Safety is a primary concern and must be ensured at all times as noted in the Alberta Forest Products Association tree retention guidelines (*Residual Trees in Cutovers Guidelines)*.

b) Every cutover will retain some form of vertical structure to ensure consistency with the timber harvest planning and operating Ground Rules. However, the amounts will vary as site conditions and site-specific objectives allow.

Retention of structure within cutovers is site-specific, as wet sites, unmerchantable areas and understory protection provide opportunities to retain various structural components (clumps, etc.) and they contribute to stand diversity in the regenerating forest. This practice will also protect soil and sensitive sites that may harbor rare plants and small wildlife species.

Retention opportunities are available on a site-specific basis and depend on:

- preharvest stand condition;
- topography;
- identified values; and
- operational and economic feasibility.

Several retention options are available for consideration by the operations planner and supervisor:

- snags;
- single green trees;
- patches varying in size, shape and location of unmerchantable and merchantable trees; and
- coarse, down woody debris (including brush pile retention).

Merchantable retention can vary on any particular harvest stand area from zero to five percent. These values are estimates based on current knowledge and experience, and may be adjusted accordingly.

b) Old growth strategy

Forest ecosystems are a complex mosaic of stands of different age, structure and composition, reflecting a continuous process of renewal through establishment, growth, death and re-establishment. Natural disturbance events such as fire, insects and disease, play a critical role in maintaining a balanced forest ecosystem and functioning ecological processes.

Very late seral stages ("old growth") are an important component of forests and landscapes. They not only provide habitat for numerous "old growth"-dependent species, but their presence is considered essential to the long-term sustainability of forest ecosystems.

This section outlines Weyerhaeuser's approach to the maintenance of "old growth" in the Drayton Valley FMA Area.

A definition of old growth

There is no widespread agreement on what constitutes "old growth" forest. Peterson et al (1995)[28] listed 26 different definitions from different authors and geographic areas. In general, all definitions refer to "old growth" as being a unique successional stage in the life of a plant community, where the structural and compositional features support specific "old growth" ecological processes.

The State of Canada's Environment classified "old growth" forests where trees are 140 years or older (Watson 1993)[29]. This contrasts with the 275-300 year range for coniferous forests

[28] Peterson, E.B., N.M. Peterson and K.A. Enns. 1995. Guidelines for old forest management in Elk Island, Jasper, Yoho, Kootenay, Banff, and Waterton Lakes National Park. Prepared for Canadian Heritage, Parks Canada, Alberta region. 78pp.

[29] Watson, B.G. 1993. Canadian Views on old growth forests. Forestry on the Hill Spec. Issue 5: 1-2

referred to by Achuff (1989)[30] for Canada's five Rocky Mountain National Parks. In the United States, the Forest Service has characterized old growth as "*later stage(s) in forest development which may be distinctive in composition but are always distinctive in structure from earlier (young and mature) successional stages*" (Moir 1992)[31]. However, Hunter and White (1997)[32], after an extensive review of numerous studies on forest ecology and development, concluded that there is no evidence of the existence of distinct thresholds between what might be called a mature forest and "old growth." According to Hunter and White (1977), forest succession and development is a continuum of changes in structure and composition where no specific age can provide an "*unambiguous threshold on which to base a definition."*

The absence of an age where "mature forest" can be distinguished from old growth does not imply that older stands are similar to younger ones or that older stands do not provide important ecological and wildlife values due to unique structural and compositional characteristics. On the contrary, the absence of a discrete age for distinguishing between mature forest and "old growth" suggests that managers need to identify the characteristics that make older stands valuable and to manage for this ecological uniqueness. The work of Hunter and White would also suggest that these unique characteristics will vary by ecosystem and at times ecosites. To date, there are no templates that can be used in all situations. Further, "old-growth" attributes that provide ecological and social values may be reached at different ages depending on the:

1. site-specific ecology of the forest stand;
2. successional stage and disturbance history;
3. structural and compositional characteristics;
4. relative contribution to the forest landscape; and
5. the relative rarity of this stage of development.

The quality of the growing space (Site Index) is also an important factor because trees grow larger, faster on better sites. The management of late seral stages may depend on their specific degree of structural diversity, on what Spies and Franklin (1988)[33] called an index of "old-growthness." However, much of the preceding considerations also apply to all other successional stages, which should be represented in an area where they are developing.

Weyerhaeuser's approach

Fire is a natural abiotic factor that has played an important function in the development of the forest ecosystem in the Drayton Valley FMA (see Section I 3.2.4 *Description of FMA Natural Disturbance Patterns*). Fires have been important in maintaining the diversity and vigor of the forested foothills, as they have in many other regions of Alberta (Kelsall et all. 1977)[34]. Young forests, almost all of which are the results of past fires, are characterized by thick stands of small lodgepole pine or aspen, depending on the site. These stands support a large number of wildlife and plant species. Very late stands (140 years or older) occur on sites that have escaped recent forest fires and are usually dominated by long-lived and large white spruce and fir, with a sparse, well-shaded understory. These stands may contain organisms native to this geographic area but which are found nowhere else due to the characteristics of these stands. More

[30] Achuff, P.L. 1989 Old Growth forests of the Canadian Rocky Mountain National Parks. Nat.. Areas J. 9(1):12-26

[31] Moir, W.H. 1992. Ecological concepts in old-growth forest definition. In: Old-growth forests in the Southwest and Rocky Mountain regions, Proc. of a workshop, Portal, Arizona, USDA General Tech. Rep. RM-213. pp.18-23.

[32] Hunter, M.L. Jr. and A.S. White. 1997. Ecological thresholds and the definition of old-growth forest stands. Natural Areas Journal 17(4): 292-296.

[33] Spies, T.A. and J.F. Franklin. 1988. Old growth and forest dynamics in the Douglas-fir region of western Oregon and Washington. Natural Areas Journal 8(3): 190-201.

[34] Kelsall, J.P., E.S. Telfer and T.D. Wright. 1977. The effects of fire on the ecology of the Boreal Forest, with particular reference to the Canadian north: a review and selected bibliography. Can. Wildl. Serv. Occasional Paper 32.

importantly, these organisms may contribute significantly to the overall biodiversity of the region and, further, they may be important to the ecological maintenance of these ecosystems.

Because fire is an important factor in boreal forest ecosystems, an age-class distribution similar to the one that results from periodic burning is an essential feature of responsible forest management. In that context, Weyerhaeuser will work toward achieving a forest age distribution similar to what would occur under more natural conditions. This distribution will attempt to achieve a more desirable balance between environmental, economic, and social values.

Restoring a pre-1900 age-class distribution would produce a forest where most stands would be very young. The reduction in the abundance of older-aged stands would potentially reduce the diversity of wildlife species dependent on late seral stage forest. However, an age-class distribution, such as the one dominant today, results in large expanses of forest reaching old age with an increased risk of fire, insect infestation or disease outbreak. The aging forests also limits availability of early seral stages and, hence, the habitat for wildlife species that depend on those stages.

In planning for future forest landscapes, Weyerhaeuser will attempt to maintain a range of age structures consistent with the inherent ecological processes characteristic of each natural subregion. These natural subregion-specific age structures will determine the percentage of forest in late to very late seral stages that will be maintained over the planning horizon.

The amount and distribution of late seral stages (see Section I 3.2.3 *Age class and seral stage description*) are highly influenced by topography and climate, which influence landscape burning patterns (Andison 1997[35], Feunekes et al. 1993[36]). The amount and distribution will likely vary, depending on elevation, aspect, slope and soil moisture. Generally, late seral stages are more likely to be found on sites with higher levels of soil moisture; such as on northwest, north-northeast and east facing slopes. South and southwest facing slopes and well-drained sites have the highest chance of being burned. Hence, these sites burn more frequently and are the least likely to support older forest stands (White 1985)[37]. Consistent with this natural distribution pattern, Weyerhaeuser will strive to retain late seral stages on sites where they would more likely be found, specifically in high moisture areas, on north, north-northeast and east facing slopes, and along side valleys that run southeast to northwest. This approach will be particularly applied in the Upper Foothills and Subalpine natural subregions where topography determines forest cover and more late seral stages tend to be found naturally.

While the amount of forest retained in late seral stages is important, its spatial distribution in relation to younger forest stands and its occurrence in a variety of patch sizes over the landscape are critical. To meet this objective, Weyerhaeuser will ensure that a range of patch sizes of late seral stages, including a number of patches larger than 300 hectares (Woodley and Forbes 1997)[38](if possible based on current landuse levels), is maintained in each Landscape Management Unit throughout the planning horizon.

Amount of forest in late seral stages

In the absence of an agreed upon definition of "old growth" (see Section II 2.2.3b *Old growth*), and while research is underway to assess ecological similarities and differences among older stands of different ages, Weyerhaeuser will ensure that a certain amount of forest older than "rotation age" will always be present within the Drayton Valley FMA (**late seral stages**: >110

[35] Andison, D.W. 1997. Landscape fire behaviour patterns in the Foothills Model Forest. Foothills Model Forest Report. Hinton, Alberta. 63 pp.
[36] Feunekes, U, Rogeau, M.P. and White, C.A. 1993. A fire growth model for the Central Rockies Ecosystem. Pages 47-59 in C.A. White and P.L. Achuff, tech coords. Proc. Of the Central Rockies ecosystem interagency fire management workshop, Feb. 23-25, 1993, Lake Louise, Alberta. Parks Canada, Banff, Alberta.
[37] White, C.A. 1985. Wildland fires in Banff National Park, 1880-1980. Parks can., Nat. Parks Br., Ottawa, Ontario. Occasional Paper # 3
[38] Woodley, S and G. Forbes. Editors. 1997. Forest Management Guidelines to protect native biodiversity in the Fundy Model Forest. Greater Fundy Ecosystem Research Group. New Brunswick Co-operative Fish and Wildlife Research Unit, University of New Brunswick. 35 p.

years for conifers and >80 year old for deciduous, see Section I 3.2.3 *Age class and seral stage description*). In addition to the amount retained past rotation age, Weyerhaeuser will ensure that a percentage of past rotation forest will be in **very late seral stage** (> 140 years) condition.

Late and very late seral forests of each type will be maintained within each natural subregion to accommodate plant and wildlife species dependent on these older forest types. The following minimum retention amounts reflect ecological requirements at the natural subregion level. The amounts were derived from analysis of the current age class distribution, a coarse level assessment of historical trends, and natural disturbance patterns of each natural subregion. **In addition** to these minimum amounts, Weyerhaeuser **will protect rare old stands** as they are identified within the FMA Area. A research project has been initiated to identify these sites and is expected to be completed by February 2001. Furthermore, current Weyerhaeuser practices to retain stand level structure in cutovers (see Section II 2.2.3 a) Stand Retention) will provide structural diversity in regenerating forests and create some old forest structures throughout the rotation. Similarly, residual patches of >0.5 ha should retain some old forest characteristics in cutovers immediately after harvest, while smaller patches and single residual trees may create old forest structures late in rotation (J. Schieck 2000) [39].

In the Lower Foothills natural subregion, minimum retention levels will be 5% of the late seral class, of which 1% is in very late seral stage (>140 years). This retention level will apply to all plant species associations except white spruce and lodgepole pine. This is because pure white spruce usually only occurs in the older seral stages (in the younger stages it occurs mainly in mixedwood stands). The minimum retention levels for pure white spruce are increased to 10% for the late seral stage of which 2% is in very late seral stage (>140 years). In contrast, lodgepole pine stands are usually of a fire origin and stands older than 110 years are unlikely to remain on a landscape for a significant length of time. For that reason, minimum retention amount for lodgepole pine is 1%.

Table 29 – Proposed Minimum Retention within the Lower Foothills Natural Subregion

Amount of late seral stages in the Lower Foothills of the Drayton Valley FMA (% of cover type)			
Forest Type	**Current amount older than 80 years for deciduous and 110 years for mixed wood and coniferous forests (% of forest cover type)**	**Amount present in 1950[40]**	**Minimum retention**
Deciduous forest (81,674 ha)	**3.1%**	**0%**	**5%**
Mixed wood forest (55,569 ha)	**10.6%**	**0%**	**5%**
Pine-spruce forests (105,351 ha)	**21.3%**	**0.6%**	**5%**
Lodgepole pine forest[41] (46,787 ha)	**9.5%**	**0%**	**1%**
White spruce forest (15,899 ha)	**25.9%**	**0.3%**	**10%**

[39] Jim Schieck, Provincial Biodiversity Specialist Resource Conservation & Planning Branch Fisheries and Wildlife Management Division, Natural Resource Service, Edmonton. September 27, 2000, letter to Jim Allen, Wildlife Biologist, Rocky Mountain House regarding Weyerhaeuser Old Growth Strategy.

[40] The amount present in 1950 is outlined here only to show a point in time when the forest in the Drayton Valley FMA was significantly younger than it is now.

[41] Lodgepole pine and white spruce forests are defined as having a minimum of 80% of the respective species in the AVI call.

In the Upper Foothills, the minimum retention levels of late seral stages are higher, thus reflecting the naturally longer fire cycle, and higher probability that older stands remain in the landscape for longer periods. In this Subregion, minimum retention levels are as follow: for deciduous and mixed wood stands, 5% of the late seral stage (>110 years), of which 2% will be in the very late seral stage (> 140 years); for lodgepole pine forests, 2% of the late seral stage (>110 years), of which 1% will be in the very late seral stage (>140 years). The minimum retention for lodgepole pine-white spruce forests increased to 10% for the late seral class (>110) and to 5% for the very late seral class (>140) reflecting successional trajectory from pine to spruce dominated forests. The minimum retention for white spruce (or Engelmann spruce) is increased to 15% for the late seral class and to 5% for the very late seral class.

Table 30 – Proposed Minimum Retention within the Upper Foothills Natural Subregion

Amount of late seral stages in the Upper Foothills of the Drayton Valley FMA (% of cover type)			
Forest Type	**Current amount older than 80 years for deciduous and 110 years for mixed wood and coniferous forests (% of forest cover type)**	**Amount present in 1950[42]**	**Minimum retention**
Deciduous forest (1,049 ha)	**3.5%**	**0%**	**5%**
Mixed wood forest (1,919 ha)	**9.7%**	**0%**	**5%**
Pine-spruce forests (21,852 ha)	**47.5%**	**16.0%**	**10%**
Lodgepole pine forest (24,239 ha)	**15.6%**	**0.3%**	**2%**
White spruce forest (6,099 ha)	**69.9%**	**5.1%**	**15%**

The Subalpine natural subregion is known to experience less frequent, but more catastrophic, fire events. In this natural subregion, older stands have a higher probability of remaining on the landscape for longer periods than in the other natural subregions. The Subalpine natural subregion has a longer fire cycle (table 10, Section I 3.2.4) reflecting a generally cooler, wetter climate, and less lightning activity. Consistent with this natural pattern, in the Subalpine, Weyerhaeuser will maintain greater amounts of late seral stages as follows: minimum retention for lodgepole pine forests will be 5% of which 2% will be in the very late seral stage (>140 years). The minimum retention for lodgepole pine-white spruce forests remains at 10% for the late seral class (>110) and 5% for the very late seral class (>140) reflecting successional trajectory from pine to spruce dominated forests. However, the minimum retention for Engelmann spruce (or white spruce) is increased to 20% for the late seral class (>110 years) and to 5% for the very late seral class (>140 years).

[42] The amount present in 1950 is outlined here only to show a point in time when the forest in the Drayton Valley FMA was significantly younger than it is now.

Table 31 – Proposed Minimum Retention within the Subalpine Natural Subregion

Amount of late seral stages in the Subalpine of the Drayton Valley FMA (% of cover type)			
Forest Type	**Current amount older than 110 years (% of cover type)**	**Amount present in 1950[43]**	**Minimum retention**
Pine-spruce forests (4,798 ha)	**60.3%**	**25.8%**	**10%**
Lodgepole pine forest (1,498 ha)	**13.1%**	**1.7%**	**5%**
White spruce forest (2,701 ha)	**90.4%**	**44.3%**	**20%**

Research and monitoring

Weyerhaeuser's strategy to address the maintenance of "old growth" is based on the best current understanding of ecological processes and is a first step towards ecologically-based forest management. Approaches and strategies may change as our knowledge base expands.

Ultimately, the success of ecologically based forest management in maintaining biodiversity and the sustainability of forest ecosystems hinges on better understanding forest ecosystem processes, local disturbance regimes, and the range of natural variation in forest structure and diversity. To meet this objective, Weyerhaeuser in Alberta is supporting and sponsoring numerous university-based research initiatives that are being used to continuously adjust and improve current strategies and practices.

In acknowledgment of the uncertainty surrounding forest ecosystems and our still limited understanding of ecological processes and animal-plant relationships, Weyerhaeuser in Alberta is committed to continuously assess the potential impact of its operations and to monitor to ensure that specific forest management objectives are met. The objectives of research and monitoring are to:

- measure compliance with the strategy;
- assess the effectiveness of the strategy in meeting biodiversity objectives;
- understand the difference in structure and composition of old stands of different ages;
- identify wildlife species that depend on late seral stages and maintain their habitat in amount sufficient to support viable populations; and
- identify and protect a representation of very old stands that may be ecologically unique.

c) Harvest patterns

To maintain forest diversity at the stand and landscape level, Weyerhaeuser will employ the following techniques to establish the harvest pattern across the FMA Area:

- multiple pass harvesting at the landscape level;
- a forest stand-replacing silviculture system (clearcutting);
- dispersed logging by sequencing stands across the FMA during each five-year period;
- identify and protect unique habitat types from harvesting; and

[43] The amount present in 1950 is outlined here only to show a point in time when the forest in the Drayton Valley FMA was significantly younger than it is now.

- as described above, the maintenance of late and very late seral stages across the FMA Area.

The Timber Harvest Landbase (THLB) has been identified through the process described in Section III 2 (*Landbase Determination*). Eligible stands from the THLB are sequenced, evaluated and scheduled for harvest (Section II 3.2) in the General Development and Annual Operating Plans. This approach to harvest design and operations results in harvested stand areas with various sizes, shapes and structures that more closely resemble stands currently found in the FMA Area.

The number of cuts, their distribution over the landscape and the amount of timber harvested in any single area may vary to meet the needs of interior habitat species for large areas of unfragmented forest, to conserve biodiversity, ensure ecological sustainability, and to meet the needs of key wildlife species.

d) Harvest area design

The design of harvest areas is another primary tool to conserve biodiversity and protect wildlife, their habitat and the landbase in general. Harvest areas are designed to follow natural terrain features and contours as well as timber type boundaries. This benefits wildlife by maintaining the natural edges as well as adjacent protective cover and by minimizing watershed damage, blowdown and aesthetic impacts.

Harvest area shapes result from the design and operations directly associated with each forest stand. The boundary of the forest stand primarily defines the shape of the harvest area. Terrain features, access, water source areas and stand structure are all taken into account. Fish and wildlife values are also considered in the final design and operations.

The dimensions and shapes of harvest areas vary to reflect current landscape structure and diversity of individual Landscape Management Units, as described in Section I 3.2.3 *Landscape Characteristics*. Irregular block shapes are preferred because they minimize lines of sight. The range of size of harvest areas will vary depending on their irregular shapes and on the amount of patches of timber left as cover for wildlife. The key objective in design is to ensure sufficient contiguous protective cover and use of the regenerated area.

e) Recognition of areas of special importance to plants and wildlife species

In a forest ecosystem, many unique sites can host rare plant communities and/or species and provide habitat for small mammals, amphibians, reptiles, and invertebrate species. When these sites (e.g., nest sites of raptors or other species such as heron) are identified, they will be integrated into forest management planning (see Section II 2.7 *Ecological and Archeological Resources* for process on identifying, recording and tracking these finds).

Buffers of standing timber are usually prescribed for important wildlife habitat areas such as:

a) key wildlife travel corridors;

b) key wildlife ranges; and

c) fisheries.

The size and location of the buffer is governed by the need to provide protective cover and minimize disturbance. Buffers may be selectively logged where a visual impediment is maintained. In general, harvesting patterns will ensure that only one side of riparian areas or natural meadows is harvested in one pass, and that the extent of any cutover along a watercourse is minimized.

The Integrated Resource Plans for the FMA Area have also zoned areas within the Blackstone and Marshybank LMUs for Prime Protection. These areas are situated along high elevation forest and bare rock of the Bighorn Range. Weyerhaeuser has excluded these areas from the timber harvesting landbase.

f) Timing of operations

On key ungulate winter range (that is, Zone 2 areas), operations are preferably scheduled for summer, late fall or early winter to avoid disturbing animals during critical periods when energy reserves are low. Compressing the period of activity will also reduce impacts on wildlife. The extent of harvesting operations within such areas at any one time may be minimized to allow ungulates access to escape terrain and to provide continuing secure habitat.

g) Fish habitat

Fish habitat is protected by minimizing stream siltation and providing continued flow throughout the year on permanent watercourses that may be used by fish at various times in their life cycle. Increased sediment load in the water may interfere with growth of aquatic plants and small invertebrates that provide cover and food for fish. Once settled, sediment can smother fish eggs on spawning beds and change groundwater flow patterns that affect availability of oxygen over the winter. Suspended sediment can also irritate the respiratory system of fish and make them susceptible to disease. Fish will change their movements to avoid sediment plumes and this may interfere with emergence, rearing, and migration.

As outlined in Section II 2.1 Weyerhaeuser has a number of watershed strategies to be implemented during timber harvesting and road construction to minimize the potential for damage to fish habitat. The Company will continue to work with other agencies (e.g. Alberta Conservation Association) to assess and gather fisheries data for the watercourses on the FMA Area.

2.2.4 Biodiversity, Wildlife and Fisheries Objectives

Table 32 – Biodiversity, Wildlife and Fisheries Objectives

Objective	Target
Implement Weyerhaeuser's *Stand Level Ecological Guidelines* on the FMA Area	• Retain vertical and horizontal structure on all cutovers at an average of 5% merchantable timber across the FMA Area.
Maintain stands on the FMA Area which have old growth characteristics	• See tables 29, 30, and 31 for amount of area to be maintained through the planning horizon. • Conduct research on stand origin (AVI) and old growth characteristics.
Maintain forest diversity at the stand and landscape level through harvest planning	• Increase diversity within harvest designs by increasing range of block sizes and shapes, and disperse logging across LMU's
Identify, record and track areas of special importance to plant and wildlife species	• Development and maintenance of a database for areas of special importance to plant and wildlife species.
Follow IRP guidelines for operating in critical wildlife areas	• All harvest designs will confirm the existence of critical wildlife areas (IRP zone 2) and operating period constraints.
Protect fish habitat	• Maintain riparian buffers on all permanent streams and lakes. • Follow provincial guidelines for road and crossing construction

Table 33 – LMU Specific Biodiversity, Wildlife and Fisheries Objectives

LMU	Objective
Baptiste	• Consult Crimson Lake Provincial Park management on the forest management requirements for operating adjacent to the Park.
Blackstone	• Cooperate with Alberta Environment in the establishment of the Wapiabi Special Place along the Wapiabi and Sturrock Creeks. • No harvesting within IRP Zone 1 – Prime Protection Zone
Elk River	• Objectives common to all of FMA Area
Marshybank	• Cooperate with Jasper National Park and Alberta Environment on the forest management requirements for the FMA Area adjacent to Jasper National Park. Conduct research over next five-year period to determine future forest management actions. • No harvesting within IRP Zone 1 – Prime Protection Zone
Medicine Lake	• Evaluate the local geologic and habitat patterns to determine appropriate harvest design and operational requirements.
Nordegg River	• Determine, with Alberta Environment, the possible ungulate focus for habitat management.
O'Chiese	• Objectives common to all of FMA Area
Sand Creek	• Objectives common to all of FMA Area
Tall Pine	• Objectives common to all of FMA Area
Willesden Green	• Determine, with Alberta Environment, the possible ungulate focus for habitat management.

2.3 Recreation and Tourism

In meeting the DFMP goal of **integrating with the management activities of other resource users,** Weyerhaeuser will work cooperatively with recreational and tourism stakeholders, and strive to minimize the visual impact of our operations. The Integrated Resource Plans and the M.D. of Brazeau's report on the Brazeau Reservoir Region Tourism and Recreation Potential are the sources of information on which Weyerhaeuser has relied to identify recreation needs in the FMA Area.

Recognizing the need for responsible use of the forest, the Company will implement the following procedures to address the integration of recreation resources and tourism into the FMA Area activities:

- Timber harvest planning in IRP-identified zone 4 areas (general recreation) will be developed using visual landscape timber harvest planning techniques (see below) to mitigate aesthetic (visual and noise) concerns resulting from harvesting activities.
- Main public thoroughfares (highways 11 and 22), the North Saskatchewan River valley, the Brazeau River valley, the community of Lodgepole, and established intensive recreation sites will be given special consideration for aesthetics in harvest planning and operations. Additional measures may include modifying harvest designs and methods to minimize visual impacts, reducing access routes, special reclamation requirements, or retention of timber for buffers.
- Where developed or planned recreational trails exist and are recognized by Alberta Environment, harvest designs will be modified to meet the objectives of the trails, and harvesting operations will ensure there is no impairment of trail traffic.
- Should a designated recreation vehicle route pilot project (see IRP) be conducted on the FMA Area, the Company will support the objectives for such a project in its operations.
- Where access is required for a specific recreational development proposal by government, the Company will cooperate in the development of such access.
- The Company will make recommendations to Land and Forest Service on potential recreation sites as encountered by the Company during operational planning, forest inventory work, or as otherwise determined.
- The Company will cooperate with tourism operators in the FMA Area. Operators will be consulted during harvest design development regarding location of harvest areas, harvesting methods and timing, access, timing of clean up requirements and reforestation. Alberta Environment will be consulted regarding any unresolved issues prior to harvesting operations taking place.

Additional potential recreation sites identified through public involvement processes and recognized as such by Land and Forest Service, will be integrated with the Company's operations for those sites.

The Company will continue to assess the opportunity for alternative harvesting systems within selected visual buffers where a visual impediment can be maintained. Harvesting system selection and timing of operations will be key factors influencing a successful outcome.

2.3.1 Visual Landscape Timber Harvest Planning

Weyerhaeuser will identify aesthetically sensitive areas due to the presence of, but not limited to, recreational facilities, primary highways, and navigable rivers. In areas which are determined

aesthetically sensitive, the Company will develop the harvest design in accordance with "Forest Landscape Management Strategies for Alberta," (revised 1990, Alberta Environmental Protection). "Visual Landscape Design Training Manual" (1994, British Columbia Ministry of Forests) is another resource that may also be used.

Weyerhaeuser has initiated a project to develop three-dimensional modeling capabilities to generate landscape views illustrating harvest designs for use in public consultation meetings. The project is scheduled for completion in 2001. The deliverables of the project are to:

1. conduct quality control on the accuracy level of DTM (digital terrain model) data sets currently available;
2. determine the most efficient method of generating landscape views using available technologies and software;
3. compare and test the currently available visualization software for their ability to produce panoramic views from pre-selected viewpoints; and
4. review the available computer visualization applications (models) to determine their ease of use and customization. It is Weyerhaeuser's intent to develop the capacity to manage landscape visualization internally.

2.3.2 Recreation and Tourism Objectives

Table 34 – Recreation and Tourism Objectives

Objective	Target
Ensure the Company's harvesting practices do not unduly impact the viewshed in sensitive areas	• Establish a harvest design *viewshed assessment* process for use in all harvest designs.
Seek input into harvest design development from recreation and tourism operators	• Utilize computer visualization models for public reviews of harvest designs. • Consult local recreation and tourism stakeholders for input into harvest design development.

Table 35 – LMU Specific Recreation and Tourism Objectives

LMU	Objective
Baptiste	• Consult Crimson Lake Provincial Park management and associated commercial recreation users for Park boundary neighbor needs, trail protection, and aesthetic impact of forest operations. • Consult representative users of Chambers Creek trails to determine need for trail establishment & protection, environmental issues (soil erosion at ATV crossings), aesthetics and safety along trails. • Consult the management of the Chambers Creek campground to mitigate impact of forestry operations – aesthetics, log hauling, etc. • Develop operational Ground Rules for operating along the highway 11 corridor.
Blackstone	• Investigate opportunity with Alberta Environment and commercial recreation users to establish a designated trail program resulting from an access management plan. • Consult the management of the Blackstone campground to mitigate impact of forestry operations – aesthetics, log hauling, etc. • Cooperate with Alberta Environment to mitigate the impact of forestry operations on the adjacent Bighorn Wildland Recreation Area. • Develop operational Ground Rules for operating along the Forestry Trunk Road corridor.
Elk River	• Objectives common to all of FMA Area.
Marshybank	• Investigate opportunity with Alberta Environment and commercial recreation users to establish a designated trail program resulting from an access management plan. • Cooperate with Alberta Environment to mitigate the impact of forestry operations on the adjacent Big Horn Wildland Recreation Area.
Medicine Lake	• Consult the management of the Medicine Lake campground to mitigate impact of forestry operations – aesthetics, log hauling, etc.
Nordegg River	• Mitigate the impact on the viewshed integrity along the Brazeau River corridor.
O'Chiese	• Objectives common to all of FMA Area.
Sand Creek	• Mitigate the impact on the viewshed integrity along North Saskatchewan River corridor. • Consult the community of Lodgepole to mitigate impact of forestry operations – aesthetics, safety. • Cooperate with Alberta Environment on the management requirements for operating adjacent to the Jack Knife Springs day-use site.
Tall Pine	• Mitigate the impact on the viewshed integrity along North Saskatchewan River corridor.
Willesden Green	• Mitigate the impact on the viewshed integrity along the North Saskatchewan River corridor. • Develop operational Ground Rules for operating along the highway 22 corridor.

2.4 Grazing

The Company will continue to cooperate with grazing disposition holders and with Alberta Environment to ensure we integrate Weyerhaeuser's forest management activities (the harvesting and growing of trees) with the grazing activities of the disposition holders. Significant numbers of grazing dispositions lie within the gross boundary of the FMA Area. Grazing Leases, Permits and Allotments are included in the FMA Area landbase for this Plan submission. Forest Grazing Licences issued after the signing date of the Forest Management Agreement represent integrated landbase and are included in this Plan. All grazing dispositions are included in the timber harvesting landbase for the FMA Area to calculate the AAC for the embedded quotas, Community Timber Program and Local Timber Permit program. Table 20 in Section I summarizes the delineation of grazing dispositions recognized for this DFMP submission.

The *Disposition and Fees Regulations* established under the *Public Lands Act* set forth the rights and considerations for both the grazing disposition holder and the FMA holder. In addition, meeting Weyerhaeuser's goal to **integrate with the management activities of other resource users** will incorporate the following into harvesting operations:

- Timber harvesting sequenced for Weyerhaeuser on Forest Grazing Licences will be identified in General Development Plan submissions.
- For grazing dispositions where forestry operations are sequenced, licensees will be notified and invited to participate in developing an integrated operational plan for the grazing disposition area. Such a plan will address the requirements for minimizing the impact of timber harvesting on the grazing opportunity, while still providing for timber harvesting and reforestation. Alberta Environment will be consulted regarding any unresolved issues before harvesting operations occur. The Company's objective will be to have all stakeholders sign off on the completed integrated operating plan for the grazing disposition prior to the commencement of any operations.
- Detailed reforestation plans for all harvesting activities on Forest Grazing Licences operated by the Company will be developed before these areas are logged. The objective of the reforestation plan will be to ensure successful regeneration of cutovers to Provincial standards.
- The Company will cooperate with disposition holders in retaining access after harvesting for their use, where the disposition holder assumes responsibility henceforth for such access subject to approval by Lands and Forest Service.
- Where timber harvesting operations will occur immediately adjacent to grazing dispositions excluded from the FMA Area, the Company will notify these disposition holders during harvest plan development and in advance of operations, to address any concerns.

Where salvage timber is generated from harvesting on grazing dispositions not integrated with the FMA (not part of the FMA Area's timber harvesting landbase), the Company will endeavor to procure such timber as a priority in its purchased wood program.

To ensure that the available landbase is not further diminished, Weyerhaeuser is requesting that no new grazing dispositions be awarded that would result in a withdrawal from the FMA Area. The Company supports grazing dispositions that are integrated with forest management (i.e. Forest Grazing Licences).

2.4.1 Grazing Objectives

Table 36 – Grazing Integration Objectives

Objective	Target
Prepare an integrated operating plan for all grazing dispositions operated on	• Ensure all parties (the grazing disposition holder, the Company and Alberta Environment) sign off on the completed integrated operating plan.
Inform grazing disposition holders where forestry operations will be adjacent to their disposition	• Contact grazing disposition holders as part of the harvest design development to address any concerns.

Table 37 – LMU Specific Grazing Objectives

LMU	Objective
Baptiste	• Objectives common to all of FMA Area.
Blackstone	• Objectives common to all of FMA Area.
Elk River	• Objectives common to all of FMA Area.
Marshybank	• Objectives common to all of FMA Area.
Medicine Lake	• Objectives common to all of FMA Area.
Nordegg River	• Objectives common to all of FMA Area.
O'Chiese	• Objectives common to all of FMA Area.
Sand Creek	• Objectives common to all of FMA Area.
Tall Pine	• Objectives common to all of FMA Area.
Willesden Green	• Objectives common to all of FMA Area.

2.5 Oil and Gas

One of the most prominent land uses on the FMA Area is oil and gas development (see Section I 3.2.6). The FMA Area overlaps, in whole or in part, six defined oil and gas fields. Oil and gas development is so intensive in some portions of the Area that it can have a significant impact on forest management and contribute to the cumulative impact on other resources. Development of oil and gas resources is expected to continue, particularly in the FMA Area west of the Forestry Trunk Road.

In an effort to maintain the timber harvesting landbase for the FMA Area, Weyerhaeuser is developing a site rehabilitation program to return abandoned sites to productive forest land. In selecting candidate sites for this program, Weyerhaeuser will review the legal obligations related to environmental liabilities for the site.

Another important consideration is the effect of overlapping Quota allocations on the administration of land developments. For example, a Coniferous Timber Licence that is issued on the FMA Area after the FMA was signed creates a case of overlapping dispositions (i.e., a timber licence over the FMA Area). Both disposition holders have rights and obligations, which, except for geophysical exploration, can result in administrative complications. Therefore, Weyerhaeuser will coordinate the application of the most current policies regarding timber damages assessment with quota holders on the FMA Area.

One of the objectives of the DFMP is to establish a comprehensive and accurate land inventory (map and data file) for the FMA Area that would include all oilfield developments. Such an inventory will facilitate operational integration and monitoring of what is a potentially significant source of deletions from the forest landbase.

To assist in achieving the DFMP goal to **integrate with the management activities of other resource users,** the following procedures will be used to meet the DFMP strategy of working cooperatively with the oil and gas industry:

- Existing oilfield access will be used for timber harvesting operations whenever possible to minimize land developments.
- Annual operating plan information will be provided to oilfield operators in advance of harvesting operations to identify any operational concerns.
- Weyerhaeuser will establish clear lines of communication and consultation with oil and gas field operations before, during and after timber harvesting operations.
- An information package will be developed for land withdrawal applicants outlining all rights, obligations and procedures.

2.5.1 Oil and Gas Objectives

Table 38 – Oil and Gas Integration Objectives

Objective	Target
Identify operational concerns and opportunities prior to operations commencing	• Provide AOP information to oilfield operators. • Consult with oilfield operators on proposed permanent access development.
Assist Oil and Gas companies with reforestation activities of reclaimed dispositions.	• Determine opportunities for utilization of abandoned oil field dispositions for forest production (afforestation).
Utilize salvage timber generated by exploration and land developments.	• Salvage wood will be the top priority in the Company's purchased wood program. • An information package will be developed for land withdrawal applicants outlining all rights, obligations and procedures.
Establish and maintain a comprehensive and accurate land inventory (map and data file) for the FMA Area that would include all oilfield developments.	• Continuous updates to database and reporting to Alberta Environment.

Table 39 – LMU Specific Oil and Gas Objectives

LMU	Objective
Baptiste	• Objectives common to all of FMA Area.
Blackstone	• Objectives common to all of FMA Area.
Elk River	• Objectives common to all of FMA Area.
Marshybank	• Objectives common to all of FMA Area.
Medicine Lake	• Objectives common to all of FMA Area.
Nordegg River	• Objectives common to all of FMA Area.
O'Chiese	• Objectives common to all of FMA Area.
Sand Creek	• Objectives common to all of FMA Area.
Tall Pine	• Objectives common to all of FMA Area.
Willesden Green	• Objectives common to all of FMA Area.

2.6 Trapping

In accordance with the Province's policy on integrated resource management, and Weyerhaeuser's DFMP goal of **integrating with the management activities of other resource users** and Forest Stewardship Principles (Community and Stakeholder Involvement), Weyerhaeuser is committed to involving the trapping community in harvest design development and implementation. It is understood that timber harvesting can directly and immediately affect the habitat of furbearers harvested by trapping.[44] Therefore, as noted above Weyerhaeuser will work with the trappers to minimize the impact of timber harvesting on the trapping sector.

The Ground Rules and Weyerhaeuser-Drayton Valley's Trappers Policy and Procedures outline the rights and considerations for both parties. Weyerhaeuser will consult individual registered trappers during the harvest plan development to discuss:

- location of proposed harvesting areas (cutover and landscape levels) as part of the sequencing output from this Plan, the General Development Plan, and Annual Operating Plan (AOP) submissions;
- harvesting methods including stand retention levels, harvest patterns, recognition of unique areas, and timing;
- access (location, reclamation, and control methods);
- clean-up requirement such as brush pile retention; and
- reforestation activities and timing.

Reasonable effort will be made to contact the trapper in person to discuss the development of the harvest design and to obtain pertinent information from the trapper such as cabin locations, unique areas, location of lines and traps, etc. Follow-up contact with the trapper will be made prior to submission of the AOP to review the final harvest design. Any unresolved issues between Weyerhaeuser and the trapper will be communicated in the AOP to Alberta Environment. The company will also arrange follow-up consultation with the registered trapper after harvesting to review plan implementation and interpretations.

As a member of the Alberta Forest Products Association, Weyerhaeuser will support the intent and guidelines of the Alberta Trappers Compensation Program Policy and Procedures. The Alberta Trappers Compensation Program provides a framework for compensating trapline operators of Registered Fur Management Areas for trapping business losses related to industrial activity. The Company will always try to resolve any compensation issues with the trapper prior to the issue being referred to the Compensation Board.

To ensure that the Company can meet the obligations noted above, Weyerhaeuser will request that at the start of each timber year (May 1st), Alberta Environment provide a list and map of the trappers and traplines that operate within Weyerhaeuser's allocated Crown sources. In addition, Alberta Environment participates in the Compensation Program by providing information to help determine eligibility requirements for the "temporary disruptions" compensation program.

[44] A Review of the Effects of Logging on Furbearers Inhabiting the Alberta Forest Regions Managed by Weyerhaeuser Canada Ltd., Gilbert Proulx, 1998

2.6.1 Trapper Objectives

Table 40 – Trapper Integration Objectives

Objective	Target
Seek input into harvest design development from trapline operators	• Contact all trapline holders as part of harvest design development.
Continue to support the intent and guidelines of the Alberta Trappers Compensation Program Policy and Procedures.	• Inform all trappers of the Compensation Program as part of consultation process in harvest design development. • The Company will always try to resolve any compensation issues with the trapper prior to the issue being referred to the Compensation Board.

Table 41 – LMU Specific Trapper Objectives

LMU	Objective
Baptiste	• Objectives common to all of FMA Area.
Blackstone	• Objectives common to all of FMA Area.
Elk River	• Objectives common to all of FMA Area.
Marshybank	• Objectives common to all of FMA Area.
Medicine Lake	• Objectives common to all of FMA Area.
Nordegg River	• Objectives common to all of FMA Area.
O'Chiese	• Objectives common to all of FMA Area.
Sand Creek	• Objectives common to all of FMA Area.
Tall Pine	• Objectives common to all of FMA Area.
Willesden Green	• Objectives common to all of FMA Area.

2.7 Ecological and Archeological Resources

The development and implementation of an ecological and archeological resources policy will reinforce Weyerhaeuser's goal to **protect unique archeological and ecological sites**. The Company will recognize and report all unique finds encountered during its forest management activities on the FMA Area to the Province. In developing the policy the Company will institute the following strategies:

1. Implement a process to verify sites, using currently documented site information from the Provincial Archaeological Survey of Alberta.
2. Develop a staff training program to understand all applicable legislation and resources and expertise available.
3. Make the Company's harvesting plans available for public review annually, which will allow public members to identify any concerns specific to an area of harvesting.

A three step process will be implemented to verify ecological and/or archaeological (including historical) sites:

Training
• Training provided to key personnel involved in planning and operations to aid them in identifying potential unique sites and /or scarce finds. • Develop "Unique Finds Policy" and ensure key personnel are trained in procedures.

⇩

Reporting
• Provide report of unique sites to Alberta Environment. • Provide report of unique sites to Weyerhaeuser Woodlands Manager. • Inform Drayton Valley Forest Advisory Committee of findings. • Enter location and details of potential sites into geographic information system.

⇩

Unique Find Verification
• Involve the appropriate resources (government and consultants) in verifying unique finds. • Apply appropriate provincial regulations. • Calculate the impact of the find on the Annual Allowable Cut (if applicable). • Analyze alternative operational methods that will maintain the integrity of the find and still provide planned, appropriate access to resources.

2.7.1 Ecological and Archeological Resource Objectives

Table 42 – Ecological and Archeological Resource Objectives

Objective	Target
Develop and implement an ecological and archeological resources procedure that provides for training of key personnel, reporting of findings, and verification of the find	• All known sites are reported. • Apply the procedure to all Annual Operating Plans and operations.

Table 43 – LMU Specific Ecological and Archeological Resource Objectives

LMU	Objective
Baptiste	• Objectives common to all of FMA Area.
Blackstone	• Cooperate with Alberta Environment in the establishment of the Wapiabi Special Place along the Wapiabi and Sturrock Creeks.
Elk River	• Objectives common to all of FMA Area.
Marshybank	• Cooperate with Alberta Environment on the management requirements for operating adjacent to the Marshybank Ecological Reserve.
Medicine Lake	• Objectives common to all of FMA Area.
Nordegg River	• Objectives common to all of FMA Area.
O'Chiese	• Cooperate with Alberta Environment on the management requirements for operating adjacent to the O'Chiese Natural Area.
Sand Creek	• Establish forest management tactics to protect the sand dunes.
Tall Pine	• Objectives common to all of FMA Area.
Willesden Green	• Objectives common to all of FMA Area.

2.8 Road Development and Access Management

Access control is one of the most contentious issues facing Alberta's natural resource managers today. Vehicular access created by the energy and forestry sectors can have profound impacts on watersheds and on fish and wildlife. Conversely, the general public does not readily accept policies or regulations on access restrictions to Crown land, as such restrictions may be perceived as infringing on some of the most fundamental rights of citizens.

Road development in the FMA Area ranges from high densities in the eastern portions (7 km of linear disturbance / km^2) to relatively low densities in the far western portions (1.4 km / km^2). The Province's Integrated Resource Plans for the FMA Area have identified access development as a key issue in resource management, concluding that:

- There is a strong need to manage the amount and type of access to address sedimentation concerns from stream crossings and land clearings.
- More access is causing increased consumption pressures on fish and wildlife populations.
- Access reclamation and closure should be an integral part of all resource extraction programs.
- Random use of motorized vehicles requires care or controls as it contributes to the pressure on fish and wildlife populations, and has soil and watershed impacts.

Roads and access management was also a key issue identified in Weyerhaeuser's public involvement program for this DFMP. Many individuals and interest groups stated the need to reduce or minimize access in recognition of the needs of wildlife, tourism and recreation and to address in a general way the cumulative impacts of development. As well, many thought Weyerhaeuser should take a lead role in managing access because of the scope of its long term planning. This view contrasts, however, with the fact that the Company has no control or influence over access development by other parties. Similarly, the Local Coordinating Committees for the two Special Places nominations within the FMA Area heard the need to address the conflict between all-terrain vehicle use and environmental protection.

Current Situation

As described in Section I 3.2.6 of the DFMP, the FMA Area has generally good access. There are over 2048 km of permanent road on the FMA Area, but Weyerhaeuser owns only 186 km of permanent road or 9% of all roads on the FMA Area. Of Weyerhaeuser's roads, about half (96 km) had been abandoned or were no longer required by other companies that Weyerhaeuser took over.

Because of the existing infrastructure, Weyerhaeuser rarely has the need to develop any main or major access roads. Most of the Company's permanent roads are Ground Rules Class 3 or lower in standard. The vast majority of roads are temporary and are used to log and haul out in the same season. These roads are promptly reforested the following year, then abandoned and reclaimed (see Section II 2.1.2 *Road Development*). In recent years, there have been examples of joint road development and management by Weyerhaeuser in partnership with other companies. In addition, Weyerhaeuser has contributed to the upgrading of the Sunchild Road in partnership with the local Municipal Districts.

At the time of this DFMP submission, Weyerhaeuser has four roads with locked gates for access control. In each situation, it is a condition of the Licence of Occupation to minimize disturbance pressures on wildlife and to protect the roads from damage as a result of public use during

periods of inclement weather. However, gates are not seen favorably by some and are frequently vandalized.

In an effort to manage access issues created by Weyerhaeuser's forest management activities the Company will:

- continue to utilize existing road development whenever possible. This would include the take over of abandoned routes, partnerships in future road development and the use of common corridors.
- continue the use of access control measures such as gates or temporary abandonment where warranted. Important to public acceptance of gates is proactive communications on the need for such measures. This would include signs and other information products.
- continue prompt abandonment of short-term roads including access control measures.
- integrate trail management objectives with harvest planning in coordination with the LFS.
- recommend an access management plan for the area west of the Forestry Trunk Road in cooperation with the LFS and other access developers.

Participants in Weyerhaeuser's public consultation for this DFMP noted special concerns about increased access to areas west of the Forestry Trunk Road, particularly next to Jasper National Park. This area has few roads now, but development is imminent from the energy sector. In order to address this larger issue of coordinating access with multiple developers and users, Weyerhaeuser will advocate the development of a cooperative access management plan with the LFS for the areas west of the Forestry Trunk Road. Weyerhaeuser has engaged such a process already for another location on the FMA Area which lead to the development of the Nordegg River Area Access Management Plan.

2.8.1 Road Development and Access Management Objectives

Table 44 – Road Development and Access Management Objectives

Objective	Target
Cooperate with other resource stakeholders in the development of shared access development	• Consult local energy property owners on the Company's proposed main road plans.
Maintain current practices of access control where requested by Alberta Environment	• Report or meet annually with Alberta Environment to review access concerns and plans (i.e. Nordegg River Road Annual Report).

Table 45 – LMU Specific Road Development and Access Management Objectives

LMU	Objective
Baptiste	• Objectives common to all of FMA Area.
Blackstone	• Cooperate with Alberta Environment in the development of an access management group and plan for the area west of the Forestry Trunk Road.
Elk River	• Objectives common to all of FMA Area.
Marshybank	• The Company will not build any permanent road into the area adjacent to Jasper National Park. • Cooperate with Alberta Environment in the development of an access management group and plan for the area west of the Forestry Trunk Road.
Medicine Lake	• Objectives common to all of FMA Area.
Nordegg River	• Continue to monitor the success of the Access Management Plan for the Nordegg corridor and use learnings in the development of other access management plans.
O'Chiese	• Cooperate with Alberta Environment and resource stakeholders to establish an access management plan for the area.
Sand Creek	• Objectives common to all of FMA Area.
Tall Pine	• Objectives common to all of FMA Area.
Willesden Green	• Objectives common to all of FMA Area.

3. TIMBER RESOURCES

The timber resources on the FMA Area are very important to Weyerhaeuser, Tall Pine Timber Co. Ltd. and the Province of Alberta. Weyerhaeuser's DFMP goals relating to timber resources are to:

1. Increase the sustainable harvest level of deciduous and coniferous timber from the FMA Area; and
2. Maintain the productive capacity of the forest.

In its work to meet these goals, Weyerhaeuser is committed to improving timber utilization, maintaining a long-term sustainable timber harvesting landbase from the FMA Area, minimizing the loss of timber from natural causes, and ensuring the maintenance of soil productivity.

3.1 Silviculture

The Forest Management Agreement provides Weyerhaeuser the right to grow timber and carry out reforestation programs. The agreement also requires Weyerhaeuser to progressively reforest all land cut over by the Company. In addition, a goal of this management plan is to **increase the sustainable harvest level of deciduous and coniferous timber from the FMA Area**. These rights, responsibilities, and goals are supported by a set of regeneration assumptions, silviculture regimes, and reforestation standards.

3.1.1 Regeneration Assumptions

The timber supply analysis for this plan assumes that future stands will regenerate, for the most part, to the same composition as the pre-harvest AVI polygon(s). Stratification of the AVI stand types for this plan was based on percent crown closure of coniferous species in the overstory. The strata criteria are described below in Table 46.

Table 46 - Stand Type Strata

Stand type	Percent conifer crown closure in overstory*
Coniferous	greater than 70%
Coniferous/Deciduous	from 50% to 70% inclusive with conifer as the leading species
Deciduous/Coniferous	from 30% to 50% inclusive with deciduous as the leading species
Deciduous	less than 30%

* In the case of A density stands with a B, C, or D density understory, the stand will be assigned and managed for the understory component.

Regeneration assumptions will strategically target the regeneration of four stand types with respect to composition: Coniferous (C); Coniferous/Deciduous (CD); Deciduous/Coniferous (DC); and Deciduous (D).

The strategy used in this plan assumes that successfully reforesting a harvested area to the reforestation standard for a corresponding stand type will sustain the mix of stand types on the landscape. Maintaining the annual allowable cut is supported when the harvested area of any stand is reforested to the stand type stratum used for the purposes of determining the annual allowable cut. Table 47 summarizes the regeneration assumptions used in the management plan.

Table 47 – Regeneration Assumptions

Broad cover group	Density	Regenerated Composition	Regenerated Density	Percentage
Coniferous	All	C	C	100
Coniferous/Deciduous	All	CD	C	100
Deciduous/Coniferous	All	DC	C	100
Deciduous	A	D	C	10
		DC	C	90
	B	D	C	10
		DC	C	90
	C	D	C	90
		DC	C	10
	D	D	C	90
		DC	C	10

The provincial regeneration standards (C, CD, DC, D) will be used to evaluate the performance of regenerating cutovers. The standards will be applied to regenerating cutovers based on the corresponding stand stratum used to determine the annual allowable cut, for example the deciduous standard will be used to evaluate the regeneration of stands that were assigned as deciduous stand types.

Many cutovers planned for harvest contain a mix of stands from different broad cover groups. The annual operating plan will balance the area new cutovers declared to each strata standard with the area cut in each of the stand timber strata in accordance with the assumptions listed in table 47. The balancing will be within the FMA on an annual basis.

To use resources efficiently while sustaining relative proportions of coniferous, mixedwood, and deciduous stands, certain factors should contribute to reforestation decisions, such as:

- Site suitability and stand condition should be considered when assigning species.
- Declining deciduous stand condition and associated low natural regeneration potential may provide a better opportunity for coniferous reforestation than for deciduous reforestation.
- Residual immature coniferous growing stock from deciduous harvesting may represent a more advantageous opportunity for coniferous reforestation than deciduous.
- Regenerating stand stocking and condition may provide a basis for re-assignment of reforestation standards

To effectively integrate these considerations into the operational decision making process while supporting the assumptions of future forest composition, an exchange of areas between different stand type strata will be considered. To ensure that yields expected from the regenerating forest are not compromised by the exchange of stand type designations, the following principles and procedures will be used during the AOP development process:

- Stand strata designation exchanges will be balanced to maintain the area within each of the coniferous, mixedwood and deciduous stand type strata, thereby potentially ensuring maintenance of yield.
- All landbase exchanges will be made in consultation with the staff of the LFS at the AOP level.

3.1.2 Silviculture Regimes

The principle silviculture system that will be used for this Plan is clear cutting. Clear cutting with retention of coniferous understory and green trees will be utilized on a site-specific basis.

Operational trials in alternative silviculture systems will also be utilized. The timber supply analysis, however, is based on a clear cutting system.

Although poplars regenerate both sexually and vegetatively, Aspen and Balsam Poplar are well suited to regenerating through a coppice method that relies on root suckering. Vigorous reproduction from root suckers can be obtained only if the parent stand is cut completely clear (Smith 1962). The two most important factors for the stimulation of aspen suckers are the disruption of apical dominance and increased soil temperature (Peterson 1992).

Although old age is not likely a causative agent of aspen or balsam poplar stand decadence or break-up, it appears to be well correlated. Regeneration potential of a particular clone is not dependent on the age of the clone (Schier 1975). Genetic differentiation between clones is an important factor in determining suckering ability (Farmer 1962). However, other factors associated with stand age, and consequently stand break-up, do have an influence on regeneration potential and explain the reduced suckering. These are:

- restricted root distribution within the stand, as trees and clones die back, results in poorer distribution and lower density of suckers than healthy stands (Schier 1975; Perela 1972), and;
- increases in shrub and other vegetation layers, as the canopy opens, will reduce soil temperatures and increase competition. Lower soil temperature and increased competition will reduce suckering potential (Navratil et al 1990).

As the average age of deciduous stands at harvest increases, so does the risk of poor regeneration.

Regeneration in white spruce and lodgepole pine is sexual. Because of the variability in seed availability, germination rates, and slow initial performance, conifer regeneration will dominantly rely on planting. Where site and stand conditions indicate a low level of competition and few limiting factors, regeneration through seeding will be considered for lodgepole pine.

a) Clear cut Harvesting

The primary harvesting system used on the FMA Area is clear cutting, with subsequent reforestation activities to provide for a sustainable timber harvesting landbase, aligned to the silviculture regime used in the Timber Supply Analysis. Clear cutting involves the removal of virtually all merchantable stems from the cutover.

As part of this harvesting system Weyerhaeuser will be employing the *Stand Level Ecological Guidelines* to meet the following specific objectives:

- to provide for both vertical and horizontal structure;
- to protect sensitive sites;
- to enhance opportunities for both current and short term wildlife habitat; and
- to minimize the loss of nutrients from the forest ecosystem.

b) Partial Cut Harvesting

Although not a silviculture regime used in the Timber Supply Analysis, Weyerhaeuser will continue to develop expertise in applying alternative harvesting systems during this management plan. Variations of shelterwood systems and selection systems have potential for being used within the FMA Area. Both shelterwood and selection systems utilize partial cutting techniques and provide for continuous forest cover on a site. These systems provide enhanced

value for aesthetics, control of competing vegetation in the establishment phase, and retention of mature forest cover for longer periods. Integrating the use of these systems with clearcutting would increase the variability in the forest condition that is being maintained. Concerns with utilizing these systems center around increased costs, residual stand condition and stability, and reliability of regeneration techniques.

Trials of alternative systems are planned at an operational scale. The objectives of the trials are to:

- refine operational planning approaches;
- assess harvesting systems and costs;
- assess residual stand condition and stability characteristics; and
- assess regeneration effectiveness.

Shelterwood and selection harvesting trials will be presented for approval in the Annual Operating Plan.

c) Understory Protection

Timber harvesting may present the challenge of utilizing the currently mature timber while protecting an immature understory of coniferous growing stock. In order to meet the Company's protection objective the procedures below will be followed in the preparation of all Annual Operating Plans:

- The presence of coniferous understories will be identified as part of stand and site assessment, and will be identified in all timber harvest plans.
- Where necessary, detailed block planning and layout will be provided for skid patterns, deck and road locations, and understory distribution.
- Modified harvesting techniques such as designated skid trails and landings, directed felling patterns and use of alternate equipment will be used.
- Modified harvest design techniques and patterns such as strip shelterwood and crown thinning will be used to provide protection to the understory from blowdown.

3.1.3 Decision Support Model

a) Operational Planning

Weyerhaeuser operations will use a formalized Pre-Harvest Silviculture Prescription (PHSP) procedure for assessing sites, setting a management objective, and developing activity schedules for planned harvest and regeneration operations. The reforestation standard for respective coniferous, mixedwood, and deciduous stands will be incorporated into the management objectives for each harvest area. A PHSP procedure results in two products:

1. Site Assessment – A collection of information that characterizes a site and contributes to subsequent classification of that site.
2. Silviculture Prescription – A list of activities that meet the management objective for regenerating an area.

The PHSP procedure requires stratifying the harvest area, assessing it, and developing a prescription for each stratum or treatment unit. The most common level of stratification is at the cutover level, but treatment units can be identified within cutovers or a series of homogenous cutovers can be combined into one treatment unit.

b) Operational Activities

Reforestation tactics are selected to meet strategic objectives of maintaining stocked coniferous, mixedwood, and deciduous stands. Coniferous regeneration will be primarily through planting while deciduous regeneration will be primarily through suckering.

To enhance the productivity of the forest growing stock, a strategy of prompt regeneration will be used. Planning regeneration activities prior to harvest and scheduling treatments as soon as logistically feasible after harvest will facilitate prompt regeneration. The Timber Supply Analysis uses a two-year reforestation lag period for coniferous species and a one-year reforestation lag period for deciduous species (see Appendix 7). Operational tactics for regeneration are summarized in Table 48.

Table 48 – Reforestation Tactics Summary

Stand Type and Regeneration Standard	Primary Species		Secondary Species	
	Tactic	Conditions	Tactic	Conditions
Coniferous	Site preparation and plant coniferous	• Spruce and Pine • Moist sites • Competitive vegetation	Tend stands to release conifer component	• Where coniferous crop trees exist or deciduous competition is great
	Plant coniferous with no site preparation	• Spruce and Pine • Well drained sites • Low competition		
	Site preparation for natural seeding (drag)	• Pine • Well drained sites • Low competition		
Coniferous / Deciduous Mixedwood	Site preparation and plant coniferous	• Spruce and Pine • Moist sites • Competitive vegetation	Retain some deciduous component in stand tending operations to meet CD regeneration standard	• Where coniferous crop trees exist or deciduous competition is great
	Plant coniferous with no site preparation	• Spruce and Pine • Well drained sites • Low competition		
	Site preparation for natural seeding (drag)	• Pine • Well drained sites • Low competition		
Deciduous / Coniferous Mixedwood	Site preparation and plant coniferous	• Spruce and Pine • Moist sites • Competitive vegetation	Retain some deciduous component in stand tending operations to meet DC regeneration standard	• Where coniferous crop trees exist or deciduous competition is great
	Plant coniferous with no site preparation	• Spruce and Pine • Well drained sites • Low competition		
	Site preparation for natural seeding (drag)	• Pine • Well drained sites • Low competition		
Deciduous	Leave for natural (sucker)	• Healthy stands with “better drainage”	Plant coniferous	• Moist sites • Decadent stands • Heavy traffic areas
	Site preparation and plant coniferous or deciduous	• Spruce and Aspen • Moist sites • Decadent stands • Heavy traffic areas	Understory protection	• Where it exists in a wind firm format, or a harvesting system can ensure wind firmness

3.1.4 Enhanced Forest Management

An enhanced forest management program is being developed for implementation on the FMA Area. However, due to time constraints and modeling capabilities this Plan does not incorporate the benefits of enhanced forest management activities. The intent of the enhanced forest management program for the period of this plan is to establish trials to:

- gain operational experience in implementing these activities;
- demonstrate the results of these activities; and
- provide a basis for evaluating the forest response to these activities

The enhanced forest management activities are focused in the following areas:

- coniferous understory planting;
- density management through spacing and cleaning;
- incremental increased stocking of satisfactorily reforested sites; and
- rehabilitation of low density stands currently not included in the productive forest landbase

Knowledge gained from these trials will aid in determining an appropriate enhanced forest management strategy to be utilized in future detailed forest management planning.

Tree Improvement

To gain operational knowledge for future forest management planning the Company has tree improvement programs for white spruce and trembling aspen (*Populus tremuloides*) are being maintained as a component of Weyerhaeuser woodlands operations.

The white spruce program is a cooperative program for Breeding Region I. To date, 35 selections have been made and will be established in a clonal orchard at Huallen. Weyerhaeuser is maintaining a progeny test site at Medicine Lake. The program will produce genetically superior seed for operational reforestation in 2009.

Weyerhaeuser is implementing an aspen tree improvement program through the Western Boreal Aspen Cooperative. The strategy is targeting the development and evaluation of both pure *tremuloides* crosses and aspen hybrids. Currently, selections have been made from across western Canada and are being maintained in a potted breeding orchard at our Tree Improvement Centre north of Drayton Valley. Provenance trials have been established at Medicine Lake as part of this program.

Appendices 8 and 9 have copies of the breeding strategies for the Aspen and White Spruce programs respectively.

3.1.5 Record Keeping

Weyerhaeuser currently tracks harvesting and silviculture operations in a tabular format through the use of the Silviculture Records Management System (SRMS). SRMS also tracks the status of harvested blocks by maintaining landbase designation, stand modifiers and reforestation status.

Weyerhaeuser is transitioning into the use of a spatial harvesting and silviculture-tracking system called Woodlands the System (WtS). WtS is a custom GIS application developed by Linnet Geomatics International Inc. (Winnipeg, Manitoba). WTS integrates a tabular Oracle database and a spatial ArcView 3.2 geographic database through the use of PowerBuilder forms and Avenue code that has been customized specifically for Weyerhaeuser.

Conversion of our existing data into the WtS database is underway and scheduled for completion by January 2001. A utility will be developed to allow the export of data from WTS into an ARIS compatible format for reporting to the government.

3.1.6 Silviculture Objectives

Table 49 – Silviculture Objectives

Objective	Target
Meet the Provincial reforestation standards for all corresponding stand types	• Comply with the regulations 100% of the time.
Balance the landbase exchanges to maintain the area within each of the stand types	• Provide landbase exchanges and balance sheet in Annual Operating Plan.
Ensure prompt reforestation of all cutovers	• Maintain a one-year regeneration lag period for deciduous species. • Maintain a two-year regeneration lag period for coniferous species.
Maintain silviculture records current	• Provide silviculture records to Alberta Environment twice a year (WtS to ARIS).
Determine opportunity on historic conifer reforestation blocks with high deciduous content to be changed to mixedwood status	• Assign landbase designation to historic cutovers based on representative field surveys (see Section III 2.3.1).

Table 50 – LMU Specific Silviculture Objectives

LMU	Objective
Baptiste	• Objectives common to all of FMA Area.
Blackstone	• Objectives common to all of FMA Area.
Elk River	• Objectives common to all of FMA Area.
Marshybank	• Objectives common to all of FMA Area.
Medicine Lake	• Objectives common to all of FMA Area.
Nordegg River	• Objectives common to all of FMA Area.
O'Chiese	• Objectives common to all of FMA Area.
Sand Creek	• Objectives common to all of FMA Area.
Tall Pine	• Objectives common to all of FMA Area.
Willesden Green	• Objectives common to all of FMA Area.

3.2 Timber Harvesting Decision Model

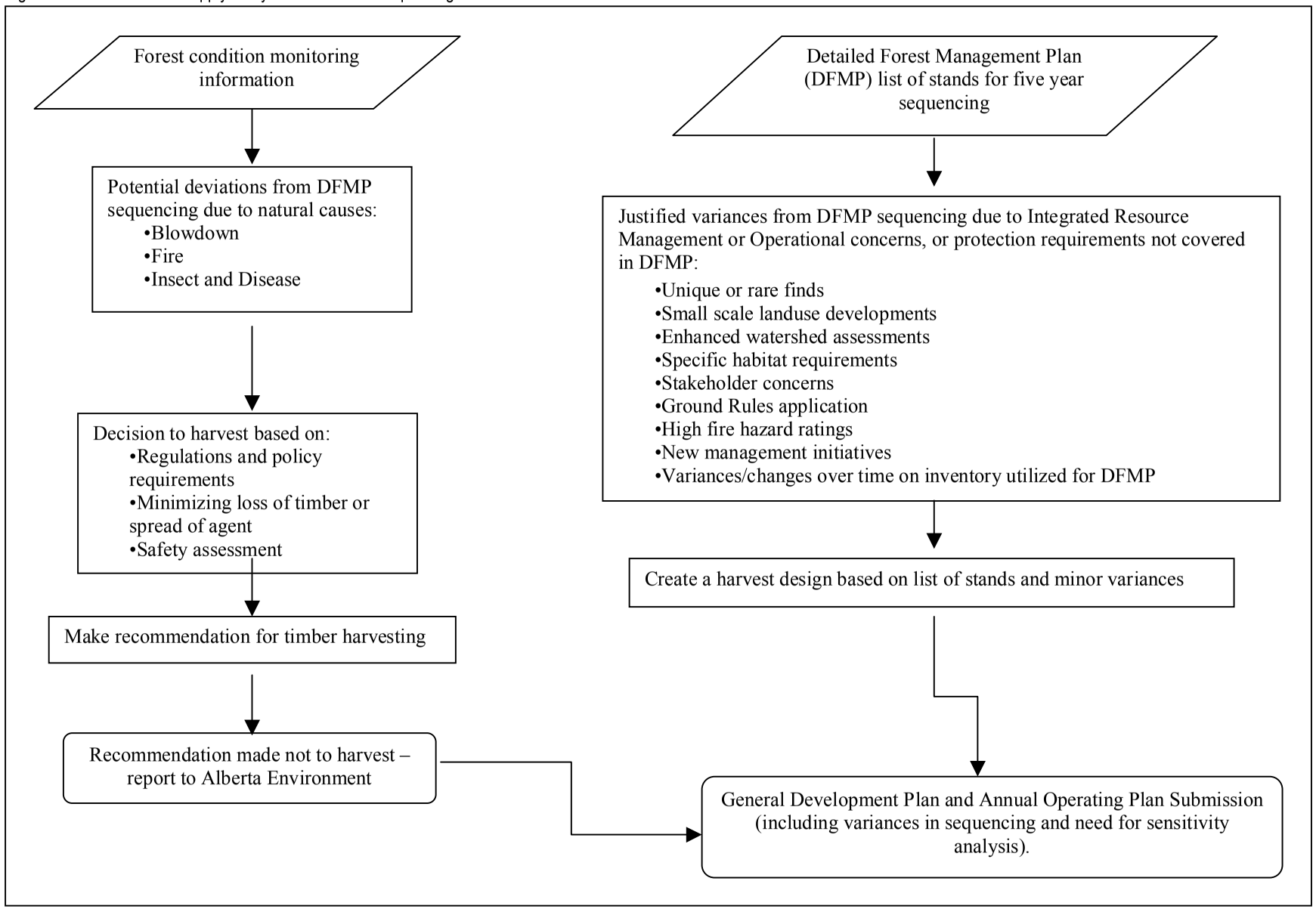
The flow chart in figure 19 describes the process that will be used to determine which stands will be selected for harvest design submissions. The model for this is simple – *follow the timber supply analysis sequencing or justify otherwise; then complete with a sensitivity assessment where warranted.*

The Timber Supply Analysis for this DFMP provides a stand-level sequencing for four five-year periods. Harvest design submissions for a given period will select stands from the DFMP list of sequenced stands. The assessment will then be to determine "what conditions would prevent such stands from being harvested." Such conditions can be divided into four broad categories, noted below.

Table 51 – Variance from DFMP Stand Sequencing

Reasons for Variance from DFMP Stand Sequencing:
A) Endangered Timber Stand conditions unaccounted for in the FMA inventory may arise that would result in endangered timber conditions or a requirement to salvage damaged or dead timber. This would include causes such as fire (including risk), insects and disease, blowdown or pending alternate land uses. Subject to an assessment of ecological values, such stands would be recommended for harvest to capture timber that might otherwise be lost.
B) Integrated Resource Management or Protection Needs Similarly there may be site-specific management objectives that could not be accounted for in the DFMP analysis, or that arose after the DFMP submission, which would preclude timber harvesting for a given stand. Such examples would include: • Unique or rare finds; • Small scale landuse developments; • Enhanced watershed assessments; • Specific habitat requirements; • Stakeholder concerns; • Ground Rules application • High fire hazard ratings; or • New management initiatives
C) Operational Implementation Implementation of a sequenced stand may be changed due to operational factors not within the scope of the Detailed Forest Management Plan. Such examples would include: • Block size combined with location (i.e. a very small block all by itself during a cut period); • Inventory polygon size constraint (i.e. portions of an adjacent unsequenced polygon may be added to a block to meet environmental or operational objectives); • Development or maintenance of trial silviculture systems; • Existing adjacency not accounted for in the sequencing exercise; and • Harvesting season restrictions.
D) Inventory Variance Variances in the inventory call for a sequenced stand that was discovered during harvest planning.

Figure 19 – DFMP Timber Supply Analysis Link to Annual Operating Plan



All harvest design submissions will describe any variances from the DFMP sequencing at the stand level. Large variances that would have a potentially significant impact on the timber supply analysis will be evaluated for sensitivity.

Weyerhaeuser remains committed to using salvage (dead or dying) timber on the FMA Area. The primary concerns in the utilization of dead timber are:

- for deciduous timber, the effect of moisture loss on wood ultra-structure, the ability to accommodate the timber in drying processes, and increased wood decay; and
- for coniferous timber, wood degradation from insects and introduced pathogens, and physical damage associated with moisture loss.

The amount and location of dead timber are operational factors that may determine the feasibility of use. Regardless, the most important objective is prompt harvesting and utilization after the time of injury or mortality.

3.2.1 Timber Harvesting Decision Objectives

Table 52 – Timber Harvesting Decision Objectives

Objective	Target
Follow the sequencing of stands provided in this Plan or explain variance	• Provided account of actual versus proposed sequencing in Annual Operating Plan
Salvage dead and dying timber from the FMA Area as a first priority	• Perform salvage operations as opportunities are available (see figure 19).

Table 53 – LMU Specific Timber Harvesting Decision Objectives

LMU	Objective
Baptiste	• Objectives common to all of FMA Area.
Blackstone	• Objectives common to all of FMA Area.
Elk River	• Objectives common to all of FMA Area.
Marshybank	• Objectives common to all of FMA Area.
Medicine Lake	• Objectives common to all of FMA Area.
Nordegg River	• Objectives common to all of FMA Area.
O'Chiese	• Objectives common to all of FMA Area.
Sand Creek	• Objectives common to all of FMA Area.
Tall Pine	• Objectives common to all of FMA Area.
Willesden Green	• Objectives common to all of FMA Area.

3.3 Integrated Timber Operations

Weyerhaeuser shares the timber resources on the FMA Area with Tall Pine Timber Co. Ltd. of Lodgepole, and with two programs administered by the Alberta Land and Forest Service: the Rose Creek West Community Timber Program and the Local Timber Permit program. Weyerhaeuser aims to meet the DFMP goal to **integrate with the management activities of other resource users** by working cooperatively with these other timber operators. Continued sharing of information and exchange of best practices related to harvesting and silviculture methods will ensure continuous improvement.

To achieve sustainable production of timber and integrate other resource values for the FMA Area, the area needs to be managed as a Forest Management Unit unto itself, and this Plan must be the forest management plan for all lands contained within the FMA Area. The Company has consulted Tall Pine Timber Co. Ltd. and the Local Advisory Committee of the Rose Creek West Community Timber Program (CTP) during the development of this Plan and sought their acceptance of it. Following Plan approval, copies of the Plan will be provided to them.

3.3.1 Deciduous Integration with Conifer Operations

Two categories of deciduous timber are integrated within the overlapping Quotas and Rose Creek West CTP timber harvest planning on the FMA Area:

- Coniferous predominant stands - the deciduous component of pure coniferous (C) and conifer predominant mixedwood (CD) areas sequenced to and harvested by Coniferous Quota or CTP operations;
- Deciduous predominant stands - the pure deciduous (D) and deciduous predominant mixedwood (DC) component contained within the Rose Creek West CTP, a Quota Cut Plan Area, or Coniferous Timber Licence.

Conifer Predominant Stands

Weyerhaeuser recognizes that the pure coniferous (C) and conifer predominant mixedwood (CD) stands from within the defined Rose Creek West CTP and Tall Pine Timber Co. Ltd's Coniferous Timber Licences are available for harvesting by these users respectively.

Utilizing the deciduous timber that occurs incidentally (i.e., within the same cutover) for Tall Pine or CTP harvesting operations in pure coniferous and conifer predominant mixedwood stands is sound forest management and essential to securing our wood supply. In order to integrate operations for this timber source, the following procedures will be implemented:

a) Weyerhaeuser's General Development Plan will include an estimate of the five-year integrated deciduous scheduling by Landscape Management Unit. This will be accomplished by using sequencing and forest inventory information to determine the deciduous and coniferous volumes and applying it to Tall Pine's or the CTP's conifer volume scheduling, provided that scheduling information (at the block level) is made available to Weyerhaeuser by Tall Pine or Land and Forest Service.

b) Where the incidental deciduous timber (within the conifer cutover) is harvested by Tall Pine or the CTP Permit holder, it shall be done with Weyerhaeuser's consent prior to Annual Operating Plan approval and charged against the FMA deciduous production. The Licensee or Permitee shall be responsible for all operational

clearances of Alberta Environment. Weyerhaeuser will be responsible for scaling reports and submission of Crown dues on deciduous timber.

c) Where Weyerhaeuser harvests the incidental deciduous timber, it shall be done under authority of the FMA and as soon as practical following the coniferous harvest so as not to impede reforestation and reclamation efforts. Both parties shall be responsible for their respective operational clearances from Alberta Environment.

d) Where Weyerhaeuser harvests and utilizes both the deciduous and coniferous components of a cutover approved under the Annual Operating Plan for a given Coniferous Timber Licence of another Quota holder, it shall be done with prior approval of the Licensee. The conifer production will then be charged to the appropriate Coniferous Timber Quota.

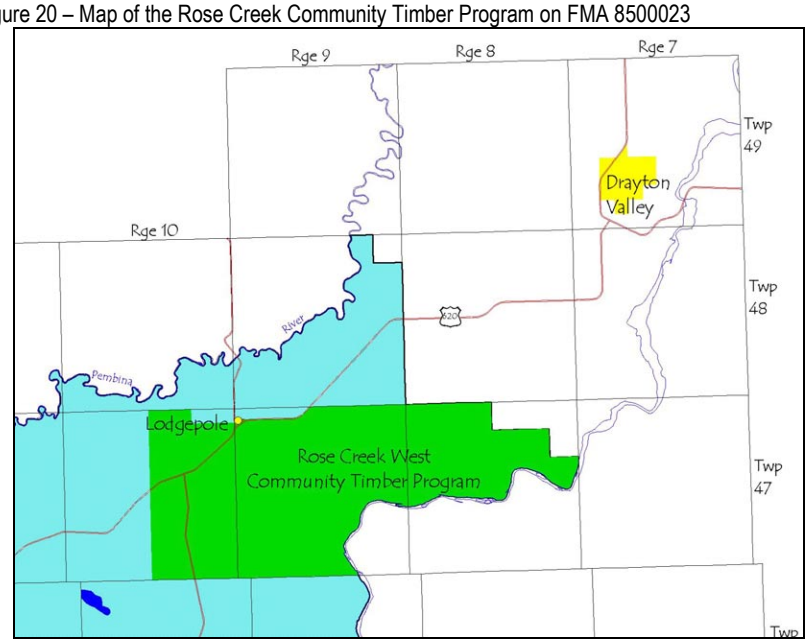
Commitment and flexibility by Weyerhaeuser, Tall Pine, Rose Creek West CTP Permit holders, and Land and Forest Service are essential to successful integration. It must be recognized that the amount of integrated deciduous timber made available in any given year will ultimately depend on the level of harvest by Tall Pine and the Rose Creek West CTP. If requested, Weyerhaeuser will provide covertype volume tables to other timber operators on the FMA Area so they may better estimate the integrated deciduous component from their coniferous cutovers.

To assist in managing the integrated deciduous component on the FMA Area, a copy of the harvest designs and Annual Operating Plans prepared by / for Tall Pine and a summary of the Annual Operating Plans for the Rose Creek West CTP will be submitted to Weyerhaeuser jointly with Land and Forest Service.

Deciduous Predominant Stands

The second category of integrated deciduous wood supply is the pure deciduous (D) and deciduous predominant mixedwood (DC) stands contained within the Tall Pine Landscape Management Unit (LMU – see *Landscape Management Units Map* on page 6 of Appendix 4) or the Rose Creek West CTP (Figure 20). In principle, it is more logical for the D and DC covertypes to be operated by Weyerhaeuser because there is more deciduous volume than coniferous volume and the Plan calls for a deciduous management regime.

Figure 20 – Map of the Rose Creek Community Timber Program on FMA 8500023



Weyerhaeuser will continue to evaluate the feasibility of harvesting deciduous predominant stands from within the Tall Pine LMU and the Rose Creek West CTP area independent of the coniferous component (i.e., a "stand-alone" logging chance for Weyerhaeuser).

3.3.2 Conifer Quota Harvesting Integration – Tall Pine Timber Co. Ltd.

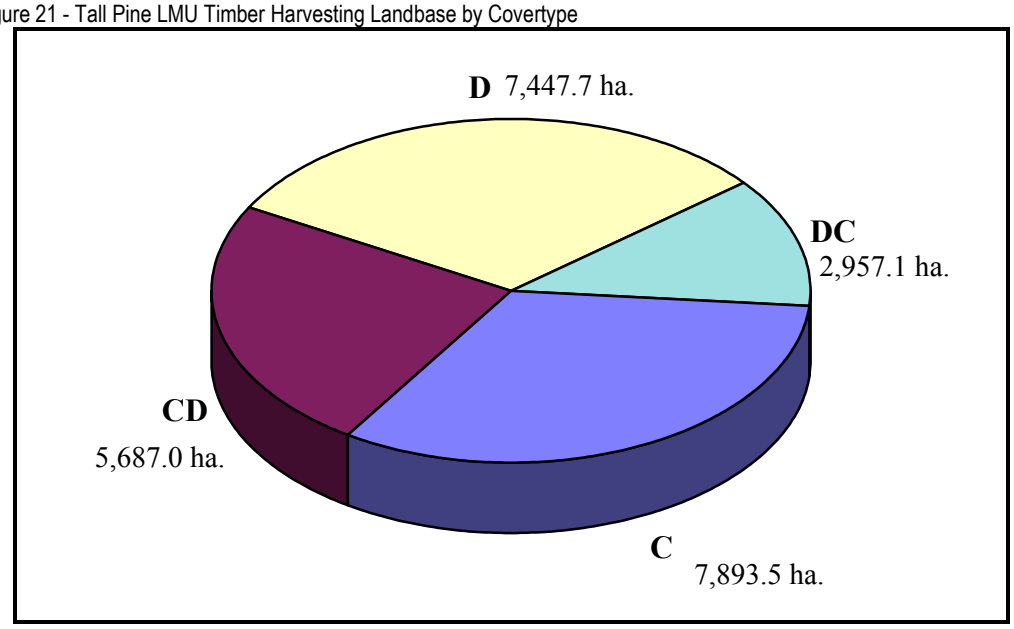
Presently, three integrated coniferous quotas on Weyerhaeuser's FMA Area are assigned to Tall Pine Timber Co. Ltd.

In consultation with Tall Pine, the Plan provides for conifer sequencing for Tall Pine Timber Co. Ltd. from within the Tall Pine LMU for the next 20 years (four five-year periods). The *Evaluation of Resource Management Strategies and Objectives* (Section III) of this Plan led to a decision on the sequencing of coniferous predominant stands and integrated deciduous stands.

Operationally, the deciduous stands may be more suitable for sequencing simultaneously with Tall Pine's harvesting and, if so, should be harvested by them. Conversely, these stands may be of sufficient size or in such a location to be considered as a separate harvesting opportunity for Weyerhaeuser. In either case, this assessment will also consider long-term timber development and integrated resource management objectives. Coniferous timber harvest plans and operational factors may ultimately influence the Company's decision to harvest integrated deciduous stands in the same operating period as Tall Pine's operations. Therefore, an assessment will be made upon completion of a coniferous harvest design as to the feasibility of the Company's harvesting opportunity from within the Tall Pine LMU. Where appropriate, Weyerhaeuser will cooperate in developing a deciduous harvest design to integrate with the coniferous harvest design.

Figure 21 shows the timber harvesting landbase breakdown for the Tall Pine LMU by the broad covertype of pure coniferous (C), coniferous predominant mixedwood (CD), deciduous predominant mixedwood (DC), and pure deciduous (D).

Figure 21 - Tall Pine LMU Timber Harvesting Landbase by Covertype



3.3.3 Integration of Non-Quota Timber Operations within the FMA Area

The Forest Management Agreement paragraph 8 (2) states that "The Minister reserves the following rights to the timber on the forest management area after consulting with the Company:

a) the right to issue timber permits on an annual basis from within the forest management area to provide timber for local use in construction and maintenance of public works by any local authority, municipality, county, the Crown in the right of Alberta or Canada and for local residents as follows:

   i) all of the coniferous timber from lands contained in township 47, ranges 8 and 9 W5M and the eastern half of township 47, range 10 W5M; and

   ii) in respect of all other land forming part of the forest management area excepting those lands described above up to 1% of the approved annual allowable cut for coniferous timber, and up to 1% of the approved annual allowable cut for deciduous timber.

Rose Creek West Community Timber Program

Weyerhaeuser recognizes that the pure coniferous (C) and conifer predominant mixedwood (CD) stands from within township 47, ranges 8 and 9 W5M and the eastern half of township 47, range 10 W5M contribute to the conifer Annual Allowable Cut of the Rose Creek West CTP (see figure 20).

To achieve sustainable production of timber and to integrate other resource values, Weyerhaeuser will complete the harvest designs as a service for, and in consultation with Land and Forest Service and the Local Advisory Committee for the Rose Creek West CTP.

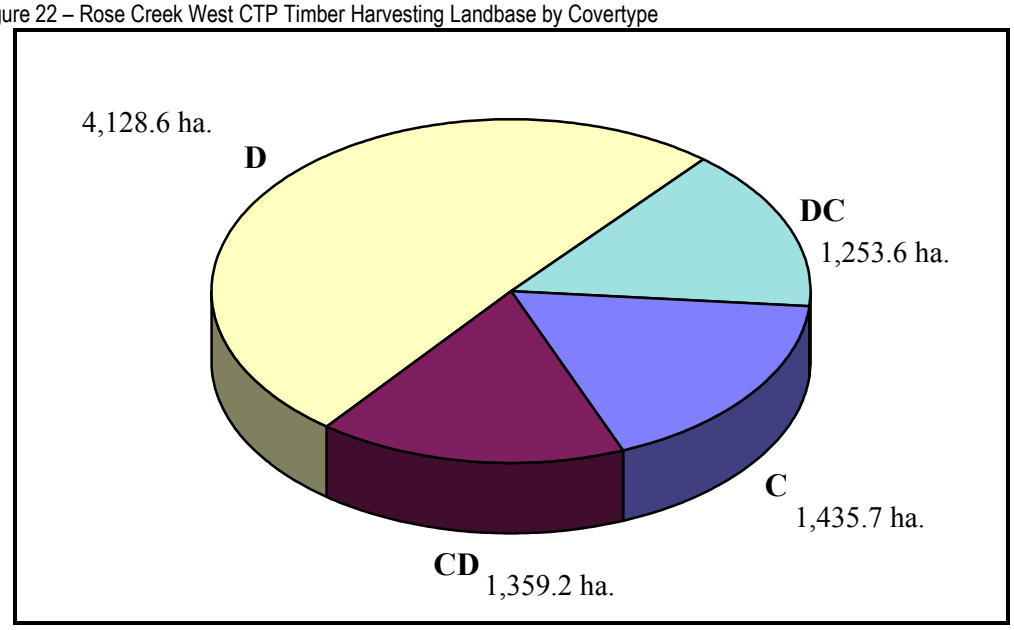
The deciduous predominant stands from within the Rose Creek West CTP will be operated by the Company as a stand-alone harvesting opportunity. The strategies for integrated deciduous volumes generated from the Rose Creek West CTP are noted in Section I 3.2.1. On an annual basis, Land and Forest Service will provide to the Company the conifer volume and the stands scheduled for harvesting by the permittees for the upcoming five-year period to ensure that Weyerhaeuser can identify integrated deciduous volumes in the General Development Plan.

Incidental conifer volumes generated from the deciduous landbase in this area will be made available to the Rose Creek West CTP through Land and Forest Service. Weyerhaeuser will provide annual estimates of conifer volume to be generated for the upcoming five-year period. Land and Forest Service and the Local Advisory Committee, in consultation with Weyerhaeuser, will determine the method of distribution of the incidental conifer volume. Weyerhaeuser and the Local Advisory Committee will work cooperatively to ensure efficient harvesting and hauling operations from the Rose Creek West CTP that will also consider long-term timber development and integrated resource management objectives.

Land and Forest Service will provide to Weyerhaeuser each year the volumes generated by block, and a map showing the areas harvested and the reforestation activities conducted the previous year.

Figure 22 shows the timber harvesting landbase (including grazing dispositions) for the Rose Creek West CTP area by the broad covertype of pure coniferous (C), coniferous predominant mixedwood (CD), deciduous predominant mixedwood (DC), and pure deciduous (D).

Figure 22 – Rose Creek West CTP Timber Harvesting Landbase by Covertype



Timber Permit Program

Land and Forest Service administers the Timber Permit (CTP, DTP and LTP) program from both the Brazeau and the Clearwater Forest Area offices. Permits are given to local users seeking wood for personal use for products such as firewood, posts, poles, building logs, and lumber.

In accordance to the Forest Management Agreement paragraph 20 (1) Weyerhaeuser and Alberta Environment have determined the proposed cutovers sequenced for permit issuance from within the FMA Area, and the Company will provide the schedule for harvesting in Annual Operating Plans. Sequenced stands represent the range of the log size profile for the FMA Area. Volume harvested under the permit program is chargeable to the FMA Annual Allowable Cut (AAC), and the volumes are not to exceed 1% of the FMA AAC on a five-year quadrant basis.

Areas where harvesting is completed will be given a cutover designation and will have the appropriate reforestation work carried out by Alberta Environment. Alberta Environment will report to Weyerhaeuser annually the volume harvested, and will identify the areas harvested and reforestation work completed under the permit program.

Integrated Birch Harvesting

It is considered good forest management to maximize utilization for a given harvest area in order to reduce the area required for harvesting by all timber users. Birch volumes will be produced primarily as incidental volume from timber harvesting operations that focus mainly on aspen, balsam poplar, and conifer. As noted in Section I 3.2.3 table 7, the forest inventory contains less than one-percent birch. Available birch volumes will fluctuate from year to year and will be distributed annually in consultation with Land and Forest Service in the following order of priority for utilization:

1. Local sawmills and small, individual firewood permits
2. Traditional commercial firewood producers
3. Use in Weyerhaeuser's manufacturing facilities.

All timber harvest planning will determine birch volumes for a given cutover so as to identify potential sources in advance and ensure there is no conflict with other resource objectives (e.g., tree retention for ecological values). Actual harvesting will occur under the following guidelines:

- Birch logging will be conducted at the same time as, or immediately following the primary operations (i.e., not before).
- The birch component may be harvested by Weyerhaeuser's logging contractors under authority of the Annual Operating Plan for use by Weyerhaeuser or for sale to a birch user and all scaling and reporting will be the responsibility of Weyerhaeuser.
- The birch component may be harvested by a birch permittee immediately following Weyerhaeuser's operations under authority of an overlapping Timber Permit to be coordinated with Alberta Environment, and all scaling and reporting will be the responsibility of Land and Forest Service.
- Minimum utilization shall be Ground Rules standards.
- Birch harvesting operations shall not unduly hinder the harvesting or reforestation operations of Weyerhaeuser or Tall Pine Timber Co. Ltd.

The Company will work with Land and Forest Service to find and develop a stand-alone birch harvesting area within the Brazeau Forest Area to accommodate birch permittee requirements when no birch is available from FMA Area's harvesting activities (that is, Weyerhaeuser's, Tall Pine's, or the Rose Creek West CTP).

As noted in the Forest Management Agreement, Alberta Environment retains the right, after consultation with Weyerhaeuser, to issue timber dispositions for birch timber from the amended area of the FMA.

3.3.4 Data Sharing Agreement

The Company will, at the request of the Quota holder, provide copies of the original digital forest inventory (Alberta Vegetated Inventory – AVI) files and covertype volume tables produced by the Company to AVI standards as per our data sharing agreement with the Province of Alberta. Also at the request of the Quota holder, the Company will make copies of the updated digital AVI files and covertype volume tables produced by the Company to AVI standards for a particular year or any previous year. This will be done at no charge if the Quota holder has funded the cost of AVI updates for that year necessitated by activities of the Quota holder according to the normal schedule for updating defined in the Data Sharing Agreement.

3.3.5 Integrated Timber Operations Objectives

Table 54 – Integrated Timber Operations Objectives

Objective	Target
Provide sequencing for Local Timber Permitees representative of the entire wood profile	• Generate stand sequencing for four five year periods across the FMA Area in consultation with Alberta Environment.
Include incidental birch in harvest designs and incorporate into annual planning to ensure appropriate utilization	• Identify any potential birch volume for all proposed cut blocks so as to identify sources in advance of harvesting.
Develop integrated (deciduous and coniferous) harvest designs for the FMA	• The Company will complete necessary preliminary harvest designs for the Rose Creek West CTP in consultation with Alberta Environment and the Local Advisory Committee. • Harvest designs and Annual Operating Plans developed by other timber operators on the FMA Area are to be provided to Weyerhaeuser in a timely manner to ensure integration of the incidental deciduous component.
Ensure utilization of incidental deciduous volume from within cutovers harvested by coniferous quota or non-quota operators.	• All incidental deciduous volume is utilized.

Table 55 – LMU Specific Integrated Timber Operations Objectives

LMU	Objective
Baptiste	• Objectives common to all of FMA Area.
Blackstone	• Objectives common to all of FMA Area.
Elk River	• Maintain the Sundance volume commitment as per Agreement.
Marshybank	• Objectives common to all of FMA Area.
Medicine Lake	• Objectives common to all of FMA Area.
Nordegg River	• Objectives common to all of FMA Area.
O'Chiese	• Objectives common to all of FMA Area.
Sand Creek	• Provide twenty years of conifer sequencing for Rose Creek West Community Timber Program (CTP) from conifer predominant stands. • The Company will complete necessary preliminary harvest designs for the Rose Creek West CTP in consultation with Alberta Environment and the Local Advisory Committee.
Tall Pine	• Provide twenty years of conifer sequencing for Tall Pine Timber Co. Ltd. from conifer predominant stands. • Utilize existing Tall Pine harvest designs to develop sequencing in LMU.
Willesden Green	• Objectives common to all of FMA Area.

3.4 Harvesting and Hauling Methods

The harvesting and hauling methods adopted by the Company were selected to meet the following criteria:

- efficiency in implementing dominant silviculture regimes;
- cost per unit of delivered wood;
- safety;
- mill requirements for piece size, wood quality, and delivery schedules; and
- alignment with public values.

The Company will be employing harvest and hauling methods to lengthen the timber harvesting and hauling season. Some of the methods are:

- optimization of summer ground by harvesting blocks at the appropriate time of year, while at the same time ensuring that soil degradation is minimized;
- use of low ground-pressure harvesting equipment during unfrozen ground conditions to mitigate any soil degradation;
- advanced inter and intra block road construction to allow ample time for the road to stabilize prior to hauling; and
- continuation of early spring timber harvesting with hauling of the timber in early summer.

The following table represents a summary of harvesting methods used by Weyerhaeuser at the time of Plan submission.

Table 56 – Harvesting Methods.

Phase	Deciduous	Coniferous
felling	manual or mechanical	manual or mechanical
skidding	rubber tired grapple or cable, or forwarder ("wide" tired during unfrozen conditions)	rubber tired grapple or cable, or forwarder ("wide" tired during unfrozen conditions)
limbing / topping	stump side or roadside; manual or mechanical	stump side or roadside; manual or mechanical
bucking	roadside manual or mechanical	roadside manual or mechanical
hauling	shortwood (2.6m) or treelength	treelength or cut to length

All harvesting operations are currently contracted on a "stump to dump" or "stump to roadside" basis.

The Company has initiated a skills development program to improve its technical knowledge of logging on steep slopes (between 45% and 60%). In the development of harvest designs a terrain stability assessment will be provided to identify sensitive sites due to the presence of, but not limited to, seepage, proximity to watercourses, and steep slopes (greater than 45%). In cooperation with our logging contractors, the Company will develop methods for timber harvesting on steep slopes in an environmentally sound, safe and cost effective manner. Harvesting on all steep slopes (in excess of 45%) will be conducted in a manner that will minimize soil erosion.

Specific to hauling, the Company is researching the use of Central Tire Inflation (CTI) technology to extend the hauling season. Also, the Company has developed timber harvest sequencing to balance the haul distance during the planning horizon.

3.4.1 Harvesting and Hauling Methods Objectives

Table 57 – Harvesting and Hauling Methods Objectives

Objective	Target
Lengthen the timber harvesting and hauling season	• Ensure that summer ground is optimized by harvesting blocks at the appropriate time of year. • Continue the use of low ground pressure tires during unfrozen ground conditions. • Develop advance inter and intra block roads. • Continue early spring harvesting with hauling in early summer.
Follow the Plan's sequencing including areas with slopes between 45% and 60%.	• Complete a terrain stability assessment for all harvest designs to ensure soil erosion is minimized.
Balance haul distances during the planning horizon	• Sequence stands across the entire FMA Area for all planning periods.

Table 58 – LMU Specific Harvesting and Hauling Methods Objectives

LMU	Objective
Baptiste	• Objectives common to all of FMA Area.
Blackstone	• Allow only 1000 hectares of harvesting during first five years of Plan.
Elk River	• Optimize the summer hauling chance for conifer.
Marshybank	• No harvesting scheduled for area adjacent to Jasper National Park for first five years of Plan. • Allow only 500 hectares of harvesting during first five years of Plan.
Medicine Lake	• Objectives common to all of FMA Area.
Nordegg River	• Objectives common to all of FMA Area.
O'Chiese	• Objectives common to all of FMA Area.
Sand Creek	• Objectives common to all of FMA Area.
Tall Pine	• Objectives common to all of FMA Area.
Willesden Green	• Objectives common to all of FMA Area.

3.5 Road Development

Public and private roads provide relatively good access to the FMA Area. Section I 3.2.6 table 19 shows the extent of existing road development across the FMA Area, by Landscape Management Unit.

To maintain the productive capacity of the forest the Company will:

- minimize the amount of site disturbance from inter and intra block roads developed for harvesting and silviculture activities;
- minimize the right of way widths for all roads to limits that do not affect safety or environmental standards; and
- target an average of less than five percent of the block area to be disturbed for harvesting operations.

Weyerhaeuser has completed the Nordegg River Road, which connects the Sunchild Road with the Forestry Trunk Road. The Nordegg River Road is a long-term (> 5 years) road that runs east/west between the Brazeau River and the Nordegg River. Permanent road construction is generally expected to be short term (< 5 years) to class III standards, according to the Ground Rules. All existing and proposed permanent road construction will be presented in the General Development Plan submissions. During this Plan period the Company will be evaluating route selection and developing access to and within the Blackstone and Marshybank LMUs.

3.5.1 Road Development Objectives

Table 59 – Road Development Objectives

Objective	Target
Develop advance inter and intra block roads	• All main summer intra and inter block roads to be developed during previous operating season.
Minimize the amount of site disturbance from road construction	• Utilize minimum right of way widths • On average less than five percent of the block area to be disturbed for hauling operations (i.e. roads and landings).

Table 60 – LMU Specific Road Development Objectives

LMU	Objective
Baptiste	• Objectives common to all of FMA Area.
Blackstone	• Minimize the amount of permanent road developed by the Company. • Plan and develop the main haul route(s) in consultation with other resource users and Alberta Environment.
Elk River	• Objectives common to all of FMA Area.
Marshybank	• The Company will not build any permanent road into the area adjacent to Jasper National Park. • Minimize the amount of permanent road developed by the Company. • Plan and develop the main haul route(s) in consultation with other resource users and Alberta Environment.
Medicine Lake	• Objectives common to all of FMA Area.
Nordegg River	• Maintain access control points on the Nordegg River Road.
O'Chiese	• Objectives common to all of FMA Area.
Sand Creek	• Objectives common to all of FMA Area.
Tall Pine	• Objectives common to all of FMA Area.
Willesden Green	• Maintain access control points on the Rose Creek Road.

3.6 Input into Operational Planning

Community and stakeholder input and involvement is an important forest stewardship principle for Weyerhaeuser and aligns well with the DFMP goal to **improve public acceptance of Weyerhaeuser's – Drayton Valley forest management activities**. In achieving this goal the Company will strive to:

- obtain meaningful input and advice from the public on our forest management activities;
- educate and communicate with the public about the forest;
- cooperate with all land neighbours;
- recognize social values;
- align our practices with public values; and
- manage the forest in a socially acceptable manner

As noted in the Public Involvement Plan, Weyerhaeuser will maintain ongoing consultation activities with affected and interested members of the public after the DFMP has been approved and implementation of the Plan has begun. This will involve identifying local and site-specific concerns and incorporating these concerns into the operational planning process. As well,Weyerhaeuser will take advantage of opportunities to identify and respond to broader strategic concerns raised by the public and incorporate these concerns into future DFMPs.

3.6.1 General Public

As part of Weyerhaeuser's public involvement program, Weyerhaeuser will be seeking input from the general public on all operating plans. All approved Annual Operating Plans will be available for public review at the offices of the Land and Forest Service and at Weyerhaeuser's office, as well as other designated locations. Such notice will be given to the public annually through local media. In addition, contact lists will be maintained for information dissemination. Subsequent input will be documented and directed to the appropriate planning process. The Company's stewardship and monitoring reports will also be made available to the general public.

3.6.2 FMA Area Stakeholders

In addition to the strategies outlined in the parts of this Section pertaining to stakeholders, the Company will work proactively to obtain input from local stakeholders to its operational planning process by:

- maintaining a list of stakeholders for the harvest design area through the cooperation of Alberta Environment staff who will provide information from their databases;
- seeking stakeholder input into the harvest design prior to its development and submission by providing design objectives and maps of the harvest design area before the field work begins;
- ensuring feedback by providing a completed harvest design to the stakeholders, outlining the stakeholders' input and how it was incorporated into the harvest design; and
- making copies of the plans available.

3.6.3 Forest Advisory Committee

Weyerhaeuser will continue to utilize the Forest Advisory Committee (FAC), at the FAC's discretion, to review and participate in the development of timber harvest designs and operational planning. As per the Terms of Reference for the FAC, Weyerhaeuser will solicit FAC participation into these planning documents as the FAC's time and priorities permits.

3.6.4 Public Input Objectives

Table 61 – Public Input Objectives

Objective	Target
Obtain meaningful input and advice from the public on our forest management activities	• All Annual Operating Plans and harvest designs available for reading at Company office and Alberta Environment. • Communicate input received during open houses, etc to Alberta Environment including resolution outcome. • Maintain ongoing consultation activities with affected and interested members of the public after the DFMP has been approved and implementation of the Plan has begun as per the Public Involvement Plan.
Educate and communicate with the public about the forest	• Participate in school presentations, National Forestry Week activities, presentations to business community and interested parties, etc.
Provide updates to the FAC on the Company's operational planning	• See input from the FAC members on harvest designs as their time allows.
Cooperate with all land neighbors	• Involve land neighbors (e.g. private land) in the development of harvest designs.

Table 62 – LMU Specific Public Input Objectives

LMU	Objective
Baptiste	• Objectives common to all of FMA Area.
Blackstone	• Objectives common to all of FMA Area.
Elk River	• Objectives common to all of FMA Area.
Marshybank	• Objectives common to all of FMA Area.
Medicine Lake	• Objectives common to all of FMA Area.
Nordegg River	• Objectives common to all of FMA Area.
O'Chiese	• Objectives common to all of FMA Area.
Sand Creek	• Objectives common to all of FMA Area.
Tall Pine	• Objectives common to all of FMA Area.
Willesden Green	• Objectives common to all of FMA Area.

3.7 Forest Protection and Health

Protecting the forest and maintaining or improving forest health are important factors in helping the Company achieve the DFMP goal of **increasing the sustainable harvest level of deciduous and coniferous timber from the FMA Area.**

3.7.1 Forest Protection - Fire

To achieve this goal, Weyerhaeuser's strategy is to continue to work cooperatively with government agencies at the provincial and municipal levels to protect the forest values entrusted to the Company. Weyerhaeuser's objectives in fire management are to protect and enhance timber resources, to protect private and public property and to protect human life.

Weyerhaeuser is currently negotiating revisions to the existing Fire Control Agreement with Lands and Forest Service. The Agreement will outline the Company's responsibilities for forest fire protection measures and suppression activities. The Fire Control Agreement will contain the following key points:

- company requirements for fire suppression equipment, training and personnel;
- Land and Forest Service and the Company's separate roles and responsibility for suppression, pre-suppression, and training;
- requirements of an Annual Fire Control Plan to be submitted in conjunction with the Annual Operation Plan; and
- financial details for the calculation of liability for costs of forest fires.

In cooperation with Alberta Environment, Weyerhaeuser has completed a Fire Behavior Prediction System data set for the FMA Area. The Canadian Forest Fire Behavior Prediction System provides quantitative estimates of head fire spread rate, fuel consumption, fire intensity, and fire description. With the aid of an elliptical fire growth model, it gives estimates of fire area, perimeter, perimeter growth rate, and flank and back fire behavior. Detailed descriptions of the fuel types can be found in Appendix 5, and the *FMA Fire Risk (Fire Behavior Prediction) Map* is available on page 12 of Appendix 4.

Operationally, Weyerhaeuser will inform or solicit advice from Land and Forest Service about:

- opportunities for harvest designs to minimize the potential spread of fire. The Forest Fire Behavior Prediction System will be the basis for the decision model. Fire protection objectives may conflict with our harvest design objectives, such as aesthetics or wildlife considerations, but will still be taken into consideration;
- salvage of merchantable timber that has been damaged or killed by fire, as this will be a priority of utilization;
- the use of prescribed fire as a silviculture tool. Weyerhaeuser does not currently use this silviculture tool, however, it may be considered in the future. Weyerhaeuser will cooperate with other agencies in their use of prescribed fire for the purposes of research or vegetation management, provided that precautions are taken to ensure that no timber is at significant risk; and
- annual or short-term operational strategies for fire management that will be included in the Annual Fire Plan and/or the AOP plans.

3.7.2 Forest Health

A healthy forest is the goal of forest management objectives. In a forest health program, biological, physiological, and environmental factors that have an adverse effect on the health of the forest are carefully monitored and managed. These factors include insects; microorganisms (viruses, bacteria, fungi); parasitic plants; mammals; birds; noxious and restricted weeds; and non-infectious disorders caused by climate, soil, applied chemicals, air pollutants and other physiographic conditions.

Forest health is maintained through detection, surveying and monitoring, risk assessment, and the implementation of various management programs in forest stands.[45] As a member of the Alberta Environment's Regional Integrated Pest Management Working Group, the Company will cooperate with and assist Alberta Environment in detecting and monitoring important forest insects, diseases and other natural damaging agents, including blowdown.

The detection and monitoring program will consist of the following components.

- Blowdown location and severity will be monitored annually, using the following approaches and techniques:
    - Cutover update process will be used.
    - Monitoring will occur during all silviculture work including, but not limited to regeneration surveys.
    - As necessary, an aerial survey of the harvested portions of the FMA Area will be conducted, focusing on areas known to be at risk.
- Training of key planning and operations personnel on the identification of forest health agents.
- Insect and disease (I/D) information (type and severity) will be collected when regenerating stands are surveyed. In most cases this will include an establishment and performance survey. The establishment survey will take place three to eight years after harvest and the performance survey 8 to 14 years after harvest.
- Extensive damage information (abiotic injuries, diseases, insects, treatment injuries, vegetation problems, and wildlife damage) is currently being collected on all Northern Interior Vegetation Management Association (NIVMA) plots. This information is collected before and after harvest. The post-harvest information is collected at permanent sample plots on crop trees at years 1,2,3,5,7,10, and 15. This data is stored in a central database and can be accessed by any NIVMA members for analysis.
- During the pre-harvest assessment surveys, insect and disease information will be collected to identify potential issues related to regeneration efforts. This information can then be considered in developing the silviculture prescription.
- A reporting process will be used when employees or contractors, during their normal work routine, encounter an insect or disease problem. Although this is somewhat "ad hoc", it allows insect and disease issues to be raised. It is prudent to have those individuals spending time in the FMA Area to keep their eyes open for I/D problems. The system will allow for potential issues to be followed up and pursued by experts in the field.

[45] Alberta Environment web site

- In consultation with Alberta Environment the Company will develop a record keeping and tracking system for forest health agents.

Weyerhaeuser will also work cooperatively with Alberta Environment staff as they implement their forest pest monitoring program. This program has been strengthened since the Forest Insect and Disease Survey (FIDS) of Northern Forestry Centre, Canadian Forest Service, Natural Resources Canada has been disbanded. Aerial surveys for defoliation and surveys with pheromones have been the main monitoring tools used by Alberta Environment.

In addition, any significant signs will be recorded as part of all forest inventories and operational stand assessments done by the Company. Any information that would indicate a potential problem will be reported to Lands and Forest Service for consultation on what actions should be taken collectively to prevent damaging outbreaks. The Company, with the cooperation of Land and Forest Service, will be developing a Forest Insect and Disease data collection and inventory process during the Detailed Forest Management Plan period.

Weyerhaeuser will continue to participate in the research and development of mitigation and control techniques for insect and disease damage; for example:

- The Company will work with researchers, Alberta Environment, and other industry partners to develop strategies and techniques to mitigate the damage to the forest resource from forest pests. Before control measures are implemented, it is imperative to truly understand and quantify the impact to the forest resource, and to evaluate the potential risks (e.g., ecological) when implementing a control program. The monitoring program, therefore, is critical in building a knowledge base that, over time, will allow Weyerhaeuser to rank the importance of various pests in terms of their potential impact on the forest resource.
- Weyerhaeuser is currently participating in a number of I/D research projects, including Dr. Peter Blenis' Shepherd's Crook Impact Study, and Dr. Jan Volney's study on Abiotic and Biotic Factors Affecting Productivity of Aspen.
- The Forest Health Branch is developing a predictive modelling tool that will enable stands to be assessed for hazard related to the Mountain pine beetle. The company will request that the entire FMA Area be mapped to identify key portions that could be threatened by Mountain pine beetle.
- Work on a predictive model for *Armillaria* is also being undertaken and, when completed, the Company will be reviewing the applicability of this model as a forest planning tool.

3.7.3 Noxious Weeds

The invasion of noxious weeds in the forested areas of the Municipal Districts and Counties continues to be a concern. Weyerhaeuser recognizes that its timber harvesting operations are a potential mechanism for spreading such weeds and will cooperate with the Municipal Districts and Counties in the control of noxious weeds in its operating areas. Specific measures will include:

- training of Weyerhaeuser Forestlands staff on noxious weed identification, growth characteristics and control;
- annual inspections of Weyerhaeuser's permanent roads;
- establishment and implementation of a policy that requires logging equipment to be cleaned when moved from rural or town sites (or infested forest sites) to the forest sites; and

- documenting any sightings as encountered during normal survey work.

Hand picking and disposal will be promoted for spot encounters, however Weyerhaeuser will use chemical control methods under permit as deemed necessary.

3.7.4 Forest Protection Objectives

Table 63 – Forest Protection Objectives

Objective	Target
Complete the amendment to the Fire Control Agreement	• Spring 2001
Participate in a forest health reporting and monitoring program with Alberta Environment	• Participate in training exercises to improve operational and planning staff on forest health agents. • Document and report significant sightings of insects and diseases during operational survey work. • Continued participation in the Alberta Environment Regional Insect and Disease working group.
Cooperate with provincial and municipal governments to monitor and control noxious weeds on the Company's operating areas.	• Conduct annual training with operations and planning personnel. • Perform annual inspections of the Company's permanent roads. • Document and report all sightings of noxious weeds during operational survey work.

Table 64 – LMU Specific Forest Protection Objectives

LMU	Objective
Baptiste	• Objectives common to all of FMA Area.
Blackstone	• Cooperate with Alberta Environment in the reporting and monitoring of mountain pine beetle.
Elk River	• Objectives common to all of FMA Area.
Marshybank	• Cooperate with Alberta Environment in the reporting and monitoring of mountain pine beetle.
Medicine Lake	• Objectives common to all of FMA Area.
Nordegg River	• Objectives common to all of FMA Area.
O'Chiese	• Objectives common to all of FMA Area.
Sand Creek	• Objectives common to all of FMA Area.
Tall Pine	• Objectives common to all of FMA Area.
Willesden Green	• Objectives common to all of FMA Area.

SECTION III
EVALUATION OF RESOURCE MANAGEMENT STRATEGIES AND OBJECTIVES AND SELECTION OF PREFERRED STRATEGY

INTRODUCTION

The purpose of Section III is to present the methods and results used to select the preferred management scenario. The preferred scenario indicates current and future expected levels of outputs associated with meeting all management objectives presented in the previous section. Outputs include measures and indicators of a wide variety of forest resource values.

The previous management plan for the FMA was completed in the spring of 1992. Over the past eight years, a number of things have changed with respect to the size of the FMA, and the kind and quality of information used to represent it. The following list describes some of the more significant changes:

- In the 1992 DFMP, the total area of the FMA was about 247,588 ha. The current total area of the FMA is about 419,109ha.
- In the 1992 DFMP the productive forest land base used to support the projected harvest of timber was about 187,682 ha. The timber harvesting landbase used for the current analysis is about 264,616.4 ha.
- The average maximum mean annual increments used in the 1992 DFMP were assumed to be about 1.45 m^3/ha/year for deciduous dominated stands and about 1.2 m^3/ha/year for conifer dominated stands. These same parameters today are about 3 m^3/ha/year for deciduous dominated stands and about 2.6 m^3/ha/year for conifer dominated stands.
- The utilization assumptions used to estimate merchantable deciduous volumes have changed. The 1992 DFMP used a "17/10" standard (17 cm stump diameter, outside bark, and 10 cm top diameter, inside bark) for deciduous volumes and a "15/10" standard for conifer volumes. The current analysis uses a "15/11 standard for conifer volumes and a "15/10" standard for deciduous volumes.
- The 1992 analysis used the Phase III forest inventory, which was the most current inventory at the time. The current analysis used the new "Alberta Vegetation Inventory" or AVI.

There are a large number of other changes in methods, assumptions, and information that have been improved since the previous DFMP in 1992. However, the points listed above explain a considerable portion of the differences in changes to the resultant harvest schedules projected in this DFMP.

1. GROWTH AND YIELD

1.1 Volume Sampling Programs

Volume sampling data used in the timber supply analysis was compiled from a variety of stratified random sampling programs. The majority of the data were temporary sample plot data although permanent sample plot (PSP) data collected by Weyerhaeuser on the FMA Area was also used (initial measurements and re-measurements).

1.1.1 Temporary Volume Sampling

During the summers of 1997, 1998 and 1999 Weyerhaeuser established Temporary Sample Plots (TSPs) on the Drayton Valley FMA to provide a basis for the Timber Supply Analysis that is localized to the FMA Area (see Appendix 4 *Temporary Sample Plot Map* on page 19). All TSPs were marked with an aluminum stake and referenced with a location determined by Global Positioning System in order to:

1. record the location of plot center,
2. confirm location on forest inventory maps,
3. facilitate check cruising, and
4. allow for the possible re-establishment of plot locations in subsequent volume sampling programs.

Minor changes to the plot configuration have occurred during subsequent year's programs to simplify establishment and check cruising. Comprehensive field procedures are provided in Appendix 10.

Table 65 – Temporary Volume Sampling Sources

Program	Locations sampled	Description	Number of plots
1997 FMA volume sampling program	FMA	Program was conducted in 1997. Stratification was based on AVI in the pre-extension FMA and Phase 3 in the extended portion of the FMA. The stratification using AVI and Phase 3 was based on species composition, species, density and height class. Plots were established as 3 plot clusters. Plot size was 0.016 ha.	636
1998 FMA volume sampling program	FMA	Program was conducted in 1998. Stratification was based on AVI in the FMA. The stratification was based on species composition, species, density and height class. Transects were established for the entire FMA at an azimuth of 60° every 250 m. (A square grid of 250 m × 250 m results in 1 intersection for every 6.25 ha.) The grid of transects was overlaid (using GIS) onto the AVI polygon base. The linear distance of each transect within each polygon was determined and three plots within each polygon were randomly placed on the transect(s) within each stand. Not all polygons were intersected by the transects. Plot size was 0.016 ha.	1686
1999 FMA volume sampling program	FMA	Program was conducted in 1999. Stratification was based on AVI in the FMA. The stratification was based on species composition, species, density and height class. Plot location was based on the same transects established for the entire FMA in 1998. Plot size was 0.016 ha.	199

1.1.2 Permanent Sample Plots

Weyerhaeuser has a committed to establish a Permanent Sample Plot (PSP) program for the Drayton Valley FMA. The PSP program represents a long-term commitment on the part of Weyerhaeuser to determine the growth and yield of the forests within the FMA Area. The program was initiated in 1994 with the establishment of several PSPs. These initial PSPs were used to help refine the methodology for plots that have been subsequently established.

The PSP field procedures are based, to some extent, on the Land and Forest Service's PSP program. The plot configuration has been changed to simplify establishment and re-measurement. Additional changes to the procedure were also necessary to facilitate measurement of hardwood and mixedwood stands. The complete field procedures are discussed in the Weyerhaeuser document: *PSP Field Procedures, October 1995*.

In an effort to quantify the decline of over mature deciduous stands Weyerhaeuser re-measured 30 PSPs during the summer of 1999 (see Appendix 4 *Permanent Sample Plot Map* on page 20).

Table 66 – Permanent Volume Sampling Sources

Program	Locations sampled	Description	Number of plots
FMA PSP program	FMA	Weyerhaeuser established PSPs from within the FMA were used in the analysis. The majority of plots only have a single measurement. Plot size is 0.1 ha.	179
FMA PSP re-measurement program	FMA	Weyerhaeuser PSPs established within the pre-extension FMA on over mature deciduous sites were re-measured.	30

1.2 Yield Forecasting

1.2.1 Volume Compilation

a) Utilization Standards

The timber supply analysis was based on planned operational utilization of coniferous and deciduous trees. Coniferous species included as part of the coniferous timber supply include white spruce, lodgepole pine, Engelmann spruce, balsam fir, subalpine fir and black spruce. Deciduous species planned for utilization include aspen, black poplar and white birch.

Tree utilization standards, defined by stump diameter and top diameter, are illustrated in Table 67.

Table 67 – Utilization standards

Species Group	Stump Diameter[46] (outside bark, cm)	Top Diameter (inside bark, cm)
Coniferous	15	11
Deciduous	15	10

Conifer trees are processed in tree length form or as cut-to-length. Deciduous trees are processed in a short wood harvesting system. This processing difference is reflected in the compilation of volumes.

b) Tree Volume Compilation

Tree volumes were compiled based on taper equations developed by Huang (1994)[47]. The volumes of coniferous trees for the entire merchantable length were derived from the methodology described by Huang. As the volume realized in short wood harvesting may be less than the volume derived in tree length processing, the methodology was modified to reflect current harvesting practices.

In short wood, section lengths of 2.56 m were assumed, except for the last section in the tree. The last section was allowed to vary between 2.13 m and 2.69 m. If the last section of the tree was less than 2.13m, it was assumed to be coarse woody debris. The consequence of this approach is that compiled tree volumes using the short wood system are generally smaller than the volumes compiled as tree length.

c) Height – Diameter Relationships

Height was measured on a random sample of trees within each temporary sample plot. Height for the non-measured trees was estimated from height-diameter[48] relationships, derived from the trees that were measured.

The height – diameter relationships were based on species, Natural Subregion and SiteLogix® predictive ecosite classification. Where significant differences in the height – diameter relationships were related to ecosite, the ecosite designations were grouped into classes of good, medium and fair. The membership in the ecosite groups were solely based on observed differences in the height – diameter relationships.

[46] Stump diameter as measured at 0.3 m above the point of germination.
[47] Huang, S. 1994. Ecologically based individual tree volume estimation for major Alberta tree species. Report #1. Land and Forest Service.
[48] Diameter at breast height: 1.3m above the point of germination.

The height – diameter relationships are summarized in Appendix 11 and are described as follows:

Functional Form:

Height = 1.3+a*(1-EXP(-(b)*DBH))**c

where:

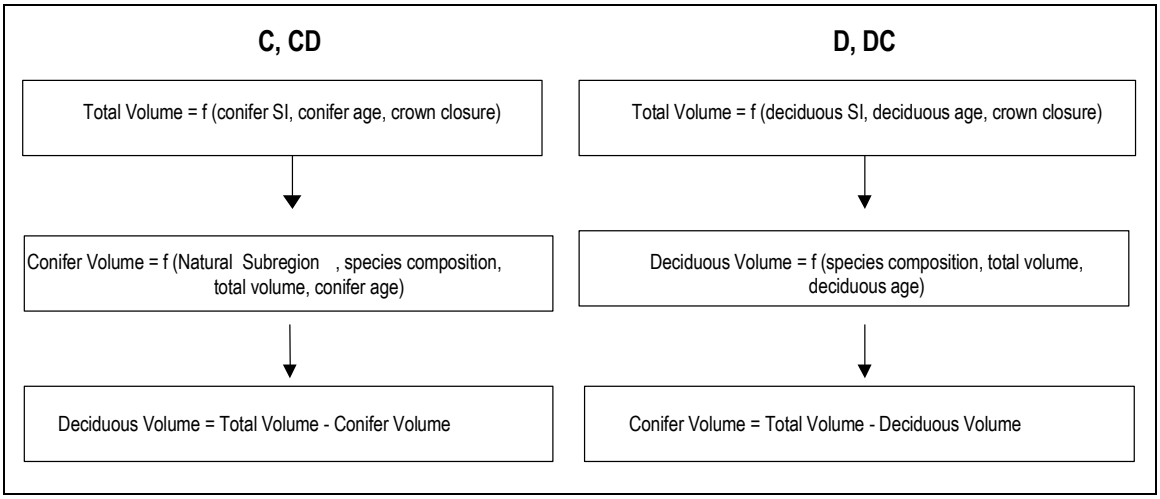
Height = tree height (m)
DBH= diameter at breast height (m)
a,b,c = coefficients

In cases where there were insufficient data to develop a height-diameter relationship, coefficients from other relationships were used (e.g. The coefficients used to predict heights of aspen in sub-alpine areas were based on relationships derived from the Upper Foothills Natural Subregion).

1.2.2 Yield Relationships

In general, the yield produced from a forest or stand is function of inherent site productivity, species composition, stocking level, developmental state, management intervention (e.g., fertilization, density management), and events that could be considered stochastic (e.g. insect infestations, hail damage). In this management plan, yield was forecast as a function of site index (SI), crown closure (from AVI), species composition (from AVI) and age (implied from AVI). The first step in the process was to estimate total gross merchantable volume. Deciduous and coniferous volumes were then derived as functions of total volume, as shown in Figure 23.

Figure 23 - Volume functions for deciduous and coniferous dominated stands



In the relationships derived for C and CD stands, all plots within stands having 40% conifer or more (based on AVI classification) were used to develop the relationship. Similarly, all plots within stands of 60% conifer or less were used in the development of relationships for D and DC stands. The intent was to develop relationships for mixedwood stands that were reasonably compatible. Appendix 12 contains the model forms and coefficients for the yield relationships.

Separate yield relationships were developed for conifer dominated stands in the Upper Foothills subregion primarily because of the difference in deciduous volumes between the Upper Foothills and the Lower Foothills.

The distribution of plots by Natural Subregion and cover group is shown in Table 68.

Table 68 - Distribution of Sampling Plots by Natural Subregion and Cover Group

Natural Subregion	Cover Group			
	C	CD	DC	D
Lower Foothills	925	238	222	856
Upper Foothills	529	10	9	2
Sub-Alpine	112	0	0	0
Total	**1566**	**248**	**231**	**859**

It is necessary to distinguish between the methodology used for development of yield relationships and the approach for implementation of the relationships. Table 69 indicates the source of information for each independent variable for development of yield curve equations, and the data used to apply yield relationships.

Table 69 - Yield relationship source of information

Independent Variable	Source of Data for Development of Yield Relationships	Source of Data for Application of Yield Relationships
Natural Sub-Region	Mapped ecosite on which the plot was established classification (SiteLogix)	Obtained from mapped ecosite classification (SiteLogix)
Species Composition	AVI classification – conifer proportions from 0 though 10 were used	AVI classification – conifer proportions from 0 though 10 were used
Age	Average age from the trees measured on each plot (average conifer age and average deciduous age)	Age implied by the AVI origin
Site Index (SI)	Based on individual trees measured for age and height	Based on average SI for aggregated mapped ecosite classes
Crown Closure	AVI classification	AVI classification
Cover Group	AVI classification	AVI classification

Actual measured ages were used to develop the yield relationships for two primary reasons:

1. Volume is more directly related to plot age rather than age implied by AVI origin. The AVI is a photo-based inventory; stand origin is a difficult variable to estimate. The result is that yield relationships are intuitively more reasonable and the regression results are improved when actual age is used rather than age implied by AVI.
2. Error in the age implied by AVI origin may result in a distortion of time, if the yield relationships are based on AVI origin. The primary purpose of the yield relationships is to *forecast* yield. If there is error in the AVI origin data and the error is not consistent with age then distortion of age will occur. The example in Table 70 illustrates the type of problem that can occur.

Table 70 - Example problem

	Age Implied by AVI	Average of Actual Stand Age
Stands with an AVI age of 50	50	40
Stands with an AVI age of 80	80	90
Difference in Age	30	50

In this example, stands having an AVI age of 50, were found to have an actual average age of 40 years, and stands having an AVI age of 80 were found to have and average age of 90 years. If a stand of AVI age 50 is grown for 30 years, then its volume will be that of an 80-year-old AVI stand. However, if we look at the actual ages, it would actually have taken

that stand 50 years, not 30 to reach that volume. The reason is that the error in AVI ages is not consistent over time.

Development of yield equations based on actual (real) age is also more realistic when one considers that the majority of growing stock projected over time has a real age associated with it. The age associated with growing stock projected subsequent to recent (past 20 years) or future harvests is a real age. It is well known that accurate projection of these portions of the age class distribution is crucial to an accurate estimate of a long-term sustainable harvest.

The approach taken in this supply analysis is that the age implied by AVI is best thought of as an estimate of actual age. Where actual age was known, it was used; where it wasn't known, the estimate of actual age was substituted.

Appendix 13 shows each yield curve used in the timber supply analysis, as well as a compilation of area-weighted yield curves. An area-weighted yield curve was produced for each cover type, namely conifer, conifer/deciduous, deciduous/conifer, and deciduous.

a) Site Productivity

The timber harvesting landbase is stratified into three classes of site productivity (Good, Medium, and Poor) for both coniferous and deciduous species. The stratification used site index as a measure of site productivity, aggregated on the basis of ecosite classification.

The assessment uses the volume sampling plot data to determine the Site Index for coniferous and deciduous and relates these values to ecosite classifications that were assigned for each plot in the field.

The process initially stratified the timber harvesting landbase by Natural Subregion. The Lower Foothills was treated separately from the Upper Foothills and Subalpine. Within the Natural Subregion strata, the Site Index values for each species group were plotted to show the range of Site Index observations. Ecosite classes were grouped based on the median Site Index value observed, the range of Site Index observations and an operational understanding of site productivity.

The assignment of ecosites into site productivity classes is shown in Appendix 14, Table 1. The next step was to assign the site productivity classes to the ecosite inventory. The ecosite inventory uses both ecosite and ecosite complexes. A frequency distribution Table was used to relate the field call ecosites from the plot data and the ecosite predictions made by the Site Logix® process. The ecosite predictions in the inventory were assigned to a site productivity class based on the high frequency of predictions occurring within each class. The assignment of the mapped ecosite predictions into site productivity classes is shown in Appendix 14, Table 2.

Based on the volume sampling data, site indices were averaged by productivity class (see Appendix 14, Table 3). In some areas, the ecosite classification did not exist, and consequently the average site indices were determined for each TPR class. Stands considered as being Reforestation/Productivity deletions were excluded from the averages.

1.2.3 Rotation Ages

Rotation age is the desired age of harvest of regenerated stands. Given the need to consider forest resource values other than timber and the irregular age class structure of the forest in the FMA, it is expected that there will always be a range of ages at which stands will be harvested.

In Alberta, a definition of rotation age is used to define the planning horizon (planning horizons are generally two rotations in length). This rotation age is generally defined as the

point where mean annual increment (MAI) begins increasing at a decreasing rate (culmination of MAI). Under the condition of an equal distribution of area across all age classes (less than or equal to rotation age), this would result in the maximum amount of fibre available for harvest. The ayield relationships developed for this plan show that MAI culminates on average at 70 years for deciduous dominated stands. In conifer dominated stands, MAI culminates on average at 90 years.

To establish the planning horizon, an average rotation age of 70 years was used for deciduous dominated stands. An average rotation age of 90 years was selected for conifer dominated stands.

2. LANDBASE DETERMINATION

Weyerhaeuser's FMA Area contains land that is excluded from all timber harvesting activity (as noted in paragraph 4 of the Forest Management Agreement). These exclusions include:

- timber dispositions issued prior to the date of the Agreement;
- dispositions pursuant to the Public Lands Act, issued prior to the date of the Agreement;
- patented, licenced or leased land; and
- the beds and shores of all streams, rivers and lakes.

For the purpose of the Timber Supply Analysis, lands under timber disposition were considered to be part of the FMA Area, because the land will be returned to the FMA Area when the disposition is cancelled.

Operational deletions were also made from the FMA Area to address other resource values and current limitations to harvesting and reforestation practices (social, economic or ecological). Considerable effort was made to determine and confirm these exclusions from the FMA Area (see below).

No explicit forecasts were made for future land withdrawals, future seismic activity, or catastrophic events. Future changes in land use will be accommodated by subsequent timber supply analysis and management plans. It is assumed that the current level of land withdrawals that impact the harvesting land base will remain constant over the entire planning horizon. This assumption will be monitored and adjusted accordingly over time using the results of annual disturbance update reporting, and periodic forest inventory updates. A description of all surface dispositions accounted for is shown in Appendix 15.

2.1 Forest Inventories

Weyerhaeuser completed inventories of vegetative cover, ecosites and land use activities for the FMA Area prior to preparation of the Detailed Forest Management Plan.

2.1.1 Alberta Vegetation Inventory

A second inventory of the FMA Area was initiated in 1991 and completed in 1996. Although the inventory was done over a seven-year period with different contractors, the final product was standardized to the Alberta Vegetation Inventory (AVI) version 2.1 specifications. In 1999, the Forest Management Division audited the inventory and advised Weyerhaeuser that the inventory met the standards for an AVI inventory as stated in the audit report of July 5, 1999.

2.1.2 Predictive Ecosite Inventory - SiteLogix®

The use of ecosite classification has been gaining acceptance in operational forestry over the past decade. Ecosites are ecological units defined by moisture and nutrient regimes and are based on the combined interaction of biophysical factors, which together dictate the availability of moisture and nutrients for plant growth. Ecosite classes reflect the inherent potential for forest composition and productivity. An inventory of ecosite classes improves the foundation for strategic planning by representing site capacity in a more complete manner than does the current stand or tree cover.

In 1998, Weyerhaeuser began developing a predictive ecosite inventory. The mapping product is based on the ecosite classification described in the *Field Guide to Ecosites of*

West-central Alberta (Beckingham *et al.* 1996). The process, SiteLogix®, is a proprietary process that utilizes plot data and existing forest cover (AVI), soils, and topographic (DTM) data sources to predict ecosite classes or ecosite class complexes.

A description of the predictive ecosite inventory methods and discussion of results can be found in Appendix 16.

2.1.3 Land Use Classification

Weyerhaeuser has completed the following land use inventories for the FMA Area:

- Private land
- Crown dispositions -
    - grazing dispositions
    - surface leases (e.g., oil field dispositions)
    - protected areas (e.g., natural areas)
- Forest management considerations -
    - operability
    - productivity / reforestation
    - riparian area protection
    - corridor management
    - ecological
    - seismic lines

These inventories capture all land use activities and dispositions for the FMA landbase in digital format, and are current to at least May 1, 1999.

a) Private land

The objective of the private land inventory was to identify any private land within the Weyerhaeuser Drayton Valley FMA Area and capture these areas in a digital GIS coverage.

The following data sources were used to capture the private land within the FMA boundary:

1. Land Status Automated System (LSAS) Land Standing Report (July 1999)
A Land Standing Report was acquired for the FMA Area. The report identified the locations of "CROWN" (public land), "FREEHOLD" (patented) and "MIXED" (partially patented) quarter sections in the vicinity of the FMA Area. The locations of the "FREEHOLD" and "MIXED" land were loaded into GIS, using the legal and base features for reference.

2. Municipal maps
Municipal District and County maps were acquired for Brazeau No. 77, Clearwater No. 99 and Ponoka No. 3. The locations of privately held land were loaded into GIS, using legal and base features for reference.

3. 1:40,000 scale landuse plats (July 1998)
Landuse plats were acquired in July 1998. All patented land identified on the plats was loaded into GIS, using the legal and base features for reference.

Notable discrepancies existed between the three different data sources. As a result, all three sources were loaded independently of each other. The following procedures were used in the final coverage assembly for the FMA Area:

- Check maps were generated to verify the location and extent of private land against the original sources.
- All three data sources were combined to provide one coverage. All polygons were attributed to their original source.

The information collected from the landuse plats, County and Municipal District maps, and Land Standing Report were provided to an independent consultant to perform a Land Title search to confirm the accuracy of the data sources and to generate a database of landowners.

- A Land Title search was performed by quarter section for the areas identified by the above process. This process, by quarter section, confirmed the status of the areas as private land.
- For quarter sections with multiple registrations (more than one landowner registered) the sub-plans were obtained. The spatial information of these sub-plans has not been added to Weyerhaeuser's GIS.

A final LSAS search of all quarter sections within the FMA boundary was conducted to confirm that the remaining quarter sections were Crown land.

b) Grazing Dispositions

All grazing dispositions are included in the FMA AAC calculation (see section II 3.2.6 Table 20), and contribute to the timber harvesting land base, where they meet requirements for timber harvesting operability. They were included in order to calculate the harvest levels for embedded quotas, the Community Timber Program, and Local Permit Programs.

The following disposition types were loaded:

- FGL = Forest Grazing License
- GRL = Grazing Lease
- GRP = Grazing Permit
- GRR = Provincial Grazing Reserve (none occur within the FMA Area)

The following data sources were used to develop the listing of grazing dispositions within the gross boundary of the FMA:

- Digital copy of Land Standing Report from LSAS (effective date is March 1999);
- LFS maps and files; and
- Legal boundaries (¼ sections) and base features (lakes, streams, rivers, roads, etc.) in GIS.

In loading each disposition into the coverage, Weyerhaeuser:

1. imported Land Standing Report (LSR) data;
2. determined if the disposition was within the FMA Area;
3. created disposition coverage, using existing linework, where possible, to capture the disposition location, as it is described in the LSR databases (i.e., to nearest quarter section, legal subdivision, quadrant, quarter-quadrant, metes and bounds, etc.);

4. attributed polygons with disposition key (i.e., unique disposition number);
5. linked LSR attributes to each disposition;
6. produced and reviewed internal quality control maps to verify accuracy;
7. provided disposition information (maps and listing) to LFS for verification and corrections;
8. updated grazing disposition coverage; and
9. assembled all data for insertion into the GIS library.

c) Surface Dispositions

An inventory was completed for the FMA Area, which digitally captures all landuse dispositions (including protected areas) on the FMA landbase. In addition to the spatial representation, each disposition is linked to the Land Status Automated System (LSAS) tabular data that is currently available.

The following data sources were used in the capture of the landuse dispositions:

- LSAS Land Standing Report
- Individual disposition survey plans
- 1:40,000 landuse plats
- Provincial base data
- Forest inventory information (AVI)
- Orthophotos

The company used the following procedures in capturing the landuse dispositions on the FMA Area:

1. All available linear and polygonal disposition types were loaded into two layers in an ArcInfo GIS environment. The most accurate source data was used based on the following hierarchy:
   - ✓ 1:15,000 Orthophotos *(Most Accurate)*
   - ✓ 1:15,000 AVI / Base map data
   - ✓ 1:40,000 Landuse Plats *(Least Accurate)*

   
2. Each geographic feature was attributed with a unique disposition number.
3. The provincial LSAS information was linked (using the disposition number) to each spatial feature.

To maintain landuse data, Weyerhaeuser periodically updates these data with new disposition application documents (survey plans) and new Land Standing Report (LSR) data. The process is as follows:

1. For each new disposition:
   - Obtain survey plan from the energy or utility company.
   - Register plan in GIS.
   - Load the location of the disposition from the survey plan.
   - Verify the location of the disposition against the survey plan.
   - Link LSR data to the disposition coverage.

2. For each cancelled disposition:
    - Archive disposition coverage and attribute tables.
    - Remove disposition coverage from the land use layer.

3. Replace the GIS layers(s) with the new data.

2.2 Inventory Stratification

In determining the timber harvesting landbase[49] for the FMA Area, lands that are considered exclusions as noted in the Forest Management Agreement (e.g., private land) and forest management considerations (e.g., seismic lines) were excluded from the net landbase.

2.2.1 Private Land

Private land was excluded from the land base available for timber harvesting. For a spatial representation of private land within the FMA Area see *Private Land and Grazing Map* on page 15 of Appendix 4.

2.2.2 Crown Dispositions

a) Grazing Dispositions

Grazing dispositions issued prior to the commencement date of the FMA or pending prior to the commencement date, are included in the FMA Area (see Section I 3.2.6 Table 20), and contribute to the timber harvesting land base, where they meet requirements for this area.

b) Surface Dispositions

Restrictions for land use were examined on all mapped dispositions and those where timber harvesting was restricted were excluded from the land area available for timber management (See Appendix 16).

c) Protected Areas – existing and proposed

Existing protected areas were excluded from the timber harvesting landbase, but proposed protected areas were not excluded. Specifically the Wapiabi and Thunder Lake Special Place Nominations were retained as available landbase until such time as they are removed from the FMA Area.

2.2.3 Forest Management Considerations

In determining the timber harvesting landbase, the Company, adhering to the Alberta Timber Harvest Planning and Operating Ground Rules, made operational deletions from the FMA Area that address other resource values and current limitations to harvesting and reforestation practices (social, economic or ecological).

a) Operability

Land that is not operable due to slope, slope position, or accessibility was excluded from the THLB. The FMA Area was classified by slope classes derived from the digital elevation model. All areas with sustained slopes in excess of 60% were identified as inoperable. The remaining area of the FMA was investigated to confirm the suitability for harvesting. Any area determined inoperable with slope less than 60% was included in the inoperable coverage. Riparian areas (flood plains and banks) along major watercourses were also identified as inoperable. Harvesting on slopes in excess of 45% will be conducted in a manner that will minimize the potential for soil erosion.

[49] The timber harvesting landbase (THLB) is the portion of the total land area of the FMA on which timber harvesting activities may occur.

b) Productivity / Reforestation

Specific covertype combinations were deleted because of the relatively low productivity of the stands combined with the difficulty of reforesting the sites. The deletions in conifer dominated stands are primarily stands with wet moisture regimes. The following covertype combinations were considered as unavailable for timber management purposes.

- All stand with 20% larch or more in the covertype
- All stands with 80% black spruce or more in the covertype
- low productivity sites as indicated in the predictive ecosite classification – LF-k/l, LF-h/j, LF-h/k, LF-l, LF-l/m, LF-m, LF-j, UF-k/l, UF-l/m, UF-m, UF-i, UF-i/j

c) Riparian Management

The classification of streams and rivers within the provincial digital base does not match the classification of streams required by the Alberta Timber Harvest Planning and Operating Ground Rules for watercourse protection. Weyerhaeuser staff identified large permanent streams that required 60-metre buffers. All other permanent streams were identified with 30-metre buffers except the North Saskatchewan River where a 100-metre buffer was applied. The protective area surrounding lakes over four hectares was 100 metres.

d) Corridor Management

The Company has applied a visual management buffer along the main public thoroughfares of highways 11 and 22, and along the North Saskatchewan River valley. For the Timber Supply Analysis these areas have been removed from the THLB. However, operationally it is Weyerhaeuser's intention to continue to assess the opportunity for harvesting systems within selected visual management buffers where visual attributes can be maintained.

e) Ecological

The IRP zone for Prime Protection has been excluded from the timber harvesting landbase. This area is to preserve environmentally sensitive terrain and valuable ecological and aesthetic resources, and therefore the area has been excluded from the THLB.

f) Seismic Lines

Seismic line areas are not withdrawn from the FMA Area, however the area they occupy is non-forested. Seismic lines were assigned a width of eight metres and the area was considered unavailable for timber harvesting. Seismic lines that traversed existing cutovers were not excluded. The requirement for reforestation within a block must be met regardless of whether the seismic line exists in the block, and therefore these portions of seismic lines contribute to the THLB.

2.3 Inventory Enhancements

To improve the quality and accuracy of the Timber Supply Analysis, two enhancements to the AVI inventory were completed for the Detailed Forest Management Plan. These are existing cutover updates and the O'Chiese fire update.

2.3.1 Existing Cutovers

The base date of the inventory for the Detailed Forest Management Plan is May 1, 1999. All cutovers were updated in the net landbase to reflect harvesting activities to that date. Spatial representation of cutovers was obtained from three sources of information:

- AVI interpretation;
- interpretation on Phase 3 land classification; and
- interpretation from recent photography

Weyerhaeuser identified over 2,000 cutovers from inventory updates and enhancements and, with the assistance of LFS, all but approximately 30 have been linked spatially with an opening number and the silviculture activities in Silviculture Record Management System (SRMS). Based on the identifying information in the opening number field (silviculture activities, type of harvesting, the landscape unit, and the indication of forest or non-forest cover, all existing cutovers identified were assigned a distribution of species and density class, and assigned to yield curves.

Tables 22 and 23 in Section I 3.2.6 and the *Timber Harvesting Map* on page 17 of Appendix 4 represent the recorded harvesting that has occurred on the FMA Area.

a) Cutover Assessment

During the summer of 1999 Weyerhaeuser and Tall Pine Timber Co. Ltd. completed the task of evaluating a sample of existing cutovers on the FMA Area with the objective of assigning all cutovers to a yield class defined by stand composition and stand development. The sampling methodology is described in Appendix 17.

All blocks were assigned to an initial stratum based on the land base designation and reforestation clock start date values in SRMS and the Landscape Management Unit:

- Pre-91 – all cutovers harvested prior to March 1, 1991 under the Timber Management Regulations. This stratum also includes blocks harvested prior to the establishment of the timber quota system in 1966.
- Post-91 FMA – all cutovers harvested under authority of the FMA after the transition date of March 1, 1991. Weyerhaeuser is responsible for meeting the legislated regeneration standards on all these cutovers.
- 91-95 Quota – all cutovers harvested under authority of a timber quota, the Community Timber Program (CTP) or a Local Timber Permit (LTP) between March 1, 1991 and April 30, 1995. Reforestation of these blocks to the establishment survey was the responsibility of either the forest products company or LFS. Responsibility for meeting the legislated free growing requirement on the conifer landbase rests with Alberta Environment.
- Post-95 Quota – all cutovers harvested under authority of a timber quota, CTP or LTP after April 30, 1995. Responsibility for reforesting these blocks rests with the

company that did the harvesting. The exceptions to this are CTP and LTP blocks that remain the legal responsibility of Alberta Environment.

The completed surveys were compiled (Appendix 17) and analyzed to assign portions of the cutover population to each stratum (landbase designation and Landscape Management Unit) and to the appropriate yield class (composition, density, and productivity). Tables 1 and 2 in Appendix 18 show assignments for coniferous and deciduous cutovers respectively.

The rules for assigning cutovers that were harvested as coniferous landbase were based in part on the regeneration standard under which the block was harvested. All blocks with less than 80% total stocking were considered "B" crown closure.

Pre-91:

- Blocks where the deciduous stocking exceeds the conifer stocking but the conifer stocking is greater than 30% white spruce, were considered deciduous/coniferous composition.
- Blocks with more than 50% conifer stocking and less than 50% deciduous stocking were classified as coniferous/deciduous composition.
- Blocks with more than 70% conifer stocking and more than 30% deciduous stocking were classified as coniferous/deciduous composition.
- Blocks with more than 70% conifer stocking and less than 30% deciduous stocking were classified as pure conifer blocks.

91-95 Quota:

- The same rule as above applies, but with the additional understanding that since all blocks must pass (or have passed) the legislated conifer establishment survey, they have been assigned to a minimum conifer content of coniferous/deciduous composition.

Post-91 FMA and post-95 Quota:

- All conifer blocks harvested under authority of the FMA after March 1, 1991 or under authority of a quota after April 30, 1995, must pass the performance survey, which has a free growing component. Therefore, all blocks from this population have been assigned to the pure conifer composition.

The rules for assigning cutovers harvested as deciduous landbase were:

- All blocks were initially assumed to be deciduous composition.
- Only blocks with more than 30% white spruce stocking were classified as deciduous/coniferous composition.
- Nordegg River LMU had no deciduous blocks sampled, therefore existing regeneration survey information and subsequent retreatment efforts were used to determine proportions for population of deciduous blocks in LMU.
- Blocks with less than 80% total stocking were considered "B" crown closure.

2.3.2 O'Chiese Fire Inventory Enhancement

In 1988, the O'Chiese Fire burned approximately 7000 hectares on the FMA (fire DR6-19-88). The fire area is indicated in the approved Alberta Vegetated Inventory work conducted by the company in 1992 and 1996.

In 1999, the Company inventoried the fire area in the FMA to define the state of regeneration since the fire. The objectives of the O'Chiese fire inventory were:

1. to provide an indication of stocking levels and species within the fire area on the FMA to allow for assignment of silviculture regimes
2. to update all roads and landuse activities within the fire area on the FMA Area, and
3. to allow for the future assessment of enhanced forest management opportunities.

The 1999 O'Chiese inventory was overlaid on to the AVI inventory for the FMA. For timber management purposes only, the attributes of forested stands within the O'Chiese inventory were used rather than the attributes of the AVI stands.

2.4 Final Net Landbase Area Summaries

Table 71 summarizes the area classification by Landscape Management Unit. This table shows the total area by cover type within the timber harvesting landbase, and the total area by net down category for areas not in the harvestable landbase, that are in both forested and non-forested categories. The sum of all categories does not add to the total area listed in the table, as there are overlaps between some categories.For example, areas excluded from the harvestable landbase due to reforestation issues (reforestation deletion) may also be part of a seismic line, or a corridor buffer.

Table 71 - Net Down Summary by Landscape Management Unit and Total FMA Area

	Baptiste	*Blackstone*	*Elk River*	*Marshybank*	*Medicine Lake*	*Nordegg River*	*O'Chiese*	*Sand Creek*	*Tall Pine*	*Willesden Green*	*FMA Total*	*% of Total*
Total Area	74,246.2	38,042.0	50,216.3	20,035.8	20,049.0	46,848.2	30,161.4	44,853.4	39,667.1	54,989.9	419,109.3	
Forested Area												
Timber Harvesting Landbase												
Deciduous	10,950.1	2.2	3,654.2	636.2	5,817.3	2,758.8	7,038.7	17,623.0	7,346.7	22,253.6	78,080.7	18.63%
Deciduous / Coniferous	4,750.5	6.7	2,741.9	0.0	1,364.9	1,802.4	1,611.8	3,351.1	2,953.0	2,801.5	21,383.8	5.10%
Coniferous / Deciduous	8,790.1	16.8	7,763.8	1.5	1,784.5	6,524.7	4,566.5	5,465.8	7,749.7	5,504.4	48,167.7	11.49%
Coniferous	18,253.0	27,337.3	15,544.6	15,381.1	2,681.1	16,519.5	4,393.3	4,766.2	5,799.0	6,309.1	116,984.2	27.91%
Sub-Total	42,743.6	27,363.0	29,704.6	16,018.8	11,647.8	27,605.4	17,610.3	31,206.1	23,848.4	36,868.5	264,616.4	63.14%
Forested Area												
Private land	84.1	0.0	0.0	0.0	0.0	0.0	0.0	58.5	0.0	9.9	152.5	0.04%
Land use dispositions	451.5	309.0	483.0	17.8	374.2	37.5	499.0	547.8	456.4	243.0	3,419.2	0.82%
Grazing dispositions*	6,120.6	0.0	0.0	0.0	468.5	0.0	0.0	254.8	0.5	3,899.8	10,744.1	2.56%
IRP zone	0.0	386.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	386.8	0.09%
Riparian buffers	923.9	862.3	702.4	448.2	0.0	656.0	344.8	436.7	960.7	534.5	5,869.6	1.40%
Corridor buffers	273.3	0.0	0.0	0.0	25.9	0.0	0.0	0.0	0.0	232.4	531.5	0.13%
Seismic lines	934.1	355.7	1,154.0	186.4	466.5	515.2	403.8	688.0	614.1	784.3	6,101.8	1.46%
Inoperable areas	241.9	5,675.2	36.0	1,519.4	0.0	1,477.2	257.1	471.6	824.7	1,131.6	11,634.7	2.78%
Reforestation deletion	23,337.6	5,346.3	17,007.1	1,799.9	7,572.0	16,116.2	10,611.2	7,527.4	10,777.9	11,540.6	111,636.1	26.64%
Non-forested Area												
Other Non-forested	707.2	127.2	811.4	15.6	143.5	267.2	462.8	856.9	1,909.1	734.6	6,035.5	1.44%
Roads	1,761.2	228.6	1,528.1	52.6	161.7	460.4	470.6	2,592.7	911.4	1,822.4	9,989.8	2.38%
Private land	67.9	0.0	0.0	0.0	0.0	0.0	0.0	75.9	0.0	22.4	166.2	0.04%
Land use dispositions	409.2	20.0	374.9	4.6	176.2	40.0	61.2	762.0	286.4	345.1	2,479.6	0.59%
Grazing dispositions*	725.1	0.0	0.0	0.0	194.9	0.0	0.0	172.6	0.9	949.8	2,043.2	0.49%
Lakes	577.3	11.4	668.7	38.2	417.7	100.4	1,937.5	175.0	117.5	94.9	4,138.5	0.99%
IRP zone	0.0	1,425.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,425.2	0.34%
Riparian buffers	67.1	11.6	33.3	5.6	0.1	6.9	10.4	74.7	44.5	37.0	291.4	0.07%
Corridor buffers	234.7	0.0	0.0	0.0	16.7	0.0	0.0	0.0	0.0	209.0	460.5	0.11%
Seismic lines	137.0	17.1	80.7	4.3	32.7	19.2	40.7	113.7	100.1	137.1	682.5	0.16%
Inoperable areas	25.0	15.6	0.0	4.7	0.0	5.8	7.7	45.9	29.8	44.7	179.3	0.04%

* grazing dispositions include all dispositions within the FMA Area and where forested, is included in the timber harvesting land base

NOTE: Columns do not add to totals by LMU due to overlaps among netdown categories

3. TIMBER SUPPLY ANALYSIS

3.1 Modeling Software for the Timber Supply Analysis

Timber supply modeling inputs are grouped into three components:

1. Forest area (land base)
2. A projection of how the forest develops over time (yield projections)
3. Management policies and objectives

The integration of these three components is achieved with the use of computer models. Woodstock® and Stanley® modeling software were used for this analysis.

Woodstock is a high-level programming language that allows for the creation of a harvest schedule as the output from a linear programming problem. The linear programming problem served to define an annual harvest volume subject to objectives for operability and sustainability of both timber and non-timber resources. Yield relationships were applied to specific forest types over a specified planning horizon. Harvest activities were applied to the forest within the model based on specified objectives and parameters.

Stanley is a simulation-based spatial activity allocation model. Stanley was used to derive an operationally feasible schedule of harvest openings from the Woodstock-defined optimal harvest schedule, while accounting for policies governing the spatial distribution of harvests such as green-up constraints, block size, and minimum distance between blocks. The result is a mapped harvest sequence that can be used in operational forest planning.

3.2 Timber Supply Commitments

3.2.1 Quotas

Weyerhaeuser's FMA encompasses four Forest Management Units (FMUs), R1, R2, R3 and R4. None of these FMUs is fully contained within the FMA (i.e., portions of these FMUs lie outside the boundaries of the FMA).

The Crown has reserved the right to issue timber licences to existing quota holders in the FMA. As a means of ensuring that this right is maintained, Weyerhaeuser has determined the obligations to existing quota holders. Determination of these allocations is complicated by the overlapping configuration of the FMA with the FMUs.

Quota holders' rights to percentages of AAC in specific FMUs, in the FMA are shown in Table 72.

Table 72 - Quota Holders in FMUs who are Partially in the FMA

FMU	Quota Holder	Quota	Conifer Rights (% of FMU conifer AACs)
R1	Tallpine	R01Q0004	29.06%
	Tallpine	R01Q0005	6.01%
R2	Dale Hansen	R02Q0007	2.8%
	Rocky Wood Preservers	R02Q0005	18.47%
	Weyerhaeuser Company Ltd.	R02Q0009	32.39%
	Weyerhaeuser Company Ltd.	R02Q0006	10.43%
R4	Tallpine	R04Q0011	2.14%

Each of the FMUs in which quota holders have rights to a percentage of the AAC have been accounted for in a fashion that considers their uniqueness from a timber supply perspective.

FMU R1

In R1, the majority of the FMU is within Weyerhaeuser's FMA. The eastern portion of R1 is not within an FMA and the Crown has all management responsibilities. Tallpine is the only quota holder who has timber rights that extend into the portion of R1 that is legally outside of the FMA. In this Management Plan, Weyerhaeuser has determined the volume obligation for Tallpine's quota within the FMA and the volume obligation that is derived from R1 outside of the FMA.

FMU R4

FMU R4 is contained within two FMAs – Weyerhaeuser's FMA and Sundance Forest Products Ltd. FMA. Harvesting rights held by Tallpine (R04Q0011) are to be derived from Weyerhaeuser's FMA (refer to Appendix 1). As a means of determining the volume obligation from Weyerhaeuser's FMA, it was necessary to estimate the sustainable harvest level for all of R4 and then define the portion of this volume which is obtained solely from Weyerhaeuser's FMA.

FMU R2

FMU R2 is located within Weyerhaeuser's FMA and Sunpine Forest Products Ltd. FMA. The conifer rights held by quota holders in R2 (R2Y) within Weyerhaeuser's FMA (64.09%) were reserved. To meet the total obligation to quota holders, Sunpine Forest Products Ltd. must also reserve 64.09% of the coniferous AAC in the remainder of R2 (R2U) within their FMA.

3.2.2 Commitments for the Timber Permit Program

The Crown has reserved conifer rights in an area referred to as the Rose Creek West Community Timber Program for issuance of timber permits. In addition, to this reservation, up to one percent of the FMA Area's coniferous, excluding the AAC for the Community Timber Program, and up to one percent of the FMA Area's deciduous AAC[50] is reserved for local use timber permits. The periodic coniferous harvest volume from the Rose Creek West area was estimated in this supply analysis.

[50] As per Forest Management Agreement 8(2)(a)(ii)

3.3 Timber Supply Analysis Procedure and Results

Timber yield relationships and the land base of the FMA are described in previous sections. The management policy considerations used in the development of the plan include:

a) Planning horizon

This is the projection period for the analysis. Commonly, the length of the planning horizon is equal to two times that average rotation length. For runs where all operable (both conifer and deciduous) stands are included, the planning horizon is 32 periods or 160 years, and therefore the implicit average harvest age is 80 years. For runs with just the deciduous dominated stands, the planning horizon is 28 periods or 140 years, and the average rotation age is 70 years. For runs with exclusively conifer dominated stands, the planning horizon is 36 periods or 180 years and the average rotation age is 90 years. The role of harvest age over the planning horizon is explained below under the "harvest age" sub-heading.

b) Flow policy

Flow policy refers to the fluctuations in harvest level that are permitted within and between periods (a period is five years) over the planning horizon. Three flow policies are explored in this analysis. The first is a strict even flow policy across the entire planning horizon where all harvest levels in each period are equal to each other. The second is an even flow policy where the first rotation even flow is different that the second rotation even flow, or latter half of the planning horizon. This recognizes the current age class distribution of the forest where there is an apparent "excess" level of growing stock over and above what is required to maintain a sustainable harvest level over the entire planning horizon. The third variant of flow policy attempts to recognize that expected demand capacity for roundwood might tolerate an exogenously determined level of variance around projected harvest levels without adversely affecting optimal roundwood demand capacities. To this end two levels of each coniferous and deciduous harvest were allowed to vary within predefined limits. These limits or ranges were 75,000 m^3/period and 400,000m^3/period for conifer harvest levels and 200,000m^3/period and 500,000m^3/period for deciduous harvest levels.

c) Age class constraint

Allowing for variation in the age class structure of the forest over time is thought to be most desirable for wildlife habitat objectives and general biodiversity considerations. Typically, age class structure was controlled with requirements to maintain amounts of area of specific forest type and age in each period of the planning horizon. Harvest activities over time in a predominantly late and very late seral forest will make these older age classes become scarce over time. For this reason, it is necessary to ensure they are represented across the entire planning horizon. Table 73 shows levels for the amount of late and very late seral forest by major forest type that must be maintained in order to meet habitat requirements. Sensitivity analysis is applied in the timber supply runs to determine the impact of these constraints.

Table 73 – Area retained of late and very late seral forests

Natural Sub-Region	Cover Type and/or Species Group	Minimum Age (Years)	Minimum Area (ha)
Lower foothills	Deciduous dominated	80	2275
Lower foothills	Deciduous/Coniferous	110	2678
Lower foothills	Pine	110	452
Lower foothills	Spruce/Pine	110	5113
Lower foothills	Spruce	110	1540
Upper foothills	Deciduous dominated	80	30
Upper foothills	Coniferous/Deciduous	110	95
Upper foothills	Pine	110	480
Upper foothills	Spruce/Pine	110	2177
Upper foothills	Spruce	110	911
Lower foothills	Spruce/Pine	140	1023
Lower foothills	Spruce	140	308
Subalpine	Pine	140	30
Subalpine	Spruce/Pine	140	238
Subalpine	Spruce	140	134
Upper foothills	Coniferous/Deciduous	140	38
Upper foothills	Pine	140	240
Upper foothills	Spruce/Pine	140	1088
Upper foothills	Spruce	140	304

d) Harvest age

Stipulating a minimum harvest age and an average harvest age affects the age class profile of the harvested timber as well as the age profile of the harvestable growing stock. A constraint on harvest age is used in lieu of a constraint on the level of harvestable growing stock that must be maintained over time. Such a constraint is inherently arbitrary, and the sustainability of the expected harvest schedule beyond the two rotation planning horizon (which is also somewhat arbitrary) is achieved with a constraint on the average expected age of harvest being greater than or equal to some average age. This average harvest age is 70 years for deciduous dominated stands and 90 years for coniferous dominated stands. These averages were calculated to be the age of maximum mean annual increment for all yield curves area-weighted by cover type. The constraints used in Woodstock are that the actual average harvest age must always be greater than or equal to these averages. A graph of this is presented for the preferred scenario at the end of this section.

e) Operability

The availability of stands for harvest over time is controlled within Woodstock. For example, by identifying which forest stands exist within grazing dispositions, it is possible to determine harvest rates excluding grazing dispositions or including grazing dispositions. Woodstock operability is also defined by a minimum age for harvest. For the first sixty years (12 periods) the minimum harvest age from conifer dominated stands was 100 years and for deciduous dominated stands was 80 years. From year 60 to the end of the planning horizon (generally two rotations) the minimum harvest age was 80 years for conifer dominated stand and 60 years for deciduous dominated stands.

f) Regeneration after harvest

Both species composition and stand density are defined in existing and regenerated stands. The LRSY[51] calculation implies that stands regenerate to the same species composition and density. All timber supply runs except for one (FMA_15 in Table 79) assume that stands regenerate to a "C" density, and to the same species composition. A "C" density for regeneration is justified on the basis of stocking standards for regenerated stands. However, an exception was made for deciduous dominated (D) stands that have regenerated since 1991. Ninety percent of the A and B density post-1991 stands regenerate to at least a 40% white spruce composition, and 10% regenerate to at least a 20% conifer composition of pine or spruce. For C and D density post-1991 stands, 90% regenerate to at least a 20% conifer composition and 10% regenerate to a at least a 40% spruce composition. For the Deciduous dominated (D) stands that renerate with at leas a 40% conifer composition, these stands are now classified as Deciduous/Conifer, or "DC" instead of just Deciduous, or "D". The same empirical yield curves are used to estimate and project yields for both existing and regenerated stands.

g) Sequencing

Woodstock was used to limit harvesting of specific landscape management units in particular time periods. Constraints on the annual rate of harvest were made for specific areas within the FMA. Examples of these constraints are the rate of area harvest constraints applied to the Marshybank and Blackstone LMUs, where visual consideration and watershed objectives are significant considerations. Discussion of the rationale and impact of these constraints is shown in the results Section III 3.3.3.

h) Objective function

The objective function for all timber supply runs is the sum of projected harvest over the planning horizon. Depending on the run, the value of the objective function was either conifer dominated stands, or deciduous dominated stands, or all harvestable stands regardless of species composition.

3.3.1 Timber Supply Commitments

The assumptions listed in Table 74 were used to define the Woodstock runs for determination of all timber supply commitments for R1 and R4 only[52]. It was also necessary to determine a harvest level for the FMA Area on the same basis. The R1, R4 and FMA runs will be used to define Tallpine's quotas as percentages of the FMA Area cut.

Table 74 - Assumptions Used in the Determination of R1 and R4 Quota Rights

Element	Description
Planning horizon	180 years
Flow policy	Even-flow for the entire planning horizon
Age class constraints	None
Harvest Age	Minimum harvest age of 80 years. Average harvest age of 90 years
Operability	Includes all grazing dispositions[53]
Sequencing	No sequencing restrictions were imposed in Woodstock except for harvesting restrictions on stands adjacent to new cutovers

All volumes reported in this section are gross merchantable volumes. Deductions for cull, spatial blocking, and stand level ecological guidelines have not been applied.

[51] LRSY is an acronym for long run sustained yield. See glossary for definition

[52] A similar approach was followed for R2. However the determination of quota holder obligations for R2 was based on the final set of assumptions in the timber supply model.

[53] Quota holders have the right to access timber in grazing dispositions, regardless of whether or not the dispositions are legally within the FMA.

FMA

For comparison purposes the base coniferous non-spatial harvest level for the FMA was determined to be 393,000 m^3/year[54]. This volume excludes areas in R1 east of the FMA, but includes all grazing dispositions.

FMU R1

Table 75 summarizes the timber supply analysis results for FMU R1.

Table 75 - Summary of Forest Management Unit R01

Area	Conifer Harvest Level (m^3/year)	Run Number (see Table 80)
R1 including R1Y, and R1 outside of FMA (excludes Rose Creek Forest)	80,378	R1_1
R1Y only (R1 inside FMA only)	73,685	R1_2

As Tallpine's share of the R1 coniferous AAC is 35.07% (29.06% + 6.01% - see Table 72), the total volume allocated to Tallpine's quota for R1 should be 28,189 m^3/year. The difference between the harvest volume available solely in R1Y and R1 total represents the harvest volume rights of Tallpine outside of the FMA in R1. Thus 6,693 m^3 of Tallpine's volume should be obtained from R1 outside of the FMA. The remaining volume commitment to Tallpine must be met from the FMA Area. The volume that Tallpine may harvest annually from the FMA is 21,496 m^3 (= 28,189 m^3 - 6,693 m^3).

FMU R4

Tallpine currently has a right to 2.14% of the AAC in R4 (includes both R4Y and R4Z). As noted previously, the percent allocation is obtained solely from R4Y, but the volume allocation is based on the percent of AAC from the entire R4 FMU. The harvest level for all of R4 is shown in Table 76.

Table 76 - Summary of Forest Management Unit R04

FMU	Conifer Harvest Level (m^3/year)	Run Number (see Table 80)
R4	205,623	R4_1
Tallpine's Allocation (2.14% of R4)	4,400	-

Total Tall Pine Timber Co. Ltd. Commitments

Table 77 summarizes the non-spatial coniferous volumes to which Tallpine is entitled from the FMA Area and in FMU R1 outside of the FMA. It is important to note that the definition of Tallpine's percent volume allocation associated with its quota in R1 outside of the FMA is the responsibility of the Crown.

Table 77 - Tallpine Timber Company Volumes

Source	Conifer Volume (m^3)	% Harvest (% of FMA conifer harvest level)
R1 (outside of FMA)	6,693	-
R1 (within FMA)	21,496	5.47%
R4 (within FMA)	4,400	1.12%
Total from within FMA	**25,896**	**6.59%**

[54] This value was generated from run FMA_12 which is discussed further in Table 80

FMU R2

The allocation of volume to quota holders in R2 is based on two principles:

1. **The total coniferous allocation to quota holders in R2 is 64.09% of the AAC (refer to Table 72).** More precisely, the volume reserved by the Crown for quota holders in R2 is 64.09% of the coniferous harvest level in R2Y plus 64.09% of the coniferous harvest level in R2U (refer to Table 72).
2. **The historic spheres of interest for quota holders will be respected.** Historic and current sequencing of quota holders in R2 has resulted in the harvesting by Hansen and Rocky Wood Preservers in R2U. Weyerhaeuser, operating as a quota holder in R2, has been sequenced in both R2Y and R2U.

The harvest level for R2Y is based on a Woodstock Run assuming an even-flow conifer harvest level in R2Y (Table 78).

Table 78 - Projected harvest level in R2Y

FMU	Conifer Harvest Level (m^3/year)	Run Number (see Table 80)
R2Y (includes all grazing dispositions)	77,950	R2Y

The volume reserved by the Crown in Weyerhaeuser's portion of R2 is 64.09% of 77,950m^3. In respecting historic spheres of interest, it is logical that Weyerhaeuser's share of the R2 AAC be split between R2Y and R2U. The quotas held by Hansen and Rocky Wood Preservers will be allocated volume in R2U. As not all of Weyerhaeuser's quota rights in R2 can be derived solely from R2Y; any remaining obligations will be obtained from R2U.

An example is show in Table 79.

Table 79 - Example of Allocation of Volume Methods to Quotas in R2

Description	Total Harvest Level (m^3/year)	Quota Holder Harvest Level (m^3/year)
Total R2Y conifer harvest level	77,950	
Amount reserved by the Crown for quotas in R2Y – 64.09% of 77,950		49,958
Total R2U harvest level (estimate only[55])	250,000	
Amount reserved by the Crown for quotas in R2U – 64.09% of 250,000		160,225
Totals	**327,950**	**210,183**
Weyerhaeuser's Allocation in R2Y		49,958
Rocky Wood Preservers' allocation in R2U (18.47% of 327,950)		60,572
Dale Hansen's allocation in R2U (2.8% of 327,950)		9,183
Weyerhaeuser's allocation in R2U (42.82% of 327,950) – 49,958		90,470

[55] This harvest level of 250,000 m^3 is used for illustration purposes only. The actual volume should be determined by Sunpine and the Crown based on an analysis of timber supply with assumptions similar to those used in these runs.

This plan defines Weyerhaeuser's volume allocation in R2Y. The remaining quota allocations in R2U for Weyerhaeuser, Rocky Wood Preservers and Hansen must be analyzed and proposed by Sunpine. For this reason, the volume allocation to quota holders as shown in Table 79 is presented to show how the method must be applied.

3.3.3 Timber Supply Analysis Results

Woodstock models were constructed for the FMA Area to provide the opportunity to evaluate alternative management strategies. By examining the results of alternative strategies, decisions can be made as to which strategy meets management plan objectives.

In addition to the evaluation of alternative management strategies, forest level models can also provide insight into the complex relationships that exist in the forest. Similarly, managing for specific resource values or levels may affect other resource values. Forest level modeling provides Weyerhaeuser the opportunity to evaluate the sensitivity of the forest to management activities.

A number of scenarios were examined to provide information for the evaluation of the timber supply, as outlined in the "Interim Forest Management Planning Manual Guidelines to Plan Development Version: April 1998".

Table 80 - A Summary of Input Parameters for Each Woodstock Run

Run	Land Base	Grazing Dispositions	Regeneration	Old Growth	Landbase	Objectives
R1_1	R1 including R1 outside of FMA	Included	C density	off	C, CD, DC	Max conifer volume over planning horizon
R1_2	R1 inside of FMA only	Included	C density	off	C, CD, DC	Max conifer volume over planning horizon
R4_1	R4 in R4Y and R4Z	Included	C density	off	C, CD, DC	Max conifer volume over planning horizon
FMA_12	FMA only	Included	C density	off	C, CD, DC	Max conifer volume over planning horizon
FMA_2	FMA only	Included	C density	off	C, CD	Max conifer volume over planning horizon
FMA_3	FMA only	Included	C density	off	DC, D	Max deciduous volume over planning horizon
FMA_4	FMA only	Included	C density	off	C, CD	Max conifer over 1st rotation, min of LRSY over entire rotation
FMA_5	FMA only	Included	C density	off	DC, D	Max deciduous over 1st rotation, min of LRSY over entire rotation
FMA_6	FMA only	Included	C density	off	C, CD	Max conifer, even flow of conifer LRSY = 1,465,000 m^3 over planning horizon
FMA_7	FMA only	Included	C density	off	DC, D	Max deciduous, even flow of deciduous LRSY = 965,000 m^3 over planning horizon
FMA_8	FMA only	Included	C density	off	C, CD, DC, D	Max total volume, range of 100,000 m^3 of deciduous and 80,000 m^3 of conifer per year
FMA_9	FMA only	Included	C density	off	C, CD, DC, D	Max total volume, range of 50,000 m^3 of deciduous and 15,000 m^3 of conifer per year
FMA_10	FMA only	Included	C density	on	C, CD, DC, D	Max total volume, range of 50,000 m^3 of deciduous and 15,000 m^3 of conifer per year, total area by period harvest constraints by LMU
FMA_11	FMA only	Excluded	C density	on	C, CD, DC, D	Max total volume, range of 50,000 m^3 of deciduous and 15,000 m^3 of conifer per year
FMA_14	FMA only	Included	C density	on	C, CD, DC, D	Max total volume, range of 50,000 m^3 of deciduous and 15,000 m^3 of conifer per year, no decline in stand volume as stands age
FMA_15	FMA only	Included	no change	on	C, CD, DC, D	Max total volume, range of 50,000 m^3 of deciduous and 15,000 m^3 of conifer per year, stand regenerate to whatever they were prior to harvest
FMA_16	FMA only	Included	C density	off	C, CD, DC, D	Max total volume, range of 50,000 m^3 of deciduous and 15,000 m^3 of conifer per year, same as FMA_9 except with 36 periods instead of 32 periods
R2Y	FMA only	Included	C density	on	C, CD, DC	Max conifer, even-flow for two rotations

Table 80 provides a summary of input parameters used to define each Woodstock run. The following provides a brief explanation as to the intended purpose and general outcomes of each run:

- R1_1 and R1_2 are used to determine the relative differences between a conifer harvest volume across the R1 FMA and for the portion of R1 within the FMA. This is essential to correctly determine quota allocations for R1, which are percentages of the AAC from the entire R1 FMU.
- R4_1 show total conifer harvest volumes under strict even flow across the entire planning horizon for all of R4 FMU. As with R1, the total AAC from R4 must be known in order to define the correct allocation of quota volumes from the portions of R4 within and outside of the Drayton Valley FMA.
- FMA_12 shows the total conifer harvest volume under strict even flow across the entire planning horizon for the entire FMA. To determine the quota allocations from R1 and R4 as percentages of the AAC of the FMA Area. In other words this Woodstock run was used as a denominator for the R1_1, R1_2 and R4_1 Woodstock runs.
- FMA_2 and FMA_3 are provided as information as specified in the DFMP guidelines[56] and show total conifer and deciduous harvest projections with a strict even flow constraint over two rotations. It is expected that this demonstrates some notional view of sustainability from a supply side perspective.
- FMA_4 and FMA_5 are also provided as information to further define the apparent robustness of the expected harvest schedule under a variant of the even flow constraint. These runs recognize the sustainability objective as defined by a strict even flow constraint for the first rotation and a floor of the LRSY harvest volume in the second rotation.
- FMA_6 and FMA_7 are identical to FMA_2 and FMA_3 respectively with the exception of the starting point for the even flow constraint. This starting point is defined as the exogenously determined LRSY. These runs demonstrate the impact of harvesting at a rate define by an area-weighted average of the culmination of mean annual increment.
- FMA_8 and FMA_9 were run to test the sensitivity of projected harvest levels to variances around the even flow constraint. In addition, these runs consider the entire harvestable landbase as one entity. Allowing some variance around the level of harvest between periods attempts to meet both long term sustainability objectives, and the recognition that impacts such as the level of demand for wood products is subject to periodic fluctuations, and that this in turn affects the demand for capacity to produce roundwood. It is widely recognized that strict even flow constraints ignore opportunity costs associated with the realities of market forces. Incorporation of these ranges, while somewhat simplistic, attempts to reconcile this.
- FMA_9 and FMA_10 test the impact of the introduction of periodic age class constraints in the form of old seral objectives. To allow for comparison, FMA_10 includes these constraints, while FMA_9 does not. As these constraints are consistent with current and expected operational practices, they are included in the preferred scenario or run.
- FMA_10 represents the non-spatial projected harvest level and is the preferred scenario prior to application of spatial considerations and deductions for stand level ecological guidelines, and cull. Objectives for maximum area periodic rates of harvest are applied to the Marshybank and Blackstone LMUs in this run. The proximity of these LMUs to Jasper National Park and the apparent visual sensitivity of the area suggest that rate of cut constraints would best

[56] Interim Forest Management Planning Manual Guidelines to Plan Development. Version: April 1998. Land and Forest Service, Alberta Environment.

account for these issues. A maximum rate of harvest of 100 ha/year for the first period and 200ha/year for all subsequent periods was applied to the Marshybank LMU, and a rate of 200ha/year for the first period and 300ha/year for all subsequent periods was applied to the Blackstone LMU. In addition, the area of the Marshybank LMU adjacent to Jasper National Park was restricted from all harvesting for the first 5 years in order to further refine harvest opportunities that address non-timber values. The harvest schedule generated from this run is used to develop the spatially explicit harvest schedule, which is described at the end of this section in detail. The projected harvest schedule for run FMA_10 was used as input for a spatial projection using Stanley®.

- FMA_11 measures the impact of excluding all grazing dispositions. Otherwise it is the same as FMA_10. As one would expect, a reduction in the harvestable land base leads to a reduction in the projected harvest level.
- FMA_14 was run to test the sensitivity of not accounting for natural mortality as stands age. Mortality was accounted for as a linear decline in total merchantable volume for the conifer component of stands after 130 years of age, and after 100 years of age for the deciduous component of stands. FMA_14 is otherwise identical to FMA_10.
- FMA_15 shows the impact of not allowing stands to regenerate to a "C" density, rather, all harvested stands regenerate to the same species composition and density.
- FMA_16 is the same as FMA_9 except it is run for 36 periods instead of 32 periods.
- R2_Y is run for just the portion of R2 FMU that lies within the Drayton Valley FMA. The purpose of this run is to determine the volume allocation in R2Y for quotas.

The sensitivity analyses explored by the runs address a number of issues with respect to the expected impact of current management activities and the desire to meet the objectives of the DFMP. As well, the required timber supply projections as per the DFMP guidebook have been addressed. What follows is a brief summary of impacts. More detailed output in graphical form is included in Appendix 19 "Graphical Output from Each Woodstock Run".

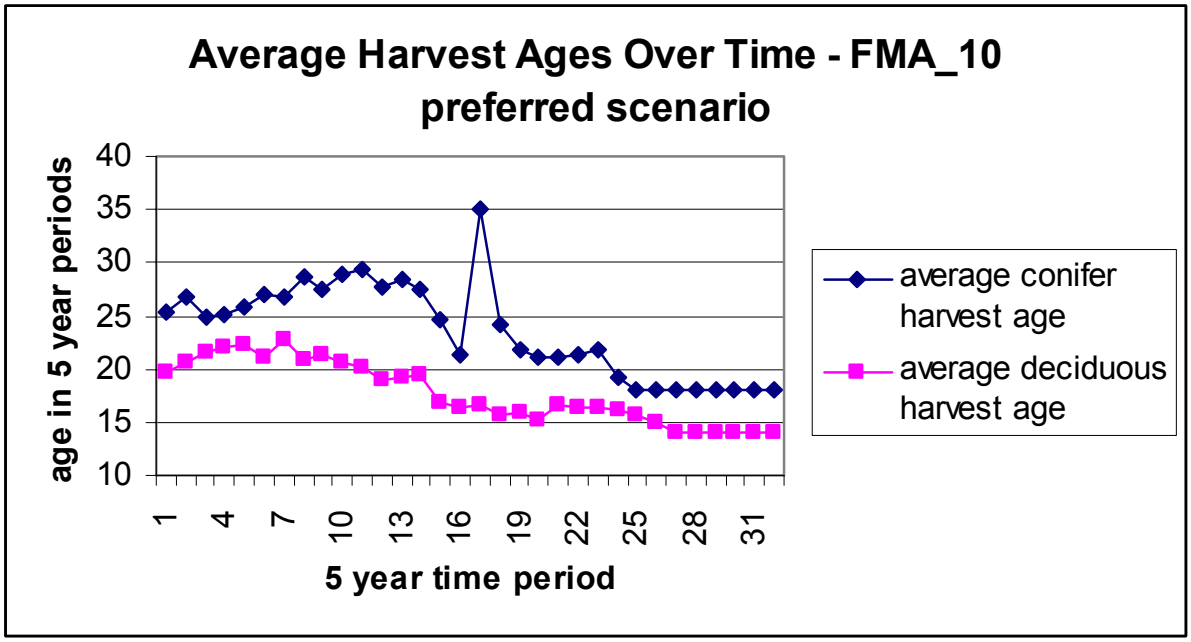
Table 81 - Projected Harvest Levels and Growing Stock for All Runs

Run	Annual Average Coniferous Harvest m^3/yr	Annual Average Deciduous Harvest m^3/yr	Average Conifer Dominated Harvest Area (ha/yr)	Average Deciduous Dominated Harvest Area (ha/yr)	Operable Deciduous Growing Stock at Present (m^3)	Operable Coniferous Growing Stock at Present (m^3)	Operable Deciduous Growing Stock at End of Planning Horizon (m^3)	Operable Coniferous Growing Stock at End of Planning Horizon (m^3)
R1_1	80,378	40,583	456	102	1,202,436	2,194,751	190,573	401,903
R1_2	73,685	36,726	336	90	1,105,522	2,082,870	167,940	368,437
R4_1	205,623	52,310	870	104	2,433,882	9,370,113	586,981	1,149,613
FMA_12	393,000	121,493	1,775	279	4,071,271	19,567,448	539,713	1,979,645
FMA_2	361,065	82,095	1,774	-	4,071,271	19,567,448	597,153	2,444,976
FMA_3	100,631	237,823	-	1,352	7,563,940	2,767,017	1,242,469	1,057,349
FMA_4	352,437	92,215	1,840	-	4,071,271	19,567,449	1,896,745	5,244,400
FMA_5	101,584	234,198	-	1,406	7,563,940	2,767,017	1,953,923	1,461,684
FMA_6	292,714	65,400	1,476	-	4,071,271	19,567,448	1,948,644	8,633,363
FMA_7	100,589	237,630	-	1,351	7,563,940	2,767,017	1,243,549	1,060,221
FMA_8	476,183	335,111	1,894	1,426	11,635,211	22,334,466	2,110,353	3,331,027
FMA_9	467,107	328,894	1,866	1,401	11,635,211	22,334,446	1,913,989	3,099,927
FMA_10	482,974	344,241	1,911	1,467	8,782,113	17,237,387	1,895,257	2,826,366
FMA_10 Spatial	438,706	326,333	1,621	1,207	8,782,113	17,237,387	7,684,168	16,757,009
FMA_11	468,632	325,223	1,876	1,383	8,591,257	17,055,919	1,818,030	2,757,218
FMA_14	429,975	350,517	1,904	1,449	9,094,572	17,376,457	2,283,581	2,880,719
FMA_15	459,975	352,539	1,863	1,478	8,782,113	17,237387	1,944,704	2,675,036
FMA_16	475,791	334,924	1,893	1,443	11,635,211	22,334,446	1,939,864	3,219,818
R2Y	77,950	35,305	332	83	858,635	2,082,228	210,643	389,760

Results from the runs demonstrate that strict even flow constraints impose a significant opportunity cost on projected harvest levels. An allowance for variance around a long term even flow constraint results in projected harvests levels that are higher on average, even with the addition of explicit objectives for late seral representation, and maximum rate of cut constraints in certain LMUs.

Figure 23 below shows the actual average harvest age over the planning horizon for both conifer (C and CD) and deciduous (D and DC) cover types. In all periods the average harvest age was greater than or equal to the constrained minimum of the average maximum mean annual increment age from the area-weighted yield curves (14 periods for deciduous types and 18 periods for conifer types).

Figure 23: Average Harvest Age Over Time – Preferred Scenario



A significant point of comparison between runs is the difference in expected harvest schedules between harvesting land bases separated on the basis of major cover type, and land bases with all cover types combined. The objective function that maximizes the sum of harvest from conifer dominated stands with only these conifer dominated stands in the land base ensures that the incidental deciduous volume by definition is not subject to a sustainability constraint. The same is true for the maximization of expected harvest from the deciduous dominated landbase with an "unsustainable" expected flow of conifer harvest. The preferred timber supply scenario recognises the objective of maximizing the sum of expected harvest from both conifer dominated and deciduous dominated stands subject to constraints on the expected harvest flow. This avoids the lack of recognition of a significant portion of the harvest as unsustainable from an even flow perspective.

4. HARVEST SEQUENCING

Stanley® was used to derive an operationally feasible schedule of harvest openings from the Woodstock-defined optimal harvest schedule, while accounting for policies governing the spatial distribution of harvests such as green-up constraints, block size, and minimum distance between blocks. The result is a mapped harvest sequence that can be used in operational forest planning.

4.1 Stanley Parameters

a) Adjacent distance

The adjacent distance is the distance that the model uses when considering if one polygon is adjacent to another polygon for the purposes of grouping polygons into blocks. By specifying a number greater than zero the model is allowed to span linear features (e.g. roads, or seismic lines) whose width is less than or equal to the adjacent distance. For example, the model will group eligible adjacent polygons into blocks that are separated by a seismic line. For the purposes of this DFMP an adjacent distance of 20 metres was used.

b) Proximal distance

The proximal distance is the distance that a polygon is considered proximate, but not adjacent, to another polygon. This distance is checked by the model to ensure that a distance greater than the proximal distance separates blocks, whose difference in harvest timing is less than or equal to the green-up interval. A proximal distance of 50 metres was used in the model.

c) Minimum block size

To ensure all of the timber harvesting landbase was eligible in the model no minimum block size was used. Very small blocks proposed by the model will be evaluated at the operational implementation to determine feasibility (see Section II 3.2).

d) Maximum block size

In consideration of social values the maximum block size of 200 hectares was used to restrict the model's upper blocking limit.

e) Target block size

To ensure that block sizes generated by the model reflect currently feasible harvest practices a target block size of 15 hectares was used.

f) Green – up delay

The green-up delay represents the amount of time that must pass before proximate blocks may be harvested, which if scheduled together would exceed the maximum opening area. In maintaining consistency with the Ground Rules and the results from the Regenerated Cutblock Assessment program (see Appendix 17) a green-up interval of 10 years was used for the deciduous and mixedwood blocks (DC and CD), and 20 years for coniferous blocks. To convert annual to periodic green-up delay the following formulae was used:

(green-up delay (yrs) / years per period) –1 = green-up delay (periods)[57]

Therefore, a green-up delay of one period for deciduous and mixedwood blocks and three periods for coniferous blocks was used.

g) Maximum deviation

The model attempts to assign blocks to polygons such that deviations from the optimal timing specified by Woodstock are minimized. However, it may be necessary to advance or delay the timing of proposed harvesting to facilitate block allocations and scheduling. For example, to minimize the impact from green-up delay. A deviation of five periods was used in the model.

h) Maximum flow fluctuation

A maximum flow fluctuation of 15% was used in the model to limit the blocking objective's fluctuation from one period to the next. In other words, the difference between the Stanley objective and the amount actually blocked is determined, and expressed as a percentage of the objective. To arrive at the maximum flow fluctuation, the period with the smallest percentage of optimal is subtracted from the period with the largest percent of optimal[12].

i) Periods blocked

A period of 50 years, or 10 periods, was blocked using Stanley. This represents approximately one third of the planning horizon and was used to adequately represent the impact of green-up constraints in the model.

[57] Stanley 4.0 Users Guide, Remsoft Inc., December 1999

4.2 Stanley Results

The projected harvest schedule for run FMA_10 was used as input for a spatial projection using Stanley®. Using the above inputs to the model, Stanley was run a number of times to derive an operationally feasible sequence of blocks across the entire FMA area.

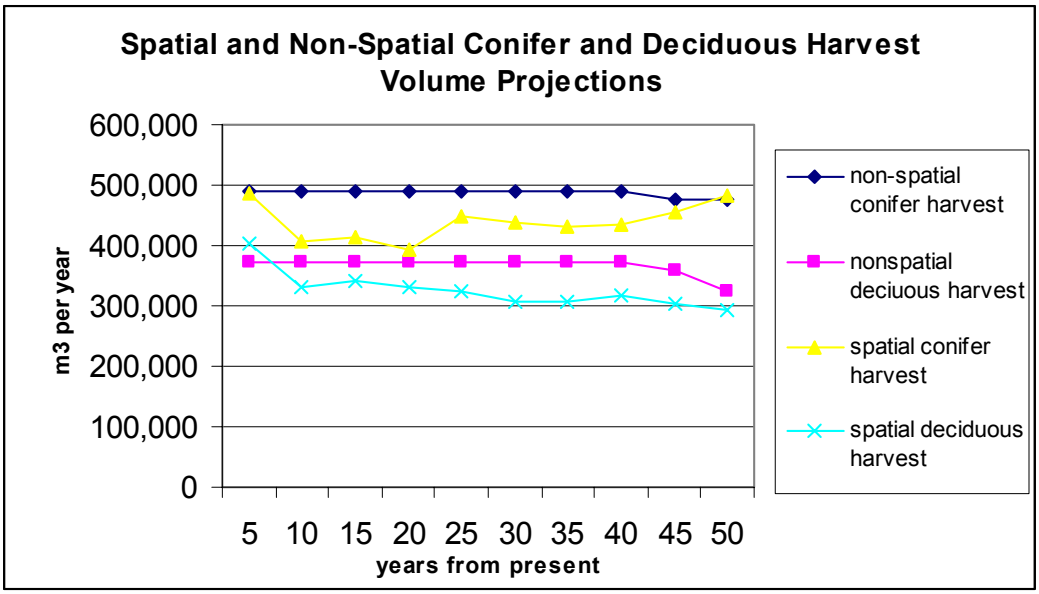
All existing cutovers (to spring of 2000) were included in the model's spatial dataset to ensure that green-up delay and adjacency constraints were included. Also, an approximation of Tall Pine Timber Co. Ltd.'s proposed harvesting as determined by existing harvest designs were entered into the spatial dataset.

The coniferous predominant blocks were sequenced first in Stanley using a thematic filter. Only polygons with greater than 70% conifer were blocked. Then the deciduous and mixedwood blocks were completed together in Stanley. Only polygons with less than 80% conifer were blocked in this model run.

4.2.1 Annual Allowable Cut Determination

The first 10 periods (50 years) of the Woodstock® schedule from run FMA_10 were replaced with the spatially explicit harvest schedule from Stanley. This resulted in harvest volumes, areas and levels of growing stock for run "FMA_10 Spatial" in Table 81. As expected, consideration of block size, adjacency, and spatial distribution resulted in further reductions to the expected harvest levels for the first 50 years (10 periods). Figure 24 below shows this impact.

Figure 24 - Impact of Spatial Considerations on Projected Harvest Levels



Tables 82 and 83 show the projected conifer and deciduous harvest volumes with both non-spatial (Woodstock), and spatial (Stanley) considerations. Outputs for the Stanley harvest were created by running the Woodstock model for the preferred scenario substituting the Stanley block schedule for the Woodstock block schedule to create output reports and graphs.

Fifty years or ten periods was chosen as a reasonable length of time over which to block the preferred Woodstock scenario. Unlike Woodstock, Stanley does not keep track of the growth and death of the forest over time, rather it obtains volume as a function of time information from the Woodstock output

files it requires as input. However, the blocked forest is essentially static, therefore blocking in Stanley can not take account of new forest regenerating as a result of projected harvest activities, and there is not sufficient information about the state of the forest beyond the time when the first stands of trees harvested and regenerated in Woodstock become available for harvest. Fortunately, the time period where stands first become available for harvest again in Woodstock can be determined. This time was defined to be 60 years from present. Fifty years was therefore chosen as the maximum amount of time that can reasonably be blocked (i.e. spatially sequenced) in Stanley.

As the number of stands available for Stanley to block and sequence over a 50 year period was in excess of Stanley's limits and due to the fact that only one green-up delay parameter can be specified for a given Stanley run, the Woodstock sequence available for blocking was split in two as a function of cover group. The Conifer and ConiferDeciduous cover groupse were blocked first, and then the Deciduous and Deciduous/Conifer cover groups were blocked. The choice for blocking the conifer land base first, was based on the fact that conifer dominated blocks required a higher green-up delay period, and therefore were inherently more difficult to block. Were the deciduous stands blocked first, the result would have been significantly lower overall success for blocking all sequenced stands.

Table 84 on the following page shows the area constraints used in the Woodstock preferred scenario (FMA_10 spatial) for late and very late seral stage representation compared to the actual areas projected to exist in the Stanley block sequenc output. There are some variances where the Stanley sequence shows projected areas less than the minimums required as specified by constraints in Woodstock. However, it must be remembered that the Stanley sequnce does not allow for inventory to aged during the production of the sequence, and there is no garauntee that the areas sequenced in Woodstock will be exactly those that are harvested. The majority of areas are represented well above the minimums specified in Woodstock.

a) Coniferous AAC

The results are provided in the table below.

Table 82 – Woodstock and Stanley Conifer Harvest Projections – Preferred Scenario FMA_10

Period (5 years)	Woodstock Conifer Harvest (m^3/year)	Stanley Conifer Harvest (m^3/year)	Percent of Woodstock Conifer Harvest Blocked in Stanley
1	490,005	485,031	99.0%
2	490,005	406,254	82.9%
3	490,005	412,840	84.3%
4	490,005	394,698	80.5%
5	490,005	448,458	91.5%
6	490,005	437,745	89.3%
7	490,005	430,082	87.8%
8	490,005	435,969	89.0%
9	475,005	454,095	95.4%
10	475,005	481,887	101.4%
Average	487,005	**438,706**	90.1%

Reductions in the proposed AAC have to be made for Stand Level Ecological Guidelines and cull. For the time period covered by this Plan a conservative estimate for merchantable tree retention across the FMA Area is five percent. Therefore the coniferous AAC is reduced 21,935 m^3/year for tree retention (438,706 m^3/year – 21,935 m^3/year = 416,771 m^3/year).

Cull deductions are applied directly to harvestable volumes rather than at the volume compilation stage. Estimates of cull were based on volume scaling data for the timber year 1999/2000 and year to date (only FMA scaling populations). The cull percentage for coniferous species is 3.06%. Therefore the coniferous AAC is reduced an additional 12,753 m^3/year. The coniferous AAC after all reductions for the FMA Area is **404,018 m^3/year**.

b) Deciduous AAC

The results are provided in the table below.

Table 83 – Woodstock and Stanley Deciduous Harvest Projections – Preferred Scenario FMA_10

Period (5 years)	Woodstock Deciduous Harvest (m^3/year)	Stanley Deciduous Harvest (m^3/year)	Percent of Woodstock Deciduous Harvest Blocked in Stanley
1	373,233	402,552	107.9%
2	373,233	332,646	89.1%
3	373,233	340,670	91.3%
4	373,233	330,286	88.5%
5	373,233	324,734	87.0%
6	373,233	308,497	82.7%
7	373,233	306,271	82.1%
8	373,233	318,600	85.4%
9	356,992	305,058	85.5%
10	323,233	294,013	91.0%
Average	366,609	**326,333**	89.0%

Table 84: Comparison of Spatial Sequence of Late and Very Late Seral Representation to Minimums Defined in the Non-Spatial Preferred Scenario.

Natural Sub-Region	Cover Type and/or Species Group	Minimum Age (Years)	Minimum Area (ha)	At Present	End of Period 2	End of Period 4	End of Period 6	End of Period 8	End of Period 10
Lower foothills	Deciduous dominated	80	2,275	35,289	29,852	24,853	25,642	25,718	20,220
Lower foothills	Deciduous/Coniferous	110	2,678	1,581	2,874	2,654	2,381	2,193	2,048
Lower foothills	Pine	110	452	3,401	14,402	24,377	21,207	14,291	7,111
Lower foothills	Spruce/Pine	110	5,113	21,132	35,706	47,999	56,088	61,399	77,278
Lower foothills	Spruce	110	1,540	3,025	3,590	3,898	3,982	4,575	6,013
Upper foothills	Deciduous dominated	80	30	245	219	102	81	77	166
Upper foothills	Coniferous/Deciduous	110	95	247	381	463	399	407	338
Upper foothills	Pine	110	480	3,681	14,918	14,415	11,411	11,260	8,460
Upper foothills	Spruce/Pine	110	2,177	10,257	16,751	16,249	15,649	15,982	15,943
Upper foothills	Spruce	110	911	4,244	3,758	3,081	2,910	2,801	2,271
Lower foothills	Spruce/Pine	140	1,023	3,442	8,448	13,762	18,972	33,843	46,172
Lower foothills	Spruce	140	308	123	331	1,060	1,324	2,066	2,380
Subalpine	Pine	140	30	94	198	185	172	856	475
Subalpine	Spruce/Pine	140	238	1,908	2,763	2,763	2,759	4,021	4,020
Subalpine	Spruce	140	134	1,858	2,304	2,303	2,271	2,384	2,354
Upper foothills	Coniferous/Deciduous	140	38	30	108	96	110	290	310
Upper foothills	Pine	140	240	1,282	1,702	1,661	1,256	6,871	4,842
Upper foothills	Spruce/Pine	140	1,088	5,201	6,780	6,705	7,437	14,620	13,882
Upper foothills	Spruce	140	304	2,400	3,002	2,579	2,132	2,288	1,792

Similar to the coniferous AAC determination reductions in the proposed AAC have to be made for Stand Level Ecological Guidelines and cull. A reduction of five percent across the FMA area for merchantable tree retention reduces the deciduous AAC by 16,317 m^3/year (326,333 m^3/year – 16,317 m^3/year = 310,016 m^3/year).

Like the coniferous, cull deductions are applied directly to harvestable volumes rather than at the volume compilation stage. The cull percentage for deciduous species is estimated at 5.83%. Therefore the deciduous AAC is reduced an additional 18,074 m^3/year. The deciduous AAC after all reductions for the FMA Area is **291,942 m^3/year**.

4.2.2 Annual Allowable Cut Commitments

a) Tall Pine Timber Co. Ltd.

As provided in table 76, Tall Pine Timber Co. Ltd. is entitled to 6.59% of the coniferous AAC from the FMA Area. Therefore, the coniferous AAC for Tall Pine Timber Co. Ltd. from the FMA Area is 6.59% of 404,018 m^3/year, or **26,625 m^3/year**. In alignment with Section II 3.3 Tall Pine has been sequenced in the Tall Pine LMU. As noted above, a number of blocks from existing harvest designs scheduled for harvesting by Tall Pine were included in the spatial blocking exercise. Weyerhaeuser will continue to work with Tall Pine to further refine the proposed coniferous sequencing in accordance with Section II 3.2 of this document.

b) Rose Creek Community Timber Program

The Crown, in consultation with the Company, has reserved the right to the coniferous timber from FMA Area lands contained in township 47, ranges 8, 9 and the western half of range 10 for local use as part of the Rose Creek Community Timber Program. With the objective of meeting current demand the coniferous AAC of **4,035 m^3/year** (as per the 1996 Forest Management Plan for FMU R4) will be maintained.

c) Timber Permit Program

As per the Forest Management Agreement[58] the Minister reserves the right to issue permits for up to one percent of the approved FMA Area coniferous AAC, excluding the AAC for the Community Timber Program, and up to one percent of the approved FMA Area deciduous AAC. Therefore, the proposed coniferous and deciduous AAC's for the timber permit program from the FMA Area are respectively **4,000 m^3/year**, and **2,919 m^3/year**.

d) Quota Volume Allocation in R2

As shown in Table 79, the volume reserved by the Crown for quota allocation in R2Y (the portion of R2 within the FMA) was determined to be 64.09% of the conifer harvest level, or **49,958 m^3/year**.

[58] Forest Management Agreement 8(2)(a)(ii)

4.3 Sequencing Analysis

4.3.1 Landscape Management Units

The table provided below shows the amount of area proposed for harvesting in the next 10 periods (50 years) by Landscape Management Unit (LMU), and provides a relative comparison of the proportions of the LMU's scheduled for logging to the total LMU area.

Table 85 – Landscape Management Unit area sequenced by cut period

Cut Period	Landscape Management Unit											Total
	Baptiste	*Blackstone*	*Elk River*	*Marshybank*	*Area adjacent to JNP*[59]	*Medicine Lake*	*Nordegg River*	*O'Chiese*	*Sand Creek*	*Tall Pine*	*Willesden Green*	
1	2,440.6	1,368.4	2,345.7	605.3	0.0	436.1	2,531.9	711.3	928.6	1,481.0	964.7	14,569.1
2	3,018.7	1,344.5	1,274.0	714.5	550.0	295.6	1,558.8	1,353.3	693.7	1,350.3	1,861.1	14,155.2
3	2,572.2	1,116.6	1,723.7	312.7	115.3	512.9	1,863.3	784.5	976.7	1,480.2	835.5	13,458.3
4	2,085.3	1,148.5	1,856.0	665.7	193.3	253.0	1,538.9	1,077.6	910.0	667.7	1,876.7	12,990.6
5	3,184.9	1,259.0	2,076.3	495.3	143.9	46.8	1,085.1	2,411.4	619.0	835.8	1,394.4	14,138.7
6	2,449.9	1,110.6	1,294.7	764.3	222.8	659.9	1,556.6	828.8	1,499.6	1,348.0	739.9	13,679.9
7	2,064.9	868.6	1,356.8	662.9	76.7	163.8	1,683.2	738.5	1,384.7	729.5	1,750.2	12,757.2
8	2,034.6	1,654.3	971.5	326.6	177.4	1,145.4	2,303.6	517.7	1,116.5	1,510.2	1,095.5	13,547.7
9	3,071.4	1,471.7	1,332.3	522.7	72.1	128.8	925.4	572.1	1,079.1	990.4	2,655.0	13,957.9
10	1,606.3	1,026.5	3,217.8	929.9	312.2	2,159.6	639.4	511.0	816.7	995.6	1,003.7	13,776.8
Totals	24,528.8	12,368.7	17,448.8	5,999.9	1,863.7	5,801.9	15,686.2	9,506.2	10,024.6	11,388.7	14,176.7	137,031.4
LMU Total Area	74,246.2	38,042.0	50,216.3	20,035.8	NA	20,049.0	46,848.2	30,161.4	44,853.4	39,667.1	54,989.9	419,109.3
LMU THLB	42,743.6	27,363.0	29,704.6	16,018.8	NA	11,647.8	27,605.4	17,610.3	31,206.1	23,848.4	36,868.5	264,616.4
% of LMU area sequenced	33.0%	32.5%	34.7%	39.2%		28.9%	33.5%	31.5%	22.3%	28.7%	25.8%	32.7%
% of LMU THLB sequenced	57.4%	45.2%	58.7%	49.1%		49.8%	56.8%	54.0%	32.1%	47.8%	38.5%	51.8%

A map of the FMA Area showing the sequencing output from Stanley for the next 10 periods is provided in Appendix 4, page 21. Similarly, maps of the individual LMUs, showing the first 20 years of sequencing are provided in Appendix 4, pages 22 to 31.

[59] The area adjacent to Jasper National Park is part of the Marshybank Landscape Management Unit. The numbers for the Marshybank LMU do not include the "Area adjacent to JNP", except for *% of LMU area sequenced* and *% of LMU THLB sequenced*.

4.3.2 Biodiversity

Weyerhaeuser's forest planning strategy for the Drayton Valley FMA aims to maintain a sustainable supply of fiber while addressing ecological and biodiversity values.

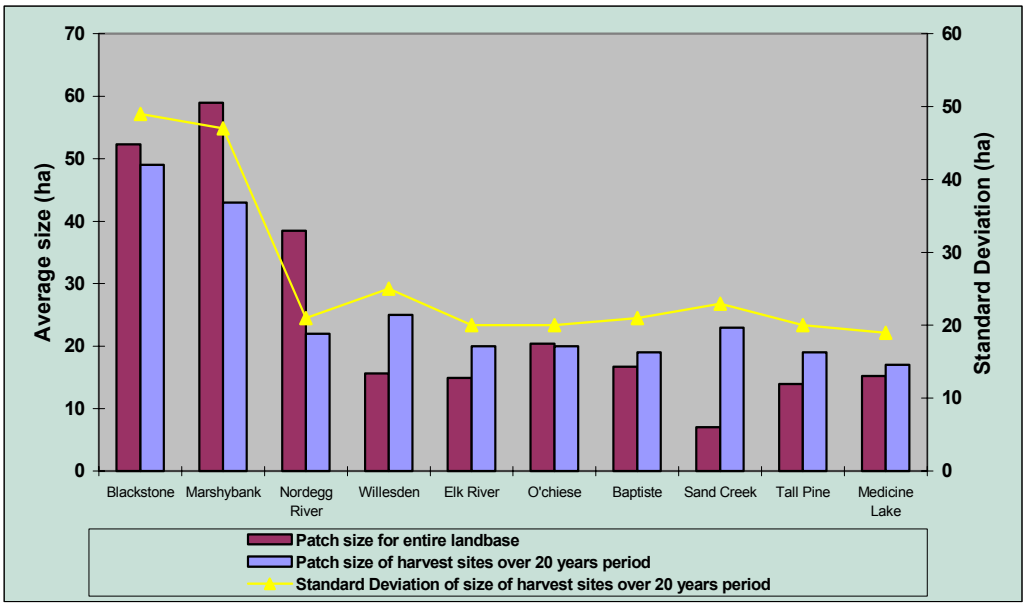
At the stand level, the practice of structure retention within harvest sites provides structural diversity and habitat for wildlife species in a regenerating site. The practice has been implemented since the winter of 1998-99. The volume that is accounted for in the TSA (deduction of 5% in the AAC calculation) reflects field assessment of practices underway over the last two winters. Aerial surveys of all 47 sites harvested in 1998-99 showed that 62% had between 1 to 5% cover, 34% had between 10 to 20% cover and 4% of the blocks sampled had greater than 25% structure remaining. Ninety-four percent of the sites had single tree retention in combination usually with clumps (on 91% of the sites) or less commonly with patches (on 38% of the sites). The results of ground surveys of 27 sites harvested over the last two years are shown Table 85. Surveys indicate that on average between 3.7 and 4.33 % of the total volume present on individual sites was left standing.

Table 86 - Drayton Valley Stand Retention Data (1999 versus 2000 Summary of Results)

	1999	2000
Non-Merchantable Retention		
Average Non-merch Stems/ha	14.8/ha	12.1/ha
Average Non-merch Volume (m^3/ha)	4.06 m3	1.16 m3
Total Non-merch Percent Retention (as a % of total volume)	1.60%	0.51%
Merchantable Retention		
Average Merchantable Stems/ha	34.6/ha	24.3/ha
Average Merchantable Volume (m^3/ha)	9.76 m3	9.76 m3
Total Merchantable Percent Retention (as a % of total volume)	3.77%	4.33%
Total Retention (Merch + Non-merch)	5.25%	4.85%
Total Volume (Hauled + Retention)	35951.64	19744.44
Average m^3 of retention volume per block	157.3 m3	63.8 m3
Average m^3 per hectare of retention	13.82 m3	10.92 m3
Tree Volume (m^3/stem)	0.257 m3	0.402 m3

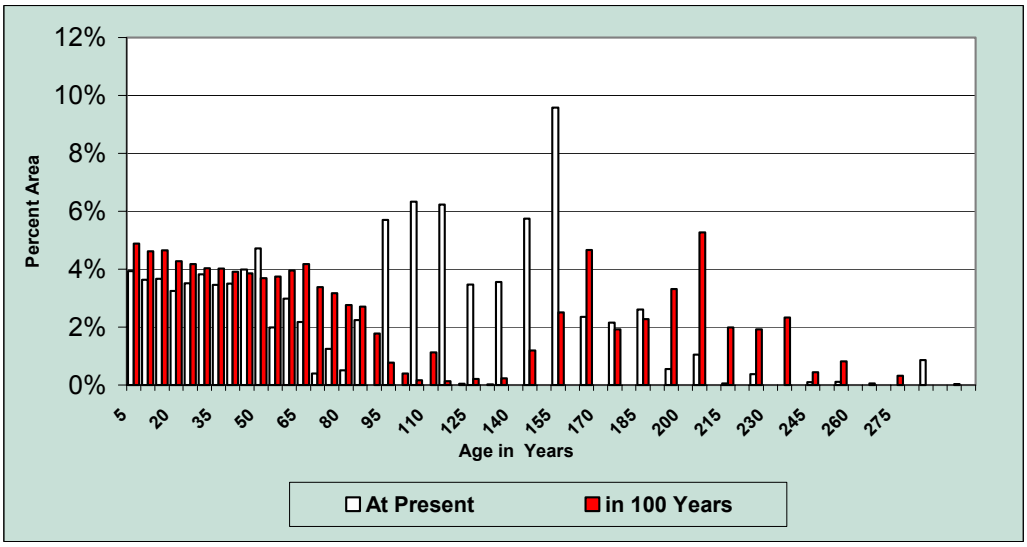
At the landscape level, the conservation of biodiversity and of wildlife habitat for all species requires the maintenance of diverse forest ecosystems with a variety of stand sizes and seral stages. In forest management, this can be achieved by increasing the diversity within harvest designs, increasing the range of block sizes and shapes, and dispersion of logging across Landscape Management Units. The disperse nature of future harvesting operations is illustrated in Appendix 4 page 21 (*FMA Sequencing Map*). The proposed harvesting pattern will ensure that patches of forest of a variety of ages and composition will be maintained across the planning landscape to provide habitat opportunities for wildlife species. The diversity of harvesting sites is further illustrated in Figure 25 where average sizes and standard deviations are presented for each Landscape Management Unit (LMU). Since operational planning will ultimately determine the feasibility of individual harvest sites and their distribution, it is not possible to assess the diversity of future forest landscapes. However, Figure 25 clearly shows the consistency of proposed harvest sites over the next twenty years with current landscape patterns as measure by average patch size. It is worth noting how the average patch size is fairly consistent with the nature of individual LMU, where the Blackstone and Marshybank LMUs will have larger harvest sites. Furthermore, in other LMUs, such as Sand Creek, the proposed average harvest site is larger than the current landscape conditions and may decrease the current degree of forest fragmentation.

Figure 25 – Current average patch size of entire FMA landbase and average size of proposed harvest sites



An important component of Weyerhaeuser approach to the conservation of biodiversity is the maintenance of late seral stages across the FMA. The targets were outlined in Section II 2.2.3. A comparison of the current age class distribution with the one forecasted 100 years from now shows that more than 30% of the forested landbase is maintained in late seral stages and will provide habitat for "old growth" dependent species.

Figure 26 – Drayton Valley FMA Area age class distribution comparison



SECTION IV
DETAILED FOREST MANAGEMENT PLAN IMPLEMENTATION

1. IMPLEMENTATION

The purpose of this section is to describe the basic framework for implementation of the DFMP strategies and tactics, as well as identifying any issues related to implementation complete with resolution processes.

The basic framework for DFMP implementation will be the three traditional methods: Planning and Operating Ground Rules, General Development Plans, and Annual Operating Plans. They are outlined as follows.

1.1 Planning and Operating Ground Rules

Purposes:

- To develop the standards and best practices for implementation of the DFMP strategies and tactics in order to ensure achievement of the DFMP goals and objectives.
- To ensure best judgement is used by specifying objectives and results, and to remain adaptive to improved knowledge and technology.
- To incorporate Provincial standards and best practices for resource management and environmental protection
- To define the basic requirements for harvest planning so as to facilitate Provincial review and approval.

Scope:

In alignment with the new Provincial model (communication from Doug Sklar, Director of Forest Management Division / LFS May 3, 2000), the FMA Ground Rules shall apply to all timber operations on the FMA Area which will be termed the Ground Rules "region". Thus the Ground Rules will incorporate three levels of scope as follows:

Provincial - Typically this would be standards for environmental protection, resource utilization, plan approvals, or administration as determined from regulations or policy.

Regional – This scope would include regional integrated resource plans, regional level policies and procedures, integration with other timber operators (Quota and Permit programs), or landscape issues unique to the region.

FMA / DFMP – This would include those standards and practices required to implement the DFMP that are appropriate for Ground Rules application.

Content:

The Ground Rules will contain the following broad categories of standards and best practices.

- Administration
- Timber Harvest Planning
- Timber Harvest Operations
- Environmental Protection (Watershed, Fish & Wildlife, Soils)
- Integrated Resource Management (Stakeholder consultation)

1.2 General Development Plan (GDP)

Purpose:

- To provide a projection of the location and amount of harvesting and roading operations in the short term.
- To identify any issues and resolution requirements related to implementation of the DFMP or submission of future Annual Operating Plans so as to avoid delays in approvals.

Scope:

The GDP shall cover all of Weyerhaeuser's harvesting operations on the FMA Area for a 5-year period, and will be submitted annually. This will include any other sources of wood supply for the Company's facilities in Drayton Valley (i.e. FMA integrated deciduous, purchased, other Company operations).

Content:

- Application of LMU objectives
- Emerging significant issues and process for resolution
- General harvest sequencing and access development
- Information updates that influence DFMP stand sequencing, and identification of need for sensitivity analysis
- Strategies to deal with major unplanned events (e.g. fire, insect & disease, blowdown)
- Timber harvesting summaries and cut control position

1.3 Annual Operating Plan

Purpose:

- To provide stand level planning for harvesting, access, reforestation and environmental protection.
- To facilitate Provincial approval.

Scope:

All of Weyerhaeuser's harvesting operations for the FMA Area for a defined operating period.

Content:

- Stand level harvest design
- Operability assessments
- Stakeholder integration requirements
- Fine filter / small scale resource management issues and resolution
- Stand level environmental protection requirements
- DFMP sequencing variance
- Road construction, maintenance and abandonment
- Reforestation planning (including landbase reconciliation)
- Summary of annual activities for ongoing DFMP programs

1.4 DFMP Implementation Issues

The table below summarizes the DFMP implementation issues and processes for resolution.

Table 87 – DFMP implementation issues and processes for resolution

Implementation Issue	Resolution
GROUND RULES The Company is currently operating under the Provincial Ground Rules, however a new FMA regional set of Ground Rules is required to support the DFMP and the new Provincial model.	The Company will develop a Terms of Reference for development of a new set of Ground Rules concurrent with the DFMP submission. It is expected that the process to agree on new Ground Rules with the Province and other timber operators could be completed by spring 2001.
SEQUENCING a) *Transition* - The timber supply model produces a stand level sequencing. It must be determined how the current approved harvest designs can be integrated with the new DFMP sequencing. b) *AOP Link* – There must be a continuous process of linking the timber supply analysis (TSA) sequencing assumptions to AOP's.	Either a) the TSA will "block" the current AOP sequencing in the analysis or b) the first AOP under the approved DFMP will identify a transition plan for harvest designs where consideration will be given to existing road development, stakeholder consultation and wood supply requirements. Figure 19 outlines the basic concept for coordinating the TSA sequencing with justified variances.
INTEGRATING FMA OVERLAPPING QUOTA HOLDER(S) The Ground Rules will apply to *all* timber operators on the FMA. The Quota holder's sequencing will be adjusted as well as Weyerhaeuser's as a result of the TSA. The overlapping Quota holder will be required to support certain DFMP timber, integrated resource management and ecological sustainability strategies.	The FMA Area overlapping Quota holder(s) will be a participant in the process to develop the Ground Rules in coordination with the LFS. The Quota holder's current approved harvest designs have been "blocked" in the TSA and resulting sequencing i.e. the current AOP blocks will be part of the new sequencing. Weyerhaeuser has maintained an ongoing consultation process with Tall Pine Timber Co. throughout the development of the DFMP. Following DFMP approval, Weyerhaeuser will meet with Tall Pine and the LFS to review roles and responsibilities.

Table 87 continued

INTEGRATING THE COMMUNITY TIMBER PROGRAM (CTP) AND LOCAL TIMBER PERMIT (LTP) PROGRAM The Ground Rules will be established for *all* timber operators on the FMA. CTP timber harvesting operations will have to support certain DFMP timber, integrated resource management and ecological sustainability strategies.	The LFS will represent the interest of the participants in the CTP and LTP program during Ground Rules development and all subsequent planning. Weyerhaeuser will play a lead role in planning for CTP's and LTP's under the direction of the LFS.
SUNDANCE COMMITMENT As per the FMA, Weyerhaeuser is required to supply 43,500 m^3 of conifer annually to Sundance Forest Industries in Edson.	The Sundance commitment will be met through the normal sequencing and planning for the FMA (i.e. there will be no noticeable impact on the DFMP goals or objectives as a result of this commitment).

1.5 Future Issues

At the time of the development of the DFMP, there were some issues which were a) identified but could not be reasonably resolved in time for the DFMP submission or b) were emerging but not substantiated enough for consideration in the DFMP. Such issues are anticipated to have an imminent impact on the DFMP, therefore they are listed here to acknowledge their potential as future implementation issues.

Table 88 – Future DFMP issues and processes for resolution

Future DFMP Issue	Resolution
SPECIAL PLACES NOMINATIONS At the time of the DFMP submission, there are two known Special Places Program candidate sites on the FMA Area – the Wapiabi and Thunder Lake sites. Both are in process of review and have not been formally approved by the Province.	Weyerhaeuser has mapped the preliminary boundaries for the sites and has the capability to analyze the impacts of these sites as land withdrawals from the FMA Area pending Provincial approval and land reclassification.
JASPER PARK BOUNDARY As a result of public and stakeholder consultation for the DFMP, it was ascertained that a special process for determination of forest management operations adjacent to the Park boundary in the Marshybank LMU was warranted. However this process will require more time than allowed for the DFMP submission. Therefore an understanding between Weyerhaeuser and Parks Canada has been established for further consultation, assessment and planning which will result in future recommendations to the Province for the area in question.	A process for further study, planning and decision making for the area in question will be developed to determine future DFMP input or possibly revisions. In the interim, the normal TSA assumptions will apply to this area however there will be no harvesting sequenced for the area in question for the first 5 years of the DFMP.
FMA BOUNDARY During the review of Weyerhaeuser's inventory work by the LFS, the Province advised of a proposed boundary change to the FMA from that which the Company understands the original Agreement to be based on (communication from Doug Sklar, Director of Forest Management Division / LFS August 23/00)	Weyerhaeuser will meet with the LFS following DFMP approval to resolve the FMA boundary amendment, which will form the inventory basis for future Plan updates and revisions.

SECTION V
DETAILED FOREST MANAGEMENT PLAN MONITORING

1. MONITORING AND REPORTING

Background

The adaptive management approach used to implement this DFMP involves three basic elements – *monitoring, analysis and adjustment.* A more thorough presentation of this concept was provided in the Section II. The purpose of this section is to describe the framework for monitoring and how it will be reported in the context of the Plan.

Monitoring will be an ongoing process and integrated with regular operations of the Company. It will address the basic aspects of:

- Tracking actual activities versus planned activities
- Tracking actual responses to forest management activities compared to expected responses
- Identifying impacts arising from changes in assumptions, terms of reference or unplanned events

To restate from the Interim Planning Manual, regulatory performance or compliance will be reported through existing, separate systems.

Information systems designed to manage monitoring data will be acquired or developed not only to meet the needs of this DFMP, but also to serve future initiatives for environmental certification (e.g. ISO, CSA, etc.).

Reporting will be done in two reports, the purpose and content of which is described as follows.

1.1 FMA 8500023 Annual Forest Management Report

Purpose:

- To provide information of interest to the public on a regular basis.
- To report on the forest management activities undertaken in the previous year that pertain to implementation of the DFMP strategies.
- To report on any changes that would warrant an analysis of impact on the DFMP.

Content:

The content of the Annual Forest Management Report may be adjusted over time with mutual agreement between Alberta Environment and the Company, or as deemed appropriate for public involvement. Therefore, the Report will include, but may not be limited to the following items:

- Timber harvesting and road construction
    - Area and volume of timber harvested by species and landbase

    - Kilometres of road built by class
- Inventory work (timber and non-timber)
- Research work
- Reforestation and silviculture operations
    - Area reforested
    - Area of site preparation and number of seedlings planted
    - Area of stand tending, thinning
- Area summary of land withdrawals and additions
- Summary of public involvement activities, concerns or input
- Significant events or changes

1.2 FMA 8500023 Stewardship Report

Purposes:

- To report on the monitoring of the DFMP goal measures and objective targets.
- To identify any trends or issues from cumulative effect of numerous variances
- To report any changes or events that would warrant revision of the DFMP
- To provide the public with an overall assessment of the DFMP progress, i.e. "Are we doing what we said we would do?"

Content:

The content of the Stewardship Report may be adjusted over time with mutual agreement between Alberta Environment and the Company. Therefore, the Report will include, but may not be limited to the following items:

- Changes to DFMP Terms of Reference (Weyerhaeuser strategies, Provincial legislation or policy, public involvement, FMA or DFMP amendments, Ground Rules)
- Achievement of DFMP Objectives
    - Assessment of planned targets vs. actual results
    - Review and discussion of variances from plan
    - Revisions of objectives or targets
    - Review of monitoring of DFMP goal measures (including assessment of the currency of the measures themselves)
    - Review of timber supply analysis assumptions
    - Emerging trends or issues
    - Need for sensitivity analysis
- Scheduled inventory work (timber and non-timber)
- Research work
- Biodiversity/wildlife status report as determined by:
    - Trends in biodiversity indicators (birds and furbearers occurrence) based on FMA wide surveys conducted every 3 years.
    - Specific research/monitoring projects developed in conjunction with NRS and other Research Agencies, such as the University of Alberta.
- Summary of public consultation (issues and responses)
- Information of interest to publics (as determined from public consultation)
- Timber supply impacts
    - Area summary of landbase withdrawals and additions
    - Volume lost to non-timber use (i.e. other land use dispositions)
    - Variance(s) from timber supply analysis assumptions

    - Natural disturbances (e.g. fire, insect, disease, blowdown)
    - Activities on afforestation, enhanced forest management, reforestation of disturbed areas
- Harvest production summary
    - Summary of area and volume harvested by LMU, species and landbase (plan vs. actual)
    - Cut control position
    - Variances or deferrals from plan sequencing
- Silviculture
    - Performance on meeting the reforestation standard (as determined from standard reforestation records systems)
    - Enhanced forest management and timber damage assessment (TDA) funded activities
    - Record of landbase conversions

SECTION VI
FUTURE INITIATIVES

1. FUTURE INITIATIVES

This section is provided to outline the work that is anticipated to be carried out in order to prepare for future DFMP amendments or submissions. Table 88 below summarizes the future initiatives that Weyerhaeuser plans to support at the time of this DFMP. The following text gives a brief overview of the main justifications for these initiatives.

1.1 Mixedwood Management

The Terms of Reference for the DFMP describes a management approach labeled 'Mixedwood Management'. The approach includes specification of alternative silviculture regimes and enhanced forest management tactics within a landscape perspective. Much of what was intended for inclusion in the plan has yet to be completed. The Mixedwood approach still carries merit as a basis for alternative management scenarios, but the details surrounding the complexity of the approach need to be resolved.

1.2 Enhanced Forest Management Research

Weyerhaeuser continues to provide both in-kind and financial support to a number of initiatives with the general objective of building capacity to support the rational implementation of enhanced forest management. Weyerhaeuser is a member of and participates in the following organizations:

- Western Boreal Growth and Yield Cooperative
- Foothills Growth and Yield Association
- Mixedwood Management Association

Weyerhaeuser also collaborates and is involved with the:

- Sustainable Forest Management – Centre of Excellence
- University of Alberta Institute for Enhanced Forest Management

As an ongoing commitment to forest management activities on the FMA Weyerhaeuser will continue to install and manage operational trials in enhanced forest management activities. These activities include, but are not limited to:

- partial cutting mature stands
- spacing / tending juvenile stands
- understory planting
- full stocking
- stand rehabilitation

Weyerhaeuser also continues to participate in tree improvement programs for white spruce and aspen.

A key component of implementing enhanced forest management is having defendable projections of the silviculture regimes proposed in the management plan. Therefore, Weyerhaeuser will continue to investigate methods for projecting growth and yield of managed stands specific to the area under management.

Species composition of the stands in the FMA is a function of site variables and stand history. Investment in the development of an empirical basis for defining shifts in stand composition over space and time is required, as this is current not well understood. Weyerhaeuser will continue to investigate the potential to model these types of shifts and to evaluate the impact on a range of values.

Currently, Weyerhaeuser is refining methods to support corporate decision making for the types and intensities of silviculture to apply to public land forest management in Canada. This type of analysis applied to the Drayton Valley FMA will provide improved guidance for the implementation of enhanced forest management and is intimately linked to the knowledge base that supports growth and yield projections.

1.3 Forest Inventory and Timber Supply Analysis

This type of work will include:

- enhancement of forest inventory information for certain areas of the FMA Area
- cooperation with other agencies on landscape management assessments (e.g. fire management, land use developments)
- evaluating and implementing proposed FMA boundary changes
- improving timber supply modeling capacity

1.4 Ecological Sustainability

As described in the DFMP, future initiatives regarding ecological sustainability will focus on those activities designed to further knowledge of forest ecosystems and the impacts of forest management. This would encompass monitoring trends in biodiversity indicators, assessing the range of natural variation, and contributing to specific research / monitoring projects developed in conjunction with NRS and other research agencies.

1.5 Timelines

Weyerhaeuser has invested in a valuable and comprehensive set of inventories that will be used for some time to come. As well, considerable investment has been put into the development of public involvement processes. For these reasons it is important that any issues or opportunities are evaluated in a timely fashion so as to realize the investments made in this store of information. It is therefore probable that these evaluations will result in proposed amendments to the existing DFMP as opposed to new submissions, which would repeat the entire management plan process with no net increase in value to anyone.

Table 89 – Future initiatives

Initiative	Description
Economic Analysis	Economic analysis of EFM strategies and corporate approval
Growth and Yield	Mortality relationships Early stand development (natural and regenerated) Succession
Silviculture regimes	Operational trials of alternative silviculture regimes
Stand and landscape level management regimes	Multiple activity analysis at landscape level Operational implementation protocols
FMU R02 and LFS boundary changes	The Company is working with Sunpine Forest Products Ltd. to determine the portion of the R2 forest management unit required to support the Company's allocation of harvest rights. Weyerhaeuser will request that the Province incorporate the area required to support the volume allocation of the quota into the FMA area. Upon successful completion of this task Weyerhaeuser will request cancellation of their R2 quotas. In a separate matter, Alberta Environment has served notice to Weyerhaeuser that they wish to adjust the boundary to FMUs that form the basis of the FMA boundary. Pending agreement with Alberta Environment, this may result in an adjustment to the net landbase and subsequently the timber supply analysis.
Environmental management systems International Organization for Standardization Canadian Standards Association	In response to customer demand and to build confidence that Weyerhaeuser is properly managing the forest resource entrusted to us by the Province with our customers, communities and stakeholders, Weyerhaeuser has initiated the development of an Environmental Management System. Weyerhaeuser-Drayton Valley will be seeking certification from the International Organization for Standardization (ISO 14001) by the fourth quarter of 2001. The company has also made the decision to achieve Canadian Standards Association's Sustainable Forest Management Standard by the end of 2002. To achieve this standard, the Drayton Valley Forestlands will be developing a mechanism for public involvement and reporting. This process is expected to increase the Forest Advisory Committee's scope and role for the FMA area.
Access management	Weyerhaeuser will continue to participate in cooperative access management initiatives such as the Nordegg River Plan.
Biodiversity monitoring	Periodic surveys for population levels and habitat use
Riparian area management	Weyerhaeuser will strive to cooperate with NRS and LFS to develop a classification of riparian forests for all the streams, rivers and lakes that occur within the FMA Area; integrating vegetation, soils, topography, and unique surface features. It is hoped that the classification will provide the baseline for the development of site-specific buffer guidelines and riparian forest management.
Enhancement of O'Chiese burn inventory	Enhancing forest inventory for O'Chiese burn area to AVI version 2.1 standards
Fire management	Cooperate with Alberta Environment to further predictive modeling of fire hazards and behavior for future consideration in landscape management strategies.

GLOSSARY

AAC	Annual Allowable Cut
ACE	Allowable Cut Effect
Adaptive forest management	A dynamic planning or modeling process that recognizes the future cannot be predicted perfectly. In response to these imperfect predictions, planning and management strategies are modified frequently as better information becomes available. It applies scientific principles and methods to improve management activities incrementally, as decision-makers learn from experience and new scientific findings, and adapt to changing social expectations and demands. It is a continuous process requiring constant monitoring and analysis of the results of past actions, which are then fed back into current decisions. (10)
Aesthetics	The perception of beauty by people. The philosophy concerning judgements made about beauty.
Age class	The classification of stands in a forest, or trees in a stand, into a series of ages (eg. 0 to 4.99 = age class 1). For the DFMP, the age class of the AVI stands on the FMA area is defined by the stand age. The stand age is determined by using the DFMP base year (1999) minus the AVI origin plus five years. (10)
Age class distribution	Intervals into which the age range of trees, forests, stands or forest types are divided for classification and use. (5)
Alberta Vegetation Inventory	A system for describing the quantity and quality of vegetation present. It involves the stratification and mapping of the vegetation to create digital data according to the AVI Standards Manual and associated volume tables.
Allowable cut effect	The allocation of anticipated future forest timber yields to the present allowable cut. The effect is typically based on several assumptions about the yields that may develop as a result of activities and decisions taken in the present. Shortening the rotation period, raising the increment, or both, increases the allowable cut. (10)
Annual allowable cut	The volume of wood that can be harvested in one year from any area of forest under a sustained yield management regime. The choice of AAC is based on knowledge of the potential fertility of the stands currently growing in the forest, and assumptions about how existing or anticipated future stands will continue to grow, the risks of loss, and constraints on operability. (10)
Annual operating plan	Plans prepared and submitted annually by timber operators describing how, where and when to develop roads and harvest timber. They describe the integration of operations with other resource users, the mitigation of the impacts of logging, the reclamation of disturbed sites and the reforestation of harvested areas. (2)
AOP	Annual Operating Plan
Artificial regeneration	The creation of a new stand by direct seeding or by planting seedlings or cuttings. (10)
AVI	Alberta Vegetation Inventory
Biodiversity	The variety and variability of living organisms from all sources such as terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part. (11)

Broad Cover Group	Defined by the predominance of coniferous and/or deciduous tree species: Coniferous – stands with at least 80% conifer, Coniferous/Deciduous – stands with at least 50% and less than 80% conifer Deciduous/Coniferous – stands with at least 30%, and less than 50% conifer, and Deciduous – stands with less than 30% conifer.
CDWD	Coarse Down Woody Debris
Coarse filter management	Forest management at a landscape level or over broad regions aimed at maintaining a range of stands of different size, age and composition to provide habitat for all species.
Coarse woody debris	Typically, sound or rotting logs, stumps, or large branches that have fallen or been cut and left in the woods, or trees and branches that have died but remain standing or leaning. (10)
Community timber program	A term used to describe a category of timber use that provides for those operators who harvest volumes through permits.
Coniferous species	Are cone bearing plants; pertaining to the class Gymnospermae. In this DFMP, it refers to the following tree species used in the processing facilities: white spruce, black spruce, Engelmann spruce, lodgepole pine, balsam fir, alpine fir, and tamarack
Coniferous stands	Forest stands or blocks that consist predominately (> 70%) of coniferous tree species.
Coniferous Timber Quota	A coniferous timber quota grants the rights to harvest a percentage share of the annual allowable cut of a designated forest management unit for up to a 20 year term as defined under the Forests Act. (1)
Constraint	The restrictions, limitations, or regulation of an activity, quality, or state of being to a predetermined or prescribed course of action or inaction. Constraints can arise from the influence of policies, political will, management direction, attitudes, perceptions, budgets, time, personnel, data availability limitations, or complex interaction of all these factors. (10)
CTP	Community Timber Program
CTQ	Coniferous Timber Quota
Cut Control Period	A five year harvest period also know as a quadrant. (1)
Cut sequence	The order of harvest operations in time and space. (13)
Deciduous species	Belongs to the class Angiospemae. In this DFMP, it refers to the following tree species used in the processing facilities: trembling aspen, balsam poplar, and white birch.
Deciduous stands	Forest stands or blocks that consist predominately (> 70%) of deciduous tree species.
Deciduous Timber Allocation	Deciduous timber allocation defined on an area or volume basis for up to a 20 year term under the Forests Act. (1)
Digital terrain model	The computerized portrayal of a landform in three dimensions. It involves translating contour lines into digital format for use in the computer. It is also called digital elevation model. (10)
DTA	Deciduous Timber Allocation

DTM	Digital Terrain Model
Eastern Slopes Policy	A Policy for Resource Management of the Eastern Slopes. A policy covering about 90,000 km^2 of the eastern slopes of the Rocky Mountains in Alberta. It was first released in 1977 and revised in 1984. The policy presents the Government of Alberta's resource management policy for public lands and resources within the region. (6)
Ecosite	An ecological land classification in Alberta that provides a stand-level classification of ecological units that have developed under similar climate, moisture, and nutrient regime. (14)
Ecosystem	Any complex of living organisms and their environment that we isolate mentally for purposes of study, or which at a given scale can be perceived as a discrete unit and can be managed as such. (11)
EFM	Enhanced Forest Management
Endangered, threatened and rare species	Classifications of the status of species populations as determined by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Endangered indicates any indigenous species of fauna or flora that is threatened with imminent extirpation or extinction throughout all or a significant portion of its Canadian range. Threatened indicates any indigenous species of fauna or flora that is likely to become endangered in Canada if the factors affecting it vulnerability do not become reversed. Rare indicates an indigenous species of fauna or flora that, because of its biological characteristics or because it occurs at the fringe of its range, or for some other reasons, exists in low numbers or in very restricted areas in Canada but is not a threatened species. (10)
Enhanced forest management	The practice of growing more wood per hectare (as compared to extensive silviculture) by using techniques aimed at capturing or raising full land productivity.
Establishment period	The time elapsing between initiation of regeneration and its acceptance according to defined reforestation standards in the Timber Management Regulation.
Even aged stands	Stands where the ages of most trees are within 20 years of each other.
Even flow	In harvest scheduling, the requirement that the harvest level in each period be equal to the harvest level in the preceding period. (8)
Extensive silviculture	Silviculture practices which, at the minimum, meet current provincial reforestation standards and support the current annual allowable cut.
FAC	Forest Advisory Committee
Feature Species	Those species that are rare, threatened, endangered or of social value
Fine filter management	Specific habitat management for a single or a few species rather than broad management at a landscape level to maintain a range of habitat opportunities for all wildlife species (coarse filter). (10)
Fire cycle	Is the number of years required to burn over an area equal to the entire area of interest.
FMA	Forest Management Agreement

FMU	Forest Management Unit
Forecast	A prediction of future conditions and occurrences based on the perceived functioning of a forest system. A forecast differs from a "projection" which is a prediction of anticipated future conditions based on an extrapolation of past trends. (10)
Forest Advisory Committee	A collection of stakeholder representatives for Weyerhaeuser's FMA area that give advice and direction to the company and Alberta Environment to ensure that integrated forest resource management is practiced, to sustain the health and integrity of the land and forests for future generations.
Forest connectivity	A measure of how well different areas (patches) of a landscape are connected by linkages such as habitat patches or corridors of like vegetation. (10)
Forest health	As a specific condition, the term refers to a growing forest having many or all of its native species of plants and animals. As a management objective, it refers to maintaining or restoring the capacity of a forest to achieve health. (10)
Forest Management Agreement	An Order in Council contract between the Province of Alberta and the FMA holder (Weyerhaeuser) whereby the Province provides an area based Crown timber supply. In return the FMA holder commits to: Managing the timber on a perpetual sustained yield basis taking into consideration a broad range of forest values in determining forest management practices. Meeting defined economic objectives including capital investment and job creation, and seeking out new business opportunities that provide measurable economic benefits for both the Province and the FMA holder. The FMA gives the FMA holder the right to access Crown fibre and in return the FMA holder commits to forest management responsibilities, which may change from time to time. (11)
Forest management plan	A generic term referring to both Forest Management Unit plans prepared by the government, and Detailed Forest Management Plans prepared by industry. (13)
Forest Management Unit	An administrative unit of forest land designated by the Minister, as authorized under Section 14(1) of the Forests Act. (1)
Forested land	Land is considered to be forested if it supports tree growth, including seedlings and saplings. (15)
Forests Act	Revised Statutes of Alberta 1980, Chapter F-16 as amended from time to time. It establishes the authority and means by which the Minister of Environment administers and manages timber on public land for sustained yield. It describes how timber allocations can be made on crown land and empowers the Minister to enforce the Act and associated regulations. (1)
Free-to-grow	Stands that meeting stocking, height, and/or height growth rate as indicated by specifications or reforestation standards, and judged to be essentially free from competing vegetation. (5)
GDP	General Development Plan
General development plan	Five-year operating plans. They provide a comprehensive description of the proposed harvest strategy (amount by operating area and road development) and the associated renewal activities for all areas impacted by the plan. (2)

GIS	Geographic Information Systems (see spatial database)
Goals	Broad statements of intent or direction relative to an aim, end or state of being to be achieved at some point in the future or maintained over a period of time. (4)
Grazing disposition	An authorization issued under authority of the Public Lands Act for the purpose of domestic livestock grazing on Crown land.
Green-up period	The time needed to re-establish vegetation after disturbance. Specific green-up periods may be established to satisfy visual objectives, hydrological requirements, or as a means of ensuring re-establishment of vegetation (for silviculture, wildlife habitat, or hydrological reasons) before adjacent stands can be harvested. (10)
Ground rules	Ground rules provide direction to industry and government for planning, implementing and monitoring forestry operations on Crown land in Alberta. They are negotiated indicators of best forestry practices for a given FMU or FMA. They highlight important management principles, define operating and planning objectives, and present standards and guidelines for timber harvesting with other forest users. They are authorized by the Forests Act and the Timber Management Regulations. (2)
Growing stock	The sum (by number, basal area, or volume) of trees in the forest or a specified part of it. (5)
Growth and yield	In timber management, the "yield" is the volume of wood available for harvest at the end of a rotation, usually measured as unit volume per unit area (eg,. Cubic meters per hectare). The "growth" is the rate and yield of biomass produced by plants regardless of function or use. (10)
Guidelines	A set of recommended or suggested methods or actions that should be followed in most circumstances to assist administrative and planning decisions, and their implementation in the field. Note that guidelines cannot, by definition, be mandatory. (10)
Harvest design	A forest harvesting plan for a given area which may include in addition to the initially sequenced cutblocks, reserves for fish and wildlife or protection of unique sites, a reforestation program, watershed and riparian area protection, and roading and reclamation requirements.
Hibernacula	A sheltered place where snakes spend the winter.
Hog fuel	Is a by-product of the processing facilities, which is used to generate heat and/or electricity. Hog fuel can be made up of bark, saw dust, and trim blocks.
Improved stock	The result of long-term tree breeding programs geared towards selecting for heritable characteristics that are desired.
Integrated Resource Management	A holistic resource management philosophy and approach where the underlying intent is to share and coordinate among a broad range of values and interests when conceiving, designing and implementing land and resource policies, programs or projects. The concept of IRM is based on the idea that adoption of an inclusive view, examination of interconnections among values, and the identification of common goals and key elements upon which to focus management attention, can derive maximum benefits from scarce resources. (9)
IRM	Integrated Resource Management
IRP	Integrated Resource Plan (see sub-regional integrated resource plans)
Landscape	A mosaic where a mix of local ecosystems or land uses is repeated in similar form over a kilometers-wide area. (Forman 1996)

LFS	Land and Forest Service – a part of the Department of Alberta Environment.
Long run sustained yield average	The hypothetical timber harvest that can be maintained indefinitely from a management area once all stands have been converted to a managed state under a specific set of management activities. (10)
LRSYA	Long Run Sustained Yield Average
MAI	Mean Annual Increment
Mean annual increment	The total increment to a given age in years, divided by that age. (10)
Merchantable	A standard applicable to stands of timber or to individual trees indicating net usable volume. (2)
Mixedwood stands	A tree community in which no species group (conifer or deciduous) exceeds 80% of the crown closure.
Mode	An idealized representation of reality developed to describe, analyse or understand the behavior of some aspect of it. A mathematical representation of relationships under study. The quest to find a subset of variables and a function between them that predicts one or more dependent variables. (10)
Natural regeneration	The renewal of a forest stand by natural rather than human means, such as seeding-in from adjacent stands, with the seed being deposited by wind, birds, or animals. Regeneration may also originate from sprouting, suckering, or layering. (10)
Non-forested land	Land is considered to be non-forested if it does not supports tree growth, including seedlings and saplings.
Non-productive land	Forest land currently incapable of producing a merchantable stand within a reasonable length of time. (5)
NRS	Natural Resource Service – often referred to as Fish and Wildlife. Part of the Department of Alberta Environment.
Nutrient cycling	Circulation or exchange of elements, such as nitrogen and carbon dioxide, between non-living and living portions of the environment. (10)
Objective	A clear, specific statement of expected quantifiable results, related to one or more strategies, to be achieved within a defined period of time. An objective is commonly used to set a desired level of an indicator, to achieve a goal. (11)
Operability	Classification of a forest site based on the potential to harvest the timber on this site. The physiographic characteristics and moisture conditions of the site are critical to this classification, as is the harvesting equipment available and the technology associated with the harvesting operation. (13)
Order in Council	An order made by the Lieutenant Governor or Governor General by and with the advise of the Executive or Privy Council, sometimes under statutory authority or sometimes by virtue of royal prerogative. (12)
Patch	A relatively heterogeneous non-linear area that differs from its surroundings (Forman 1996)
Permanent roads	Roads that will be in use for more than two years.

Permanent Sample Plot	A fixed or variable area plot established for (forest) sampling and measuring purposes and designed for re-measurement. (3)
Potentially productive	A site that is capable of growing trees but is currently void of commercial tree species.
Productive land	Land primarily intended for growing, or currently supporting, forest. Includes land not now forested. Forest land capable of producing a merchantable stand within a reasonable length of time. (5)
PSP	Permanent Sample Plot
Quota	A form of timber disposition defined by the Forests Act that allows for the allocation of a portion of the sustainable harvest level determined for a given forest management unit
Range of natural variation	Broadly refers to ecosystem dynamics over a time frame relevant to understanding the behavior of contemporary ecosystems.
Range of variability	Characterizes fluctuations in ecosystem conditions or process over time. It can describe variations in diverse characteristics such as tree density, vertebrate population size, water temperature, frequency of disturbance, rate of change, etc.
Reforestation	The natural or artificial restocking of an area with forest trees. Activities involved in forest renewal (site preparation, tree planting, etc.).
Reforestation deletion	Stands which are deleted from the timber harvesting landbase due to their relatively low productivity combined with the difficulty of reforesting the sites.
Reforestation lag period	The time between completion of timber harvest operations and the establishment of a regenerated stand, based on current procedures for evaluating successful stand establishment. (10)
Regeneration	The renewal of a forest or stand of trees by natural or artificial means. (10)
Retention period	The length of time between harvesting passes.
Right-of-way	A strip of land over which a power line, railway line, road, or other linear disturbance extends.
Riparian area	Those terrestrial areas where the vegetation complex and microclimate conditions are products of the combined presence and influence of perennial and/or intermittent water, associated high water tables, and soils that exhibit some wetness characteristics. (10)
Rotation	The period of years required to establish and grow even aged timber crops to a specified condition of maturity. (5)
Selection harvest	An uneven aged silvicultural system in which selected trees are harvested individually or in small groups at periodic intervals throughout a rotation; the objective is to improve the timber condition, composition, structure and value.
Selective cutting	A harvest practice in which only trees of a certain species with a specified diameter and/or value are harvested.

Sensitivity analysis	An analytical procedure in which the value of one or more parameters is varied and the changes that this produces are analysed in a series of iterative evaluations. If a small change in a parameter results in a proportionately larger change in the results, the results are said to be sensitive to the parameter. (10)
Seral stages	Also called successional stages. In a forestry context, the series of plant community conditions that develop during ecological succession from major disturbance to the climax stage. (10)
SFM	Sustainable Forest Management
Silviculture	The theory and practice of controlling the establishment, composition, structure and growth of forests in order to achieve specified management objectives. (2)
Site index	A measure of forest site productivity expressed as the average height of the tallest trees in the stand at a defined index age, typically less than the planned rotation ages. For this DFMP, a site index age of 50 years was used.
Site preparation	Any action taken in conjunction with a reforestation effort (natural or artificial) to create an environment favorable for survival of suitable trees during the first growing season. This environment can be created by altering ground cover, soil, or microsite conditions, using biological, mechanical, or manual clearing, prescribed burns, herbicides, or a combination of methods. (10)
Site productivity	The mean annual increment in merchantable volume which can be expected for a forest area, assuming it is fully stocked by one or more species best adapted to the site, at or near rotation age. (5)
Spatial database	A Geographic Information System is the use of a computer system to overlay large volumes of spatial data of different types. The data are referenced to a set of geographical coordinates and encoded in digital format so that they can be sorted, selectively retrieved, statistically and spatially analysed. The different data planes can be overlaid in virtually any order, and can be used to test a variety of questions and "what if" scenarios in modeling possible outcomes from different management regimes, or disturbances in the landscape at an infinite number of scales. (10)
Special Places	A Government of Alberta initiative committed to the establishment of a network of Special Places that represent the environmental diversity of the province's six natural regions (20 subregions). The program encompasses a balanced approach to preservation, outdoor recreation, heritage appreciation, tourism and economic development. (7)
Stand	A community of trees, possessing sufficient uniformity in composition, age, arrangement or condition to be distinguishable from the forest or other growth on adjoining area, thus forming a silviculture or management entity. (5)
Stand tending	Activities such as thinning, spacing, removal of diseased trees, and weed or brush control, carried out in already established stands. (10)
Stewardship Report	A report that accounts for all activities, undertaken as a steward of a given article, resource, area or process, related to strategies to achieve stated stewardship goals. Measures of performance are included and linked to plans that express the desired goals.

Stocking	A measure of the proportion of an area occupied by trees/seedlings, expressed in terms of percentage of occupied fixed area sample plots.
Sub-regional Integrated Resource Plans	A system of Cabinet approved plans incorporating a cooperative and comprehensive approach to decision making relative to the allocation and use of Crown land and resources. (6)
Succession	The replacement of one plant community by another in a progressive development towards climax vegetation. (4)
Sustainable development	A conceptual ideal where development (in whatever form that might be) meets the needs of the present generations without compromising the ability of future generations to meet their own needs. (10)
Sustainable forest management	Management to maintain and enhance the long term health of forest ecosystems, while providing ecological, economic, social and cultural opportunities for the benefit of present and future generations. (11)
Sustained yield	The quantity of a resource that can be produced continuously under a given management regime (i.e. the rate of harvest equals the rate of production). In timber management, a theoretical calculation of the yields of wood fibre possible on a continuing basis from a forest under a specified management regime. The calculations are based on data about the age-class composition; species; site productivity; the extent of the land base available now and in the future; the past, present, and predicted management and growth rates; and the likely extent of losses due to fire, pests, and disease. (10)
Temporary road	Temporary roads are those that are part of a cutblock, or connect cutblocks and are built, used and reclaimed before expiry of the AOP, or reclaimed within two years of construction.
Timber harvesting landbase	The timber harvesting landbase is the portion of the total land area of the FMA that can be considered to contribute to and be available for long-term timber supply. It is the landbase remaining after deductions for areas that cannot, should not, or will not be managed for timber production.
Timber management	The activity involving the allocation of forested lands for harvesting of the timber on that land. Timber management may involve planning, road building, logging extraction of merchantable timber for processing off-site, and varying intensities of silvicultural activity to encourage another stand of trees to grow back. Timber management is an important subset of forest management, but it is not an equivalent activity. (10)
Timber Management Regulation	The legislative statute that describes the mechanism and regulations by which the forested lands of Alberta are managed. (2)
Timber operations	Includes all activities related to timber harvesting including site assessment, planning, road construction, harvesting, reclamation and reforestation.
Uneven aged stands	Stands in which the trees differ markedly in age, usually with a span greater than 20 years.
Unique areas	Sites that contain natural features or special values for wildlife and plant species. Also includes historical and archeological significant areas.
Utilization standard	Standards establishing stand and tree merchantability. (2)

Viewshed	The visible area, as it appears from one or more viewpoints.
Volume table	A table, graph or equation showing the estimated average tree or stand volume corresponding to selected values of more easily measured tree or stand variables. (5)
Water source areas	That portion of a watershed where soils are water saturated and/or surface flow occurs and contributes directly to streamflow.
Water yield	The quantity of water derived from a unit area of watershed. (10)
Watershed	An area of land, which may or may not be under forest cover, draining water, organic matter, dissolved nutrients, and sediments into a lake or stream. The topographic boundary, usually a height of land, that marks the dividing line from which surface streams flow in two different directions. (10)
Yield curve	Graphical representation of a yield table. (5)
Yield table	A summary table showing, for stands (usually even aged) of one or more species on different sites, characteristics at different ages of the stand. (5)

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