

F. CURRENT FOREST MANAGEMENT CONSIDERATIONS

1. Certification

Certification of sustainable forestry practices is becoming key to maintaining market share and meeting public demands. To that end, Canfor has sought and achieved certification under a variety of respected standards.

“We are implementing a very deliberate and comprehensive certification strategy at Canfor that reflects our long-standing commitment to excellence in forest stewardship. Building on our ISO 14001 certification last year, we are continuing to provide the independent proof of our environmental performance to our customers and to our stakeholders.”

D. Emerson, President & CEO

QUICK FACTS

Canfor's Certification Chronology:

- 1997 – ForestCare Certified;
- 1999 - Environmental Management System Certified to international ISO 14001; and
- 2000 – Sustainable Forest Management Plan certified to national CSA standard.

1.1 ForestCare

There has long been a need to demonstrate to the public that the publicly owned forestlands are being sustainably managed. Alberta recognized this in the early 1990s with the inception of ForestCare, a set of standards for continual improvement and environmental stewardship created by member companies of the Alberta Forest Products Association and community stakeholders from across Alberta. ForestCare is about:

- Care for the Community - developing a relationship between industry and community stakeholders;
- Care for the Forest - managing the forest sustainably and with all values (social, environmental and economic), in mind; and
- Care for the Environment - managing fuel and waste products carefully.



ForestCare Codes of Practice were published in 1993 and a set of audit protocols for measuring performance was published in 1994. Both of these documents underwent internal membership review as well as an extensive external stakeholder review prior to being published. Canfor operations in Alberta committed to the ForestCare standards and in 1997 underwent a successful ForestCare audit, which demonstrated that the Company was meeting, and in some cases exceeding, the standard. Trained ForestCare auditors, either peer auditors from within the industry or independent consultants, conducted the audits.

In the fall of 1998, Canfor began the process of developing and implementing an Environmental Management System (EMS) to the ISO 14001 international standard, a systems-based standard that is recognized and respected around the world. Many of



the ISO standards are similar to the ForestCare program; however, where ForestCare is applicable only to Alberta, ISO is international in scope. This allowed Canfor to certify its Alberta and B.C. operations.

The ISO 14001 standard requires independent third party verification by certified auditors. The ISO standard provides an organization with the elements of an effective EMS in order to support environmental protection and prevention of pollution in balance with socio-economic needs.

Some of the basic elements of Canfor's EMS are a series of procedures to guide planning and operational activities, as well as databases or methods to track performance and record environmental incidents. Canfor has developed a web-based application to manage all procedures and documents related to its EMS. All environmental incidents are tracked and investigated for their root cause. Preventative and corrective action plans are developed to ensure that the incident does not recur. The tracking and monitoring of environmental information are stored in separate databases that are not linked to the website. For more information on EMS refer to Section E 4.2.

1.2 Environmental Management System & ISO 14001

In the fall of 1999, Canfor's EMS was developed to the ISO 14001 standard and fully implemented in all of Canfor's operations in B.C. and Alberta. An independent third party team of KPMG (management consultants) certified auditors conducted a registration audit that verified the Company's compliance.



Since the initial registration audit, Canfor has undergone 2 periodic assessments. Both showed that Canfor has continually improved.

The EMS, combined with well-trained, highly motivated employees and advanced, proven technologies and techniques, allows Canfor to achieve high levels of performance through continual improvement.

QUICK FACTS

Elements of an EMS:

- **Say What You Do;**
(develop procedures)
- **Do What you Say; and**
(performance in the field)
- **Prove it.**
(independent third party audit)

BENEFITS OF EMS

From a Workers' perspective:

- It has clearly defined what they are responsible for and what they need to do if damage to the environment should occur;
- It has provided them with standardized instructions on job expectations; and
- It has ensured that they receive the required training.

From a Corporate perspective:

- It has set consistent standards and approaches to forestry across the Company;
- It has given the Company's customers some comfort that it has processes in place to manage its environmental performance that will lead to continual improvement. It also assures the Company's customers that the processes meet a credible international standard and have been verified by an independent third party; and
- It has provided a framework and foundation for other certification schemes (such as CSA, etc.).

From an Operational perspective:

- It has provided clear expectations and standard procedures;
- It has clearly defined roles and responsibilities; and
- It has made it easier to stay in compliance with the complex legal framework in which we work.

1.3 Canadian Standards Association (CSA)

Canfor has committed to the Canadian Standards Association (CSA) Z809-96 Sustainable Forest Management (SFM) System standards.

An essential element for the success of sustainable forest management is the inclusion of systematic and formal public input into the management of the forested landbase. Public participation processes are characterised by accommodating *“the public’s varied knowledge of sustainable forest management, its different interests, levels of involvement, and differing cultural and economic ties with the forest.”* (CSA 1996b: p. 15).

The purpose of the CSA standard is to describe the components and performance objectives of a sustainable forest management system. In 1996, 6 criteria were developed by the Canadian Council of Forest Ministers (CCFM) (refer to sidebar). The CSA process developed a set of critical elements for each criteria, numbering 22 in total. Through a process of public participation, the CSA performance framework attains a local relevance to the critical elements in the form of locally determined values, goals, indicators and objectives. Refer to Section G for additional information regarding the CCFM Criteria and Indicators.

The public participation required under CSA was facilitated using Canfor’s Forest Management Advisory Committee (FMAC) (refer to Section E 6.2 for more details). The Committee worked with Canfor to identify social, economic and ecological values in relation to forest management. Once the values were identified, indicators and objectives were developed to measure progress (Appendix 7).

CSA CRITERIA

1. Conservation of Biological Diversity
2. Maintenance and Enhancement of Forest Ecosystem Condition and Productivity
3. Conservation of Soil and Water Resources
4. Forest Ecosystem Contributions to Global Ecological Cycles
5. Multiple Benefits to Society
6. Accepting Society’s Responsibility for Sustainable Development



In June 2000, after an extensive review by an independent third party audit firm, KPMG, Canfor’s Grande Prairie Sustainable Forest Management Plan (SFMP) was certified to CSA Z809-96 standards. Canfor’s 2 area-based tenures in B.C. also received certification at that time.

2. Relationship of Detailed Forest Management Plan, Annual Operating Plan and 5 Year General Development Plan

The Detailed Forest Management Plan (DFMP) defines activities in a specific geographic area and time period and provides detailed justification and environmental planning to support the allowable annual cut (AAC) for both coniferous and deciduous species from the area defined in the Forest Management Agreement 9900037. As per subparagraph 10(3), the DFMP must be submitted to the Minister not more than 2 years following the commencement date of the FMA agreement.

Three forest companies; Tolko Industries Ltd., Ainsworth Lumber Company Ltd. and Grande Alberta Paper Ltd., have been allocated deciduous timber within the FMA area.



All 3 companies played an integral part in development of the DFMP by providing technical input regarding strategic and operational plans, resource and timber supply analysis, growth and yield projections, and harvest sequencing.

Both coniferous and deciduous operators within the FMA area will conduct their activities in accordance with this Plan.

2.1 Annual Operating Plan (AOP) and 5 Year General Development Plan (GDP)

It is important that the strategies developed within the Detailed Forest Management Plan (DFMP) are implemented in operational plans. The Annual Operating Plan (AOP) and 5 Year General Development Plan (GDP) are the primary plans in this regard. They are submitted to Alberta Sustainable Resource Development (ASRD) annually as per Section 18(2) of the FMA agreement. Actual harvesting operations are conducted in accordance with established *Timber Harvest Planning and Operating Ground Rules* (Refer to Section F 2.5).

Canfor is in the process of developing integrated operational plans in those areas where coniferous and deciduous operations overlap, as per subparagraph 10(1)(b) of the FMA agreement.

An objective has been established to produce fully integrated operational plans (AOP and GDP) for the 2003 submission, involving all forestry operations within the FMA area, by working co-operatively with active deciduous companies (refer to Section G Objective 7 for information regarding integration of annual operating plans).

Tolko Industries Ltd. and Canfor collaborate during the production of operational plans so that each company is aware of the plans of the other. Efforts are made to ensure that operations are conducted in conjunction with one another.

Canfor has entered into an agreement with Ainsworth Lumber Company Ltd. to negotiate a management agreement whereby the Company will supply deciduous timber to Ainsworth's Grande Prairie mill. Pending a successful resolution of this negotiation, operational plans to include Ainsworth's deciduous requirements will be fully integrated.

When Grande Alberta Paper Ltd. (GAP) requires deciduous timber, Canfor will also coordinate activities with them.

2.2 Operational Implementation of the Detailed Forest Management Plan (DFMP)

In order to sustain the annual allowable cut (AAC), operational practices will closely follow the forest management strategies that are stated in the DFMP. As the AOP and GDP are being developed, the DFMP strategies, directives and objectives are referenced in the operational plans. If operational plans are being implemented as presented in this Plan, then the objectives in the DFMP will be achieved. However, since it is difficult to capture all of the nuances of the natural world, it is likely there will be changes to these operational plans. These changes will be reviewed in light of the defined objectives to ensure that operational practices meet commitments. DFMP objectives are checked for reasonableness through annual reviews. There is always the possibility that the objectives in the DFMP may be altered as a result of changing conditions. Using the principle of adaptive management, as new or changing



information comes becomes available, the objectives in the DFMP will be reviewed and, where warranted, revised.

2.3 Implementation of the Detailed Forest Management Plan Harvest Sequence

Stands to be harvested are sequenced in the DFMP. This harvest sequence defines the geographic area in which initial planning will be conducted. The proposed area will be field checked and a preliminary harvest plan will be developed and validated in relation to DFMP objectives. After validation, the harvest and silviculture strategies will be applied to operational activities.

2.4 Harvesting the Profile Established by the Detailed Forest Management Plan (DFMP)

The *Resource and Timber Supply Analysis* determines the types of stands and operational subunits to be harvested (Appendix 3). These stands must meet the minimum harvesting standards. The checks and balances within the monitoring system ensure the same relative balance of stands is harvested over an averaging period. The averaging period generally corresponds with the periodic cut control periods (refer to Appendix 3 Table 36). As annual operating plans are prepared, the projected profile will be compared with the DFMP profile to ensure that over the averaging period, the DFMP profile is harvested.

2.4.1 DFMP / AOP Validation Process

It is important that tactical and operational plans are evaluated and monitored to ensure they comply with the objectives established for the DFMP. A validation process is under development to facilitate this evaluation. Refer to Section J 1.3.1 for additional information regarding DFMP / AOP validation.

2.5 Timber Harvest Planning and Operating Ground Rules

Timber Harvest Planning and Operating Ground Rules (“the ground rules”) outline the objectives and standards that companies operating in the FMA area are expected to meet during planning and operations. Canfor currently operates under the *Timber Harvest Planning and Operating Ground Rules* (Canfor 1988). As per Section 16(2) of Forest Management Agreement 9900037, the current ground rules are scheduled for revision within 6 months following the approval of the DFMP.

It is intended that operating ground rules will be applied with sound judgment based on practical experience and technical competence. It is recognized there will be exceptions or unusual conditions to which these standards cannot be strictly applied. Reasonable adjustments best suited to the requirements of each specific situation are expected to be used, in keeping with sound forest management practices. Alberta Sustainable Resource Development, Land and Forest Division (LFD) has the authority to waive or amend the application of these ground rules in any single specific instance, provided it is done so in writing, except when another Forest Service authority has the jurisdiction. Any amendment must be consistent with the *Forest Management Agreement*, the *Forests Act* and regulations thereto, and all other provincial statutes. It is expected that these standards will be adhered to unless otherwise stipulated in the approved operating plans, or as amended at the discretion of the LFD (Canfor 1988).



3 Enhanced Forest Management

Canfor is committed to following the Enhanced Forest Management Technical Protocols. The following is a direct excerpt from the Enhanced Forest Management Technical Protocols.

“The *Alberta Forest Legacy* (Alberta Environmental Protection 1997a) provides an overall framework for the implementation of sustainable forest management in Alberta. It is built upon recommendations provided to government since 1990, including Alberta’s Round Table on the Economy and Environment, Forest Management in Alberta – Report of the Expert Review Panel, and the Alberta Forest Conservation Strategy (Alberta Environmental Protection 1997b). The *Legacy* affirms the principles of sustainable development, adaptive management, balanced land use, ecological management, collaborative forest planning, and fairness. The policy recognizes that, for forests to contribute to a healthy environment, a healthy economy, and a high quality of life, some areas should be managed to support increasing levels of production and employment through the application of enhanced forestry practices.

Enhanced forest management increases the productivity of a site for a particular output, beyond that of sites managed to meet basic and current forest management standards. The *Legacy* stipulates that enhanced forest management will:

- Be proposed and implemented as part of a comprehensive forest management process involving participatory planning, and ongoing research, monitoring and assessment;
- Be conducted on suitable sites, selected based on sound science respecting ecological limitations and recognizing the need for a positive economic return; and
- Need secure long-term tenure that adequately protects the public trust, while recognizing the economic risk of the proponent.

In 1995, a joint government and industry task force, consisting of representatives from the Land and Forest Service and the Alberta Forest Products Association, was struck to identify policy requirements for implementing enhanced forest management while ensuring that the forest landscape includes a representative proportion of protected areas. The 1997 final report of the Enhanced Forest Management Task Force: *Policy Requirements for Implementation* made recommendations for:

- A systematic process of landscape-level planning;
- Establishing objective-orientated reforestation standards and programs for monitoring stand growth and yield;
- Quantifying potential gains from enhanced forest management;
- Updating of guidelines for determining annual allowable cut;
- Development of an implementation, monitoring and feedback process;
- Encouragement of innovative silvicultural practices that enhance forest productivity on selected areas; and
- Review and adjustment of tenure and stumpage systems.

During the following two years more detailed policy assessments were undertaken by a number of working groups to implement these recommendations. On April 13 and 14, 1999, an expert panel, drawn primarily from the task force and working groups, was convened to consolidate recommendations regarding policies and procedures required to enable enhanced forest management. The technical protocols were developed by



representatives of Land and Forest Division and the forest industry during two facilitated workshops in the fall of 1999 (November 4 and December 8).

The key components of the enhanced forest management framework in relation to the growth and yield of managed stands are: forecasting, validation, performance standards, and compliance.

Forecasting is the process of projecting what yield and quality of timber will result from applying an enhanced forest management treatment to a stand. These forecasts are typically represented by models, yield tables or yield curves for specified strata (areas of stands within a forest management area, having similar site productivity, vegetative associations, and ecological characteristics). The responsibility for developing these projections will reside with the company proposing the treatment. However, development of growth and yield models must be based on scientific evidence supporting the projected treatment response. The Crown will insist on protocols being followed for developing and assessing projections, including consistency with relevant scientific evidence, quality and applicability of data used to fit the projections, demonstrated operational feasibility, acceptable levels of risk and uncertainty, and validation.

Validation is the process of monitoring actual results against forecasts, leading to corrective feedback to the forecasts and the management plan. Validation procedures will be designed to assess the accuracy of growth forecasts for enhanced forest management treatments, within a 10-year measurement period from the time of treatment. At least until growth and yield models are fully verified, validation will require installation of treatment and control plots statistically designed to measure actual treatment responses. The rigor of validation required may be varied depending on the risk and uncertainty associated with the forecast.

Performance *standards* measure whether stand conditions meet those required to place stands on a proposed yield projection. The traditional minimum provincial regeneration standard simply demonstrates whether a crop has been re-established, and is applied at the individual stand or cut-block level. Enhanced forest management standards are the conditions that a proponent commits to meet, as a basis for approval of the yield forecasts associated with a particular treatment prescription. They should be ecologically based and objective-driven, and targets will be set for each stratum and treatment prescription specified in the management plan.

Compliance with activities and treatment prescriptions committed to in the detailed management plan will need to be demonstrated in annual operating plans, and will subsequently be assessed on all harvested or treated stands. Activity and monitoring will assess whether treatments have been applied as prescribed, and whether the treatment resulted in achievement of the required standards. Effective and spatially referenced tracking systems will be required to ensure that activities scheduled in the detailed forest management plan are actually implemented. The Crown will require that tenure holders report annually on enhanced forest management activities.”

4. Environmental Protection

Woodlands operations are conducted in accordance with all environmental protection statutes, regulations and guidelines. *Canfor's Forestry Principles* and *Environment Policy* (see sidebar) guide the Company's business and confirm its commitment to responsible stewardship of the environment by indicating some of the Company's key commitments.

4.1 Watershed Protection


Watershed protection objectives can be met by minimizing the impact that harvest operations have on water quality and quantity.

4.1.1 Minimize Impact of Water Yield

Water yield refers to streamflow quantity and timing. Streamflow is a key determinant of the energy available for erosion, transport, and deposition of sediment within channels. Streamflow is also a key component in determining the morphology of channels, with implications for the quality and quantity of fish habitat. Finally, water yield is an important component in determining the availability and suitability of water for beneficial uses.

Water yield can be altered by compaction or disturbance of the ground surface, as with roads and skid trails or by vegetation growth or removal. It generally increases after timber harvest through a reduction in transpiration and precipitation interception losses. Removal of forest canopy also affects snow accumulation and melt processes, often resulting in an increase in snowpack accumulation and melt rates, thereby increasing runoff rate and volume (Various 1997). As the forest regenerates, the forest canopy develops, re-establishing the interception and transpiration processes (hydrological recovery).

Hydrological recovery refers to the return of the hydrology of an area to pre-disturbance conditions by the regenerating stand growth. As the area regenerates and growth develops, the hydrological impact is reduced. Hydrological recovery of stands is dependent on crown closure, which in turn can be calculated as a function of height. For fully stocked stands at a height of 5 m and above, 100% hydrological recovery is assigned. For stands between 0 m and 5 m in height, the value of hydrological recovery



Environment Policy

We are committed to responsible stewardship of the environment throughout our operations.

- Comply with or surpass legal requirements.
- Comply with other environmental requirements to which the company is committed.
- Set and review environmental objectives and targets to prevent pollution and to achieve continual improvement in our environmental performance.
- Create opportunities for interested parties to have input to our forest planning activities.
- Practice forest management that recognizes ecological processes and diversity and supports integrated use of the forest.
- Promote environmental awareness throughout our operations.
- Conduct regular audits of our environmental management system.
- Communicate our environmental performance to our Board of Directors, shareholders, employees, customers and other interested parties.

D.L. Emerson
President and Chief Executive Officer
July 21, 1999

P.J.G. Bentley
Chairman





ranges from 0-100%. Figure 43 shows the hydrological recovery as it relates to stand height.

Water yield increases can be directly modelled, but equivalent clearcut area (ECA) is often used as a surrogate. ECA is defined as an area that has been harvested, cleared or burned. ECA is a primary factor considered in an evaluation of the potential effect of past and proposed forest harvesting on water yield. Expressed as a percentage, ECA describes an area of regenerated growth in terms of its hydrological equivalence to a clearcut.

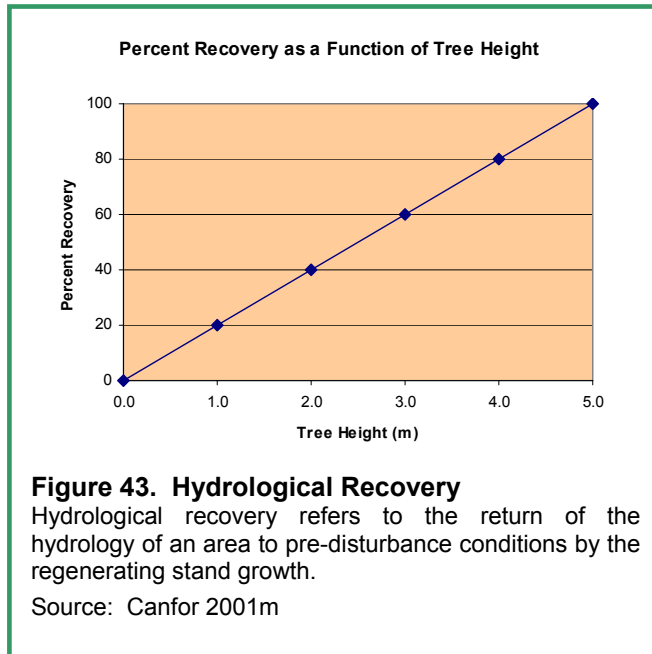


Figure 43. Hydrological Recovery

Hydrological recovery refers to the return of the hydrology of an area to pre-disturbance conditions by the regenerating stand growth.

Source: Canfor 2001m

H60 is the elevation line above which 60% of the watershed lies. This area above the H60 line is considered to be the source area for the major snowmelt peak flows (B.C. Ministry of Forests 1999).

The goal is to minimize the effect of the removal of forest cover on the water cycle (Section G "Critical Element 3c, Goal 2.1"). To achieve this goal, Canfor has established the following objective:

- To not exceed a range of 20-40% of forest cover removal, above the H60 line, in relationship to the total vegetated area within a defined watershed as per the DFMP (Section G "Critical Element 3c, Objective 2.1a.1").

To meet the water yield objectives, Canfor defined the watersheds in the FMA area (ORM 2001d), calculated the ECA values for watersheds (Canfor 2001m) and will be monitoring the results operationally. The methodology for the calculations is described in *Hydrological Recovery Based on Equivalent Clearcut Area* (Canfor 2001m). Any watershed that exceeds 35% ECA in the Bull trout area or 40% ECA outside the Bull trout area was noted and will be evaluated operationally to determine if adjustments to harvested areas are required to meet ECA objectives. This procedure will commence with the 2001 Annual Operating Plan (AOP).

4.1.1.1 Calculation of ECA

In order to ensure compliance with DFMP commitments, and to anticipate potential ECA problems in early in the planning cycle, COMPLAN output files were used to compile benchmark ECAs for 1999, 2009, and 2019. The ECA for a watershed is the area-weighted average ECA for all of the stands that fall within the watershed.

ECA cover constraint rules were established both for tracking ECA and, in the portion of each basin over the H60 elevation, constraining harvest. Within COMPLAN, model ECAs were calculated and used as a proxy for the more precise ECAs in years 1999,

2009 and 2019. Because COMPLAN uses only the forested portion of the landbase as input, a simplified proxy for ECA is used. This proxy is used to adjust for:

- vegetated non-forest areas;
- non-vegetated areas; and
- roads.

Above the H60 line, these proxy ECA targets were used to limit harvesting within COMPLAN. Cover Constraints were also defined for each watershed in its entirety, but they were used for tracking and reporting purposes only; harvesting was not prevented even if these proxy limits were exceeded.

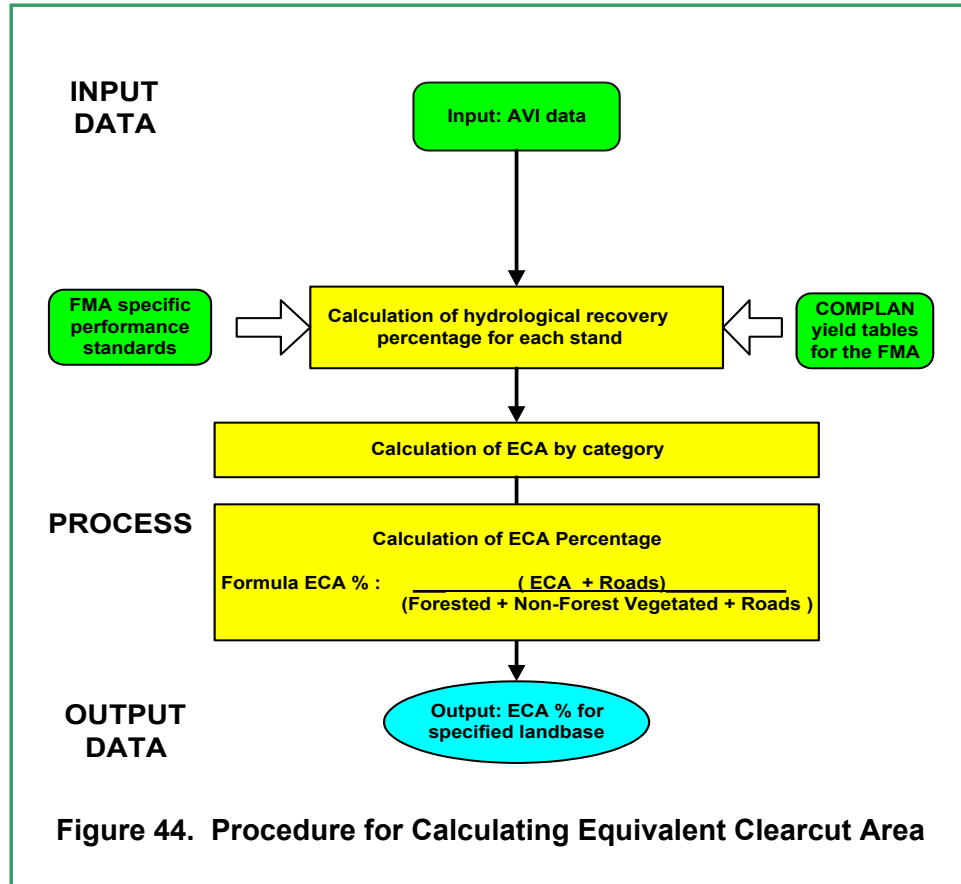
At the beginning of each planning period, COMPLAN writes the complete forest inventory for that year to a database table. Through the simulation process, this version of the forest inventory has been updated for growth and depletion. No calculation of breast height age and stand height was necessary in this case.

For each benchmark year for which ECAs are to be calculated, the following steps must be taken for the H60 portion of each watershed:

- a) In the Inventory table, assign all stands less than five metres in height and ECA area based on the function depicted in Figure 43.
- b) In the Inventory table, assign all stands that have a height greater than or equal to five metres an ECA of zero hectares.
- c) For all watersheds, calculate the ECA Area as the sum of the ECA areas for all of the stands in the watershed
- d) From the GIS database, obtain the 'Non-Forest Vegetated' area and 'Road Area' by for the H60 portion of the watershed.
- e) Calculate the ECA % using the formula below. Divide the overall ECA area through the combined area of Forested, Non-Forest Vegetated and Roads area.

$$\text{ECA \%} = \frac{(\text{ECA Area} + \text{Road Area})}{(\text{Forested} + \text{Non-Forest Vegetated} + \text{Road Area})}$$

Figure 44 provides an overview of the process for calculating ECA for the FMA area.



4.1.1.2 Watercourse Classification

Watercourses are classified in accordance with *Timber Harvest Planning and Operational Ground Rules* (Table 13). Forest companies adhere to operating ground rules for watercourses including buffers, road construction, tree felling and equipment operation within or near watercourse areas (Table 14).

4.1.1.3 Watercourse Protective Buffers

Watercourse protective buffers (buffers) are leave strips of vegetation used to protect a resource feature or value (Figure 45). Currently, approximately 6.2% of the FMA area (40,000 ha) is assigned to buffers.

The objective is to manage forest cover along watercourses in order to minimize any adverse effects of timber harvesting on water quality and riparian habitat for fish and other wildlife (Section G "Critical Element 3c, Objective 1.1c.1"). Buffers



Figure 45. Buffers

Buffers are used to protect a resource or value, such as the river shown in the above photograph.

are currently managed according to Canfor's *Timber Harvesting and Operating Ground Rules* (Canfor 1988) as follows:

- Large permanent watercourses - no disturbance or removal of merchantable timber within 60 m of the high water mark, unless approved by forest officer in writing;
- Small permanent watercourses - no disturbance or removal of merchantable timber within 30 m of the high water mark, unless approved by forest officer in writing;
- Intermittent watercourses - no buffer required unless requested by a forest officer in writing;
- Lakes (with recreational value) greater than 4 ha - no disturbance or removal of merchantable timber within 100 m of the high water mark, unless approved by forest officer in writing; and
- Lakes (with little or no recreational value) greater than 16 ha - no disturbance or removal of merchantable timber within 100 m of the high water mark, unless approved by forest officer in writing.

Canfor is committed to conducting an assessment of buffers to assess their relationship to natural disturbance processes in order to determine their efficient application.

As per subparagraph 16(2) of FMA Agreement 9900037, the Minister and the Company shall jointly develop a new set of ground rules consistent with the management plan objectives, for the preparation of operating plans and to guide harvesting and reforestation operations. These ground rules may include management of watercourse buffers.

Table 13. Watercourse Classification TableDFMP_Tables.xls
Table 79

Watercourse Classification	Physical Description	Portion of Year Water Flows	Channel Development	Fish and Wildlife Concerns	Land Use Impact
Large Permanent	- Major streams or rivers - Well-defined flood plains - Valley usually exceeds 400 m in width	- All year	- Unvegetated Channel width greater than 5 m	- Resident fish populations - Important over-wintering habitat - Important feeding and rearing habitat	- Water quality often reflects all upstream land use impacts and natural processes - Primarily sedimentation of stream channels
Small Permanent	- Permanent streams - Often small valleys - Bench (floodplain) development	- All year but may freeze completely in the winter	- Banks and channel well- - Channel width 0.5 m to 5 m	- Significant insect populations - Important spawning and rearing habitat - Resident fish populations - Overwintering for non-migratory species	- Primarily sedimentation of stream channels - Water quality - Fish populations sensitive to siltation - Loss of streambank fish habitat
Intermittent	- Small stream channels - Small springs are main source outside periods of spring runoff and heavy rainfall.	- During wet season or storms - Dries up during drought	- Distinct channel development - Usually channel is unvegetated - Channel width to 0.5 m - Some bank development	- Food production areas - Potential spawning for spring-spawning species - Drift invertebrate populations in pools and riffles	- Sedimentation from bank and streambed damage will damage fish habitat downstream
Ephemeral	- Often a vegetated draw	- Flows only during or immediately after rainfall and snowmelt	- Little or no channel - Channel is usually vegetated	- Siltation may impact fish habitat	- Sedimentation downstream due to ground disturbance
Water-Source Areas (except muskegs)	- Areas with saturated soils or surface flow - Seepages	- All year. - May or may not freeze in the winter	- N/A	- Potential high value to fall spawners - Potential high-use areas for terrestrial wildlife	- Disturbance may cause stream sedimentation - Interruption of winter flow may disrupt fish egg incubation
Lakes	- Large water collection areas permanently filled with water	- Normally frozen in the winter	- N/A	- Important fish-bearing habitat	- Aesthetic values may be disrupted - Potential for wildlife disturbance - Local sedimentation.

Source: Timber Harvest Planning and Operating Ground Rules (Alberta Environmental Protection 1994)



Table 14. Operating Ground Rules for WatercoursesDFMP_Tables.xls
Table 80

Watercourse Classification	Roads, Landings, Bared Areas	Watercourse Protective Buffers	Operating conditions Within Buffers and Water- Source Areas Where Operations are Approved	
			Tree Felling	Equipment Operation
Large Permanent	- Not permitted within 60 m of the highwater mark or from water-source areas within that buffer. - May be permitted within 60-100 m of the high-water mark with written approval of a Forest Officer.	- No disturbance or removal of merchantable timber within 60 m of the high-water mark except where specifically approved in the Annual Operating Plan.	- Trees will normally be felled so they do not enter the watercourse. - The objective is that no slash or debris enter the watercourse. - Should slash or debris enter the watercourse, immediate removal is required without a machine entering the watercourse.	- Where removal of timber within 60 m is approved, no machinery is to operate within 20 m of the high-water mark. - Timber within 20 m shall be removed by winching or other means such that the machine stays outside of the 20 m strip. - Where possible, topographical breaks should be used as protection strip boundaries.
Small Permanent	- Not permitted within 30 m of the high-water mark or from water-source areas within that buffer. - May be permitted within 60-100 m of the high-water mark with written approval of a Forest Officer.	- No disturbance or removal of merchantable timber within 30 m of the high-water mark except where specifically approved in the Annual Operating Plan.	- Trees will normally be felled so they do not enter the watercourse. - The objective is that no slash or debris enter the watercourse. - Should slash or debris enter the watercourse, immediate removal is required without a machine entering the watercourse.	- Where removal of timber within 30 m is approved, no machinery shall operate within 20 m of the high-water mark. - Timber within 20 m shall be removed by winching or other means such that the machine stays outside of the 20 m strip. - Where possible, topographical breaks should be used as protection strip boundaries.
Intermittent	- Not permitted within 30 m of the high water mark or water-source areas within that buffer.	- Buffer of brush and lesser vegetation to be left undisturbed along the channel. - Width of buffer will vary according to soils, topography, water-source areas and fisheries values. - Treed buffer is not required unless specifically requested by a Forest Officer.	- Trees will be felled so they do not enter the watercourse unless otherwise approved. - Should slash or debris enter the watercourse, immediate removal is required without the machine entering the watercourse.	- Heavy equipment may operate within 20 m only during frozen or dry periods. - No random skidding through watercourse channels. - Crossings must be planned with adequate crossing structures. Crossings are to be removed on completion of operations. - Where fish and spawning movements have been identified, special crossings that will not obstruct upstream fish passage or cause stream siltation may be required.
Ephemeral	- Construction not permitted within a watercourse or a water-source area.	- Buffer of lesser vegetation in wet gullies to be left undisturbed.	- Large accumulations of slash or debris accumulations to be removed progressively.	- Random skidding through watercourse permitted only during frozen or dry ground periods. - Temporary crossings are to be removed on completion of operations.
Lakes (little or no recreation, waterfowl or sport fishing potential)	- Not permitted within 100 m of the high-water mark without the written approval of a Forest Officer.	- On lakes exceeding 16 ha in area, there will be no disturbance of timber within 100 m of the high-water mark except where specifically approved in the Annual Operating Plan.	- Trees within these areas shall be felled away from the waterbody. - No slash or debris shall enter the waterbody.	- If timber removal is approved, no machinery is to operate within 20 m of the high-water mark.
Lakes (with recreational, waterfowl or sport fishing potential)	- For the shorelines not located within reserved areas, no disturbances will be permitted within 200 m of the high-water mark without the written approval of the Forest Superintendent.	- On lakes exceeding 4 ha in area, there will be no disturbance or removal of timber within 100 m of the high-water mark except where specifically approved in the Annual Operating Plan.	- Trees will be felled so they do not enter the waterbody. - No slash or debris shall enter the waterbody.	- If timber removal is approved, no machinery is to operate within 20 m of the high-water mark. - Consideration must be given to aesthetics when harvesting adjacent to lakes with recreational potential. Any timber harvesting within reserved areas shall be conducted subject to specific operating conditions.
Water-source Areas and Areas Subject to Normal Seasonal Flooding	- Construction not permitted unless approved in the Annual Operating Plan. - No log decks permitted. - The number of stream crossings must be minimized. - No disturbance of organic duff layer or removal of lesser vegetation.	- Treed buffers of at least 20 m on all streams. - No harvest of merchantable trees or disturbance of lesser vegetation unless approved in the Annual Operating Plan. - Buffer width may be altered according to its potential to produce surface water, provided it is approved in the Annual Operating Plan.	- Heavy machinery not permitted in the water-source areas during unfrozen soil conditions. - Minimal disturbance or removal of duff or lesser vegetation. - Timber may be harvested if stream sedimentation is the only resource concern, provided there is no disturbance of the organic soils and lesser vegetation when harvesting the trees. - On unstable areas subject to blowdown, merchantable trees should be carefully harvested from water-source areas to minimize root disturbances of duff layers and watercourse damming.	- Road construction, timber harvest, reforestation and reclamation shall be done with equipment capable of operating without causing excessive disturbance to the organic soil layers. - Heavy equipment is not permitted during moist or wet soil conditions. May be operated during frozen periods according to specific conditions in the approved Annual Operating Plan. - No dirt caps or depositing of soil will be permitted on roads in water-source areas, unless a separation layer is incorporated or the road is designed to provide adequate surface and subsurface drainage away from the road-bed. Where a separation layer is used, the soil cap shall be removed as operations are completed.
Note: Limitations on any logging machinery within water-source areas also apply to scarification equipment.				

Source: Timber Harvest Planning and Operating Ground Rules (Alberta Environmental Protection 1994)



4.1.2 Conducting Operations to Minimize Erosion

Operations are conducted in a manner that minimizes soil disturbance and surface flow of water over exposed mineral soil to reduce the volume of sediment entering any watercourse. The following sections describe the initiatives and activities to minimize soil erosion.

4.1.2.1 Prevention of Stream Sedimentation

Siltation from road construction can cause higher than normal sediment concentrations in watercourses. This increase is usually of short duration and occurs during active road construction, snowmelt and following summer precipitation.

Canfor employs a number of strategies to minimize siltation of streams. These strategies include:

- Tracking mitigative efforts made in response to siltation events found during annual road maintenance inspections (refer to Section G “Critical Element 3c, Objective 1.1b.1”);
- Utilizing techniques such as silt fences, geotextiles, straw bales, rip-rap (Figure 46), gabions (Figure 47), and settling ponds during road construction;
- Re-vegetating all exposed soil surfaces as soon as practicable after construction or disturbance;
- Directing drainage culverts onto the forest floor rather than into creeks;
- Buffering watercourses to reduce water runoff velocity and increase interception of soil particles; and
- Establishing “machine-free zones” for all watercourses, designated areas, or wet areas that are inside the approved cutblock boundary and require protection to prevent ruts caused by logging equipment.

Refer to Section F 4.1.2.2, which describes Canfor’s efforts to maintain soil productivity by reducing rutting and minimizing the area of roads within cutblocks.

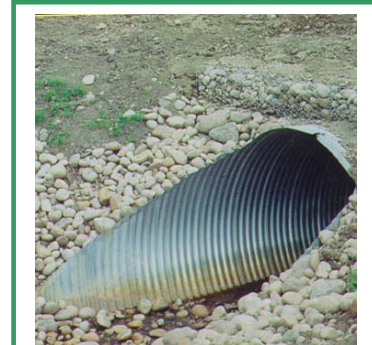


Figure 46. Rip-rap

The inlet and outlet of permanent culverts are rip-rapped with stones to prevent erosion.



Figure 47. Gabions

Gabions, like this one on Hodges Creek, stabilize creek banks that have high erosion potential due to flowing water.

4.1.2.1.1 Quantifying Siltation

The Company does not currently measure siltation within streams. However, Canfor conducts its planning and operations in accordance with all the legal requirements for minimizing sedimentation. An *Erosion Control* booklet (Canfor 1992, revised 2000) has been developed which serves as a reference guide and training aid for contractors, their employees and Company supervisors.

An objective has been established to assess current methodologies and practices to measure siltation caused by forest road construction (Section G “Critical Element 3c, Objective 1.1a.1”). Several methodologies have been assessed since submission of the

Sustainable Forest Management Plan (SFMP). Further assessment is required in order to develop a sampling program by the September 2001 target date.

4.1.2.2 Prevention of Rutting and Compaction

Woodlands operations are conducted in a manner that minimizes soil erosion and impacts to soil structure.

The objective is to meet the *Forest Soils Conservation* guidelines (Section G “Critical Element 3b, Objective 1.1c.1”). The *Forest Soils Conservation* guidelines (AFPA and LFS 1999) are a working tool to address potential impacts on forest soils such as ruts in the block and amount of internal roads.

According to the *Forest Soils Conservation* report:

- “Temporary road, bared landing areas and displaced soil should not exceed more than 5% of the total cutblock area unless justified in the Annual Operating Plan process. Examples where areas may exceed the 5% may include small block size, topography or in-block chipping operations (AFPA and LFS 1999: p. 3); and
- The target is to keep the rutting to less than 2% of the block area as measured by a linear transect system” (AFPA and LFS 1999: p. 6).

The above-mentioned targets are achieved through minimizing road widths, use of seismic lines and optimizing economical skidding distance. Cutblocks are evaluated for their soil, water, and landscape characteristics in order to design activities that minimize rutting. Contractors and equipment operators are trained to conduct their work in a safe and environmentally sensitive manner.

To monitor the success of achieving these objectives, Canfor will conduct field surveys on a statistically relevant proportion of its newly harvested areas by October 31, 2001. Thereafter, sampling will be conducted every 2 years. The results of the surveys will be monitored in relationship to the targets to determine if objectives have been met.

4.1.2.3 Steep Slope Protection

Steeper slopes are more prone to slumping when disturbed. Because of their unique characteristics, they require special management considerations when operations are planned and conducted.

4.1.2.3.1 Prevention and Mitigation of Slumping Events

Slumping is the term for a type of soil erosion that occurs on a slope. In general, it is a type of mass wasting with down-slope movement of rock fragments and/or soil (Mayhew and Penny 1992). Water is an important trigger because it lubricates clay-rich strata that serve as a sliding plane.

Unstable slopes may impact not only soil productivity but also the water resource. It is important to identify these areas as early as possible in the planning process. Canfor proposes a multi-level approach to manage slope stability on a landscape basis as well as on a harvested area and/or road basis.

Two management objectives and their corresponding acceptable level of variance have been established to address slumping along roads and within harvested areas:

1. To have zero slumping events from road construction activities in any given operating season (Section G “Critical Element 3b, Objective 2.1a.1”). The



acceptable level of variance is 2 slumps in an operating season; however, the slumps must be documented and preventative and corrective action implemented immediately; and

2. To have zero slumping events due to harvesting activities on steep or sensitive slopes (Section G “Critical Element 3b, Objective 2.1b.1”). The acceptable level of variance would be 1 slump per operating season; however, the slump must be documented and preventative and corrective action implemented immediately.

The following sections describe how Canfor achieves the objectives.

Terrain stability overview assessments will be conducted to identify stable, potentially unstable and unstable slopes. The assessment will also provide decision-making tools to allow Canfor to judge the stability of a site. The methodology used for the assessment will conform to standards as agreed between Canfor and ASRD.

The first terrain stability overview assessment will be prepared by May 2003 in operational subunits⁹ E8-1 and E8-4, which contain the steepest slopes.

Using the terrain stability overview assessment as a guide, harvested areas will be assessed to ensure that there are no unstable areas within cutblocks. There may be a need to have a qualified professional conduct a more intensive assessment if conditions warrant.

4.1.2.3.1.1 Slumping and Grade Cut Failures of Roads

Roads located across steep slopes are the major areas susceptible to mass wasting¹⁰ including slumps and road grade cut failures¹¹. Careful planning (road location) and proper road construction techniques and maintenance will minimize slumping and road grade cut failures.

There are no major slumps in the FMA area as a result of road construction activities. As indicated below, 2 minor slumps have occurred in past years, but they are stable and are currently being monitored:

- Adjacent to the south bank of the Wapiti River in 70-5-W6M; and
- Adjacent to a Class 2 road in 59-5-W6M.

High-risk areas, slumping and road grade cut failures are monitored through the Forest Road Maintenance System (FRMS) (refer to Section E 4.2).

⁹ A hypothetical area of land within the FMA area that forms 41 logical operating sub units for use in the *Resource and Timber Supply Analysis* for geographic harvest prioritization. Refer to Appendix 3 Section 6.2.1.1.14.

¹⁰ Mass wasting within the FMA area is classified as road grade cut failures, or minor and major slumps. The following classification applies for the purposes of measuring and recording the area affected by mass wasting:

- Road grade cut failures affect $< \text{or} = 100 \text{ m}^2$,
- Minor slumps affect $< \text{or} = 2,500 \text{ m}^2$; and
- Major slumps affect $> 2,500 \text{ m}^2$.

¹¹ Road grade cut failures occur when soil along a road grade moves down slope. Such failures have the potential to block ditches, create siltation and possibly trigger a slump.



4.1.2.3.1.2 Slumps on Sensitive Slopes

Careful planning and sound harvest design minimize slumping events on steep or sensitive slopes within cutblocks. Areas of instability or potential slump areas within cutblocks are identified during the block layout stage and are recorded on harvesting maps as “no harvest” zones.

These zones are recorded in the net loss database as “inoperable” and are monitored during normal operational activities. Any mass wasting found is reported and documented in the Company’s Incident Tracking System (ITS) database, and appropriate mitigation measures are applied immediately to prevent further erosion.

There are currently no active slumps on steep or sensitive slopes in harvested areas within the FMA area. If a slump occurs in the future, remedial action will be undertaken. Depending on the seriousness of the event, professionals may be employed to prepare a site-specific prescription for the site.

4.1.2.3.2 Minimizing Road Construction

Reducing environmental impact from roads is accomplished by:

- Utilize frozen ground conditions whenever and wherever possible.
- Achieving the *Forest Soils Conservation* guidelines for temporary roads, bared landing areas and displaced soil within cutblocks;
- Utilizing seismic lines wherever possible (the chosen route must meet the constraints of the equipment that will be utilizing the route); and
- Promoting common corridors and shared access (refer to Section F 12.5).

4.1.2.4 Design and Location of Watercourse Crossings

In the normal course of planning forest operations, it is inevitable that streams and rivers will be crossed. In order to minimize disruption to the water and aquatic resources, it is imperative that these watercourse crossings are designed properly. This section describes some of the important components.

4.1.2.4.1 Government Requirements for Watercourse Crossings

Alberta Sustainable Resource Development (ASRD) and the Federal Department of Fisheries and Oceans (DFO) have requirements and/or approval processes that are followed in the design and construction of watercourse crossings:

- ASRD – Roads and watercourse crossings must be designed and installed in accordance with *Resource Road Planning Guidelines* (AENR 1989) (Table 15) and *Stream Crossing Guidelines - Operational Guidelines for Industry* (AENR 1995a); and
- DFO - requires compliance with the federal *Fisheries Act 1985*. Plans for proposed roads over fish-bearing streams must be submitted to DFO for comments and/or approval.



Table 15. Road Construction Standards and Guidelines

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Table 81

ROAD DESCRIPTION		ENVIRONMENTAL PROTECTION GUIDELINES																												
Road Class	Term of Life	Detailed Plan Preparation	Field Layout	Design and Construction Guidelines														Erosion Control and Revegetation	Maintenance	Temporary	Permanent									
				Right-of-Way				Alignment				Stream Crossings																		
				Clearing Width	Back Slopes	Fill Slopes	Road Surface	Drainage Ditch	Gradients		Sight Distance	Minimum Radius of Curve	Design Speed	Borrow Pits	Timber Salvage	Debris Disposal	Bridges					Culverts								
N ¹	E ²	N ¹	E ²	Rounded or Scraper	G ³	P ⁴	A ⁵	P ⁴	Distance	Speed	Use	Management	Disposal	Design	Diameter															
I	Permanent year-round access for 20+ years	Detailed design plan on air photos or photo mosaics. Cross-sectional profiles for stream crossings and cuts and fills over 1.5 m. Types of structures for stream crossings, erosion control measures, hydrological information, revegetation and reclamation plans required. Right-of-way requirements specified and where any additional requirements may be necessary.	Centerline and stations marked before LFS field inspection. Both sides of right-of-way to be marked before construction commences. Cuts and fills over 1.5 m must be staked. Any additional right-of-way requirements to accommodate cuts and fills will be determined during LFS inspection for approval.	40 m	2:1	3:1	2.5:1	3:1	18 m	Rounded or Scraper	5	7	4	5	180 m	300 m	90 km/h	Location identified before construction commences, and site tested for materials and ground water levels before clearing of borrow area. Designated access or access constructed at an angle with buffer for off right-of-way borrow pits. Borrow pits located on the right-of-way should be incorporated with variable width and recontouring.	Timber salvage will be done as per timber management regulations.	Total deposit except stripings and fine debris (10 cm or less) to be retained for erosion control by spreading on cuts and fills and any other critical areas and walked down by a crawler.	Bridges are the preferred crossing structures and may be required where biological, hydraulic and/or terrain characteristics are significant. Should be designed to designed to facilitate other resource users.	Culverts 1.8 m in diameter or over to have installation supervised by an engineer. Culverts with diameter less than 1.8 m to be supervised by a qualified project manager. All culverts to be designed for 1:20 year flood level. All culverts to be rip-rapped and approved. Culverts placed in fish-bearing streams must facilitate fish passage.	Progressive reclamation (recontouring cuts and fills and revegetation) concurrent with construction. Recommended seed mixture as per the resource handbook to be applied by approved means. Cross drains and ditch blocks dictated by slope and soil conditions. Drainage water to be diverted off the right-of-way in as short a distance as possible. Revegetation within 100 m of watercourse and watercourse crossings and where needed to stabilize soil.	Annual maintenance required. Maintenance plan may also be required.	Removal of all crossing structures. Additional erosion control measures implemented and active maintenance required.	Complete removal of all crossing structures and engineering aspects of the road. Recontouring of road to original state and fertilizing and seeding of right-of-way.				
II	Permanent year-round access for 10+ years	See class I	See class I	40 m	2:1	3:1	2.5:1	3:1	10 m	Rounded or Scraper	6	8	5	6	100 m	230 m	80 km/h	See class I	See class I	See class I	See class I	See class I	See class I	See class I	See class I	See class I	See class I	See class I	See class I	
III	Permanent dry or frozen periods for 2 - 20 years	See class I	See class I	20 m	2:1	3:1	2.5:1	3:1	8 m	Rounded or Scraper	8	10	6	8	120 m	120 m	60 km/h	See class I	See class I	See class I	See class I	See class I	See class I	See class I	See class I	See class I	See class I	See class I	See class I	
IV	Permanent year-round or seasonal access for more than 2 years	See class I	See class I	10-20 m	2:1	3:1	2.5:1	3:1	6 m	See class IV temporary	10	12	8	10	45 m	50 m	40 km/h	See class I	See class I	See class I	See class I	See class I	See class I	See class I	See class I	See class I	See class I	See class I	See class I	
IV	Temporary dry or frozen periods for up to 2 - 5 years	Road alignment plan on aerial photographs and forest cover maps. Profiles of critical areas (cuts, fills and stream crossings). Types of structures for stream crossings.	Centerline marked for LFS field inspection.*	10-20 m ¹	2:1 ¹	3:1 ¹	2.5:1	3:1	6 m	"V" ditches where required. Ditches should be rock lined where site specific (grade and slope) may dictate their use.	10	12	8	10	45 m	50 m	40 km/h	Use of small borrow pits incorporated into right-of-way where possible.	See class I	Partial disposal - mechanical or manual cutting of accumulated slash and debris to reduce fire hazard to acceptable levels. Must be spread on right-of-way and walked down by a crawler.	Portable bridges and/or native timber bridges are preferred. (See class I) Properly constructed log fills or sawfills on intermittent streams. These crossings must be removed or opened up before spring break-up.	See class I	See class I	See class I	See class I	See class I	See class I	See class I	See class I	See class I
V	Temporary frozen periods only up to 2 years	See class IV temporary	See class IV temporary	6-20 m ²	2:1	3:1	2.5:1	3:1	5 m	See class IV temporary	12	14	12	14				See class IV temporary	See class I	See class IV temporary	See class IV temporary	See class I	See class I	See class I	See class I	See class I	See class I	See class I	See class I	See class I

Note: Table is abridged - omitted Column containing mapping designation.
 1: N = Normal Slope; 2: E = Erosion Slope; 3: S = Sustained; 4: P = Pitch; 5: Favorable; 6: Adverse
 a. For temporary class IV and V roads, construction shall be marked for inspection on critical or sensitive locations and when requested by a Forest Officer. When such marking is required, the Forest Officer shall be available for inspection.
 b. Class IV and V roads have a maximum clearing width of 20 m. Terrain and/or additional facilities on right-of-way may dictate a 20 m from the desired 10 m and 8 m for Class IV and V, respectively.
 c. On normal soils, back and fill slopes may vary from the standards specified for temporary class IV and V roads, within reasonable limits.
 d. LOCs are required for all class I, II, III and IV permanent roads used for more than 5 years.

Source: Based on *Resource Road Planning Guidelines* (AENR 1989)



4.1.2.4.2 Design of Watercourse Crossings

Careful and adequate planning is essential to locate an environmentally sound crossing site. The level of planning depends primarily on the class of stream to be crossed and the use and type of crossing structure anticipated. During site selection, some factors to consider that may influence cost, design and location of a crossing structure are (AENR 1995a):

- Life of crossing structure;
- Vehicle type and/or vehicle loads;
- Approaches;
- Timing constraints;
- Construction scheduling;
- Nearby existing structures;
- Other users;
- Fishery and wildlife values (refer to Table 13 for additional information regarding these values);
- Stream characteristics;
- Soil and ground conditions;
- Erosion potential;
- Environmental protection and mitigation;
- Maintenance; and
- Safety.

4.1.2.4.3 Watercourse Crossing Structures

A variety of structures are utilized to cross watercourses depending on the classification:

- Bridges:
 - Multi-span;
 - Single-span;
 - Portable; and
 - Native timber;
- Culverts:
 - Concrete;
 - Metal;
 - Plastic;
 - Log fill; and
 - Snowfill.

Watercourse crossings are designed and constructed in accordance with government statutes, regulations and directives including the *Water Act*, *Water Regulations* and the *Codes of Practice for Watercourse Crossings*. Examples of several types of crossing structures are shown in the accompanying photographs (Figures 48 to 53).



4.1.3 Road Maintenance Inspections

The Company conducts road maintenance inspections to ensure forestry activities are conducted in a manner that minimizes environmental impact. The Road Maintenance Inspection Program applies to all permanent (LOC) and temporary roads (R roads) (excluding block roads), and watercourse crossings constructed by Canfor. The program monitors:

- Watercourse crossings, structural integrity and erosion;
- Effectiveness of watercourse crossings for maintenance of fish habitat;
- High erosion potential areas;
- Erosion control measures (planned and completed); and
- Slumps and road grade cut failures.

Canfor's road monitoring procedure, risk ranking and inspection frequency are described in detail under the *Roads Environmental Program*, which is a component of the Environmental Management System (EMS). The tool for tracking this information is the Forest Road Maintenance System (FRMS).

4.1.4 Road Reclamation and Deactivation

Roads to be reclaimed are tentatively identified on the Annual Operating Plan maps prior to harvest. These plans may change as a result of harvesting and/or silviculture operations. All temporary roads are reclaimed immediately after harvest unless there is an operational reason, such as access for silviculture activities. If temporary roads are left open, they are seasonally deactivated and then reclaimed and reforested the following year.

Canfor's road deactivation strategy looks at both the short- and long-term use of the road. Temporary roads are usually only open for one logging season. Consequently, after use, the stream crossings are removed and the road is rehabilitated back into vegetation. Roads that are going to be active for more than one season may require a more structured approach to road deactivation. All deactivation and reclamation is conducted in accordance with government requirements and the Company's *Erosion Control* booklet (Canfor 1992, revised 2001). For additional information regarding Access refer to Section F 11.





Figure 48. Multi-span Bridge

A professional engineer evaluates the quantity and velocity of the water, the stream bank characteristics, the geometry of the stream bank and any other factors that may influence the design of the bridge.



Figure 49. Native Timber Bridge

These bridges are usually used on semi-permanent roads (R roads).



Figure 50. Single-span Bridge

"Wing walls" have been installed on the bridge abutments to protect the banks from erosion.



Figure 51. Concrete Culvert

This culvert at Zero Creek is 4.3 m in diameter and has a flat bottom to allow easy passage of fish.



Figure 52. Metal Culvert

Metal culverts like this one are used for permanent crossings.



Figure 53. Wood Culvert

Wood culverts are installed so the watercourse banks are not disturbed.

5. Fish & Wildlife Habitat

In this plan, wildlife management has an emphasis on managing the distribution of forest habitat over the landscape (coarse-filter approach¹²) with a fine-filter¹³ approach utilized for specific indicator species. The following sections describe the initiatives undertaken to ensure fish and wildlife habitat is available.

5.1 Landscape Structure

Landscape level planning is a fundamental strategy for the conservation of genetic diversity of wildlife species and the long-term ecological sustainability of managed forest ecosystems. The spatial properties or “structure” of landscapes can be used as a surrogate measure of landscape level biodiversity values. To maintain the biodiversity of an area, land managers are challenged with managing landscapes to emulate the patterns and dynamics of natural landscape mosaics. Thus, the quantitative basis for measuring the structure of landscapes is a prerequisite for ecosystem-based forest management. Quantitative measures are required to establish objectives for landscape structure and evaluate the effects of management options on ecosystem values.

At the landscape level, there are a number of important factors relating to the conservation of genetic diversity of wildlife species. Landscape structure is described by various landscape properties; therefore it is necessary to identify indices that will be used to measure these properties. Canfor utilizes landscape composition and spatial configuration to define landscape structure as follows:

- Composition is generally described by:
 - seral stage distribution (habitat type); and
 - patch size distribution (habitat size).
- Configuration is represented by:
 - fragmentation;
 - connectivity; and
 - patch shape.

The evaluation of the landscape structure will help determine the present land condition and understand and evaluate any future landscape changes resultant from the proposed management decisions. A brief summary of the methodology for determination of the landscape values follows and a full description is contained within ORM 2001e. The landscape structure values were developed in a two-phase process:

- GIS processing to create coverages and grids for the spatial files; and
- GIS Output processing and *FRAGSTATS*¹⁴ calculations.

The final phase is to produce landscape reports containing the information discussed within this section (refer to Figures 135 to Figure 141).

¹² Coarse-filter approach: maintaining vegetative communities, landscape patterns and processes (the coarse filter) within the limits of natural variability will result in the maintenance of the full complement of native plant and animal species.

¹³ Fine-filter approach: a species-by-species approach.

¹⁴ *FRAGSTATS* is a landscape pattern analysis program developed at the Oregon State University



For a detailed discussion regarding the distribution of seral stages refer to the Section G “Critical Element 1a, Objective 1.2b.1”. Due to its importance to the public, old seral stage has been discussed separately in the following section. The remaining landscape indices are discussed in Section G “Critical Element 1c, Objective 1.2a.1”.

Canfor is committed to submitting information regarding the definitions of and spatial distribution of patches on the landscape to assist the Company and ASRD to evaluate the ecological implications of the DFMP. The Company and ASRD will work co-operatively to review information, identify issues and determine the appropriate courses of action.

5.2 Old Seral Stage

Canfor's Forestry Principles (Canfor 1999a) provide the guidance for managing old growth within the FMA area:

“We will include old growth and old growth attributes as part of our management strategies and philosophy in the forests where we operate.”

Old growth stands or stands that contain old growth attributes provide biodiversity and habitat for a range of species. The natural variability of forests normally includes some old growth. The age and condition of old growth or the attributes that make up old growth vary from region to region or by forest type. However, they typically include some of the following characteristics:

- Multi-layered canopy with a variety of species;
- Low to moderate canopy closure;
- Several age classes;
- Some large, dominant trees in an overstorey (old trees);
- Snags and green trees with broken tops;
- High incidence of decay;
- Susceptibility to insect attack; and
- Coarse and fine woody debris.

Forest management strategies often see the replacement of old growth stands with younger age classes thereby creating normalized forests (i.e. an even distribution of age classes). Some stands are maintained as primary forests in buffers, riparian areas, on unstable slopes and in other permanent reserves including protected areas. However, this alone may not guarantee the maintenance of old growth attributes. Therefore it is important to manage for old growth attributes at various levels: stand, landscape and forest. Strategies to manage for old growth attributes may include lengthening rotations and creating



Figure 54. Old Seral Stage

For this Detailed Forest Management Plan, the term old growth has been replaced with old seral stage. Canfor believes it is important to manage for old seral stage attributes at various levels: stand, landscape and forest.

old growth from younger forests managed specifically for that purpose (*Canfor's Forestry Principles*).

For the purposes of this Detailed Forest Management Plan (DFMP), the term 'old growth' has been replaced with 'old seral stage' (Figure 54). Old seral stage is defined by the age of the stand at breast height for different yield groups (Canfor 2000). The breast height age ranges used to define seral stages are presented in Section G Table 44.

Canfor's target seral stage distribution is one that approximates the expected distribution created by natural disturbance regimes within the 2 Natural regions, Foothills and Boreal Forest¹⁵ (Section G "Critical Element 1a, Objective 1.2a.1"). To determine seral stage distributions under a natural fire regime, they were modelled by using a theoretical fire-return interval (ORM 2000). The amount of old seral stage in the FMA area and FMUs G8C, G2C, G5C and E8C has been forecasted on the landbase at each key point in time (Section G Figures 117 to 120). It is assumed that these time periods provide a reasonable picture of the variability of old seral stage over time.

The acceptable variance established for old seral stage is to not fall below the range of the natural disturbance regimes for the old seral stage in the FMA area and FMUs G8C, G2C, G5C and E8C. Currently, the amount of old seral stage within the FMA area is within 1-3% of achieving the acceptable variance in 3 of the 4 area summaries (Table 16). Canfor's strategy is to work towards meeting the acceptable variance for those areas not currently achieving the target.

Old seral stages will be managed over a landscape basis. From an operational perspective, annual operating plans will be reviewed to ensure that, over an averaging period, targets set for old growth retention are met. Refer to Section F 5.3.3.1.4 for information regarding maintaining old seral stages in the Caribou Area.

Table 16. Percent of Current Forested Landbase in Old Seral Stage

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Table 2

Location	Area in Old Seral Stage	Total Forested Area	% of Area in Old Seral Stage	% Natural Disturbance Range
FMA Area	36,088	592,296	6.1	7.0 – 23.4
FMU G8C	391	25,936	1.5	3.8 – 21.4
FMU G2C	5,177	63,667	8.1	3.8 – 21.4
FMU G5C and E8C	30,540	502,693	6.1	7.6 – 23.7

Source: ORM compiled data

5.3 Selected Indicator Species

Consultation with members from the Forest Management Advisory Committee (FMAC), Forest Ecosystem Management Task Force (FEMTF) and Canfor resulted in the selection of the following 7 indicator species:

¹⁵ For this discussion, the Foothills Natural region includes the Rocky Mountain Natural region. The Boreal Forest Natural region includes the Parkland Natural region.



- Moose (*Alces alces*);
- American marten (*Martes americana*);
- Pileated woodpecker (*Dryocopus pileatus*);
- Barred owl (*Strix varia*);
- Woodland caribou (*Rangifer tarandus caribou*);
- Bull trout (*Salvelinus confluentus*); and
- Trumpeter swan (*Cygnus buccinator*).

From this group, the first 4 were selected for Habitat Suitability Indexing (HSI) modelling and the last 3 to be managed by means of habitat constraint modelling within the *Resource and Timber Supply Analysis* (Canfor 2001n).

These 7 species were selected because they represent a broad and variable range of habitat characteristics.

The 7 indicator species have specific habitat requirements that can be evaluated by HSI models (Canfor 2001p). These requirements are:

- Moose - this species tend to prefer interspersed shrublands with forest cover, winter cover in dense conifer >(60% conifer cover), winter forage in deciduous trees, 3 m and all shrubs, and canopy closure at least 30%;
- American marten - this species tend to prefer mixedwood to conifer stands with at least 50% spruce and fir, and canopy closure from 30 – 75% with coarse woody debris and mean heights of 16 m;
- Pileated woodpecker - this species tend to prefer mature stands with 10 – 90% closure, snags >35 cm and mean canopy DBH > 16 cm;
- Barred Owl - this species tend to prefer coniferous mixedwood to coniferous stands with high structural diversity, open understorey, large trees, at least 20% spruce and fir and deciduous;
- Woodland caribou - this species tend to prefer relatively large tracts of land that are largely void of human activity and comprised of primarily mixedwood conifer (pine/spruce) stands (40%), pine stands (19%) and treed muskeg (31%);
- Bull trout - To our knowledge, and the knowledge of experts such as Dr. Jim Beck and Kirby Smith (Edson Regional Biologist, Alberta Environmental Protection), there is no HSI model for bull trout in Alberta or the U.S. (De La Mare 1998); and
- Trumpeter swan - this species tend to prefer small to medium sized, shallow, isolated lakes with emergent and submergent vegetation.

More information regarding habitat suitability indexing and each species can be found in the following sections.

5.3.1 The Status of Alberta Wildlife

The *General Status of Alberta Wild Species 2000*, developed by the Alberta government with consultation from professional biologists, provides a system for evaluating the general status of all wild species in Alberta- one that is identical to that used by other provinces and territories in Canada (Alberta Environment 2000). The document is the



first step in a continuing process of evaluating and reporting on the biological status of Alberta's wild species.

Seven key criteria were used when establishing status rank:

- Population size;
- Number of occurrences;
- Distribution;
- Population trend;
- Distribution trend;
- Threats to population; and
- Threats to habitat.

The status of the 7 selected indicator species identified for Canfor's FMA area have been compiled from *General Status of Alberta Wild Species 2000* (Table 17).

Table 17. The General Status of the Selected Indicator Species Identified by the Forest Management Advisory Committee.

DMP_Tables ver1.xls
Table 26

Species	Scientific Name	Equivalent Previous Rank (1996) ¹	Current Status ²
Moose	<i>Alces alces</i>	Green	Secure
American marten	<i>Martes americana</i>	Green	Secure
Pileated woodpecker	<i>Dryocopus pileatus</i>	Yellow B	Sensitive
Barred owl	<i>Strix varia</i>	Yellow B	Sensitive
Woodland caribou	<i>Rangifer tarandus caribou</i>	Blue	At Risk ³
Trumpeter swan	<i>Cygnus buccinator</i>	Blue	At Risk
Bull trout	<i>Salvelinus confluentus</i>	Species of Special Concern	Sensitive

1. The Status of Alberta Wildlife (1996) definitions:

Red: Current knowledge suggests that these species are at risk.

Blue: Current knowledge suggests that these species **may be** at risk.

Yellow B includes species that are:

- naturally rare but are not in decline,
- naturally rare and have clumped breeding distributions, or
- associated with habitats (e.g. oldgrowth forests) or habitat elements (e.g. wildlife trees) that are, or may be, deteriorating.

Green: These species are not considered at risk. Their populations are stable and their key habitats are generally secure at present.

2. The General Status of Alberta Wild Species (2000) definitions:

At Risk: Any species known to be "At Risk" after formal detailed status assessment and designations as Endangered or "Threatened" in Alberta.

Sensitive: Any species for which insufficient information, knowledge or data is available to reliably evaluate its general status.

Secure: A species that is not "At Risk," "May Be At Risk" or "Sensitive."

3. Woodland caribou are considered as "Threatened" species under Alberta's Wildlife Act.

Source: Compiled from *The General Status of Alberta Wild Species 2000* (Alberta Environment 2000a) and *Status of Alberta Wildlife* (Alberta Environmental Protection 1996a)



5.3.2 Habitat Suitability Index (HSI) Models

The techniques used to evaluate the suitability of habitat for specific species are called Habitat Suitability Index (HSI) models. They are able to predict the value of a habitat for a specific species, based on life variables related to food, availability of cover, and the physical size of the potential habitat. An HSI value of 0 indicates the lowest habitat and a value of 1 indicates the optimum habitat. An HSI can be categorized into a scale of habitat quality and for this report categorized as nil, low, medium, and high.

In order to apply the HSI models, the relationship between important habitat characteristics and stand variables was evaluated and habitat values determined for each 20-year breast height age class for each yield group. The HSI-class percentages (nil, low, medium, and high) for year 1999 for the species moose, American marten, pileated woodpecker and barred owl are shown in Section G Figure 126 to 129, respectively. The data is provided for the entire FMA area and FMUs G8C, G2C, G5C and E8C. Refer to Section G “Critical Element 1b, Objective 1.1b.1” for additional information and results of the modelled species.

Canfor is committed to participating jointly with ASRD regarding HSI models, inputs and carrying capacity to assist in identification of management issues and determination of management strategies.

5.3.2.1 Moose (*Alces alces*)

The moose is the largest member of the deer family in the world (Figure 55). Bulls can weigh over 450 kg (1,000 lb.) and stand 2.3 m (7.5 ft.) at the shoulder. Cows average about 350 kg (770 lb.).

In Alberta, moose are common throughout most ecoregions, except for the prairie and parkland. In recent years, their numbers have been increasing in the parkland. Areas of preferred habitat include muskegs, brushy meadows and small groves of aspen or coniferous trees, particularly where such habitat adjoins lakes, ponds or streams. During the spring and summer, moose feed on aquatic plants and browse on the tender shoots of willow, birch and poplar. In the spring, moose also seek aspen bark, aquatic vegetation and minerals from natural salt licks. During the winter, moose browse near the edges of dense forests where there is less snow.

Alberta Sustainable Resource Development (ASRD) estimates the provincial population (in September 1997) to be about 118,000 animals. This estimate is based on population counts in selected areas and hunter harvest information¹⁶.



Figure 55. Moose

In Alberta, moose are common throughout most ecoregions, except for the prairie and parkland.

Source: Kent Brown

¹⁶ <http://www.gov.ab.ca/env/fw/hunting/moose.html>

5.3.2.2 Pileated Woodpecker (*Drycopus pileatus*)

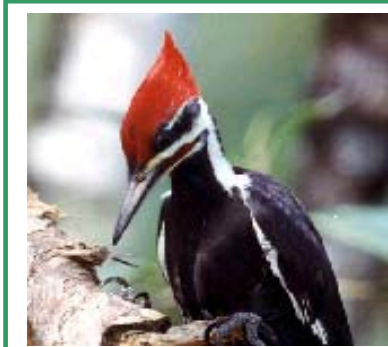


Figure 56.
Pileated Woodpecker

Each pair of pileated woodpeckers uses a territory of at least 500 ha

Source: (<http://museum.gov.ns.ca/mnh/nature>).

The pileated woodpecker population in Alberta is thought to be stable and their status is currently listed as “sensitive” (Table 17). Pileated woodpeckers are indicator species for mature and older forests (Mellen *et al* 1992) (Figure 56).

The pileated woodpecker is by far the largest woodpecker species in Alberta. Adult males and females are similar in appearance with the top of the head having a bright scarlet crest and the rest of head boldly marked with contrasting black and white. The white extends down the sides of the neck to the wings. The back and underparts are sooty black. The wings are black with white bars seen only in flight. The bill is horn-coloured¹⁷.

Pileated woodpeckers prefers older, mature, dense-canopied forest, particularly mixed and deciduous forest, where there are large dead or dying trees for nesting and downed woody materials for feeding (Federation of Alberta Naturalists 1993). Though sedentary by nature, it shows a tendency to disperse over the countryside in late autumn. Its nest is an excavated hole 3-20 m or more up a large tree, either coniferous or deciduous. Three to four glossy white eggs are laid¹⁸.

5.3.2.3 American Marten (*Martes americana*)

The marten is the most arboreal member of the weasel family, spending much of its time hunting in trees. Its long, bushy tail and distinctive buff chest patch allows for easy identification (Figure 57). Marten reach a weight of 1.5 kg and average 65-75 cm in length.

They inhabit the mixedwood, foothill and montane zones and may travel for miles without touching the ground. They commonly hunt red squirrels and can match their prey's every move in a high-speed, tree-top chase. Their diet also includes other rodents, grouse, insects, eggs and occasionally nuts or fruits. The marten's natural enemies are the equally agile fisher as well as lynx, great horned owls and wolves¹⁹.

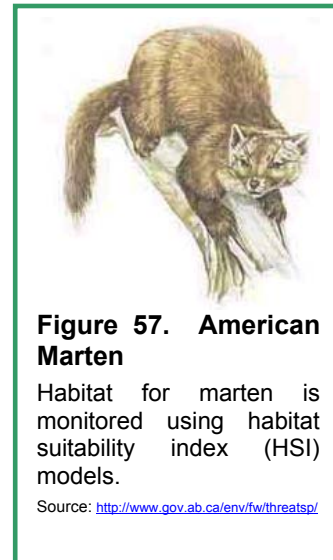


Figure 57. American Marten

Habitat for marten is monitored using habitat suitability index (HSI) models.

Source: <http://www.gov.ab.ca/env/fw/threatsp/>

5.3.2.4 Barred Owl (*Strix varia*)

This owl is about 52 cm long with the tail, back, wings and head a dark greyish-brown, barred heavily with white. The undersides are white with dark spots on the neck, bars on the breast and broad vertical streaks on the abdomen. The facial disk is grey with

¹⁷ <http://museum.gov.ns.ca/mnh/nature/nsbirds/>

¹⁸ <http://museum.gov.ns.ca/mnh/nature/nsbirds/bns0236.htm>

¹⁹ <http://www.gov.ab.ca/env/fw/threatsp/index.html>

concentric circles around the eyes. Unlike all the other owls, the barred owl has dark brown irises instead of yellow (Figure 58).

It inhabits swamps and dense forest of the mixedwood, foothill and montane zones, but hunts in neighboring open country. Sightings of this owl in Alberta have been made throughout the forested areas in the north central regions. The total range extends west of the Rocky Mountains through northern Canada and south to the United States. It is resident throughout the year. Hollows in trees, and old hawks' and crows' nests are used for nesting. Two to three eggs are laid.

A nocturnal hunter, the barred owl preys mainly on mice, but also feeds on insects, frogs, fish and small birds²⁰.

5.3.3 Habitat Constraint Modelling

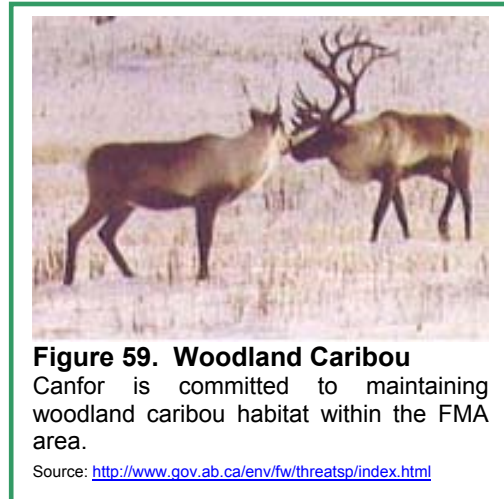
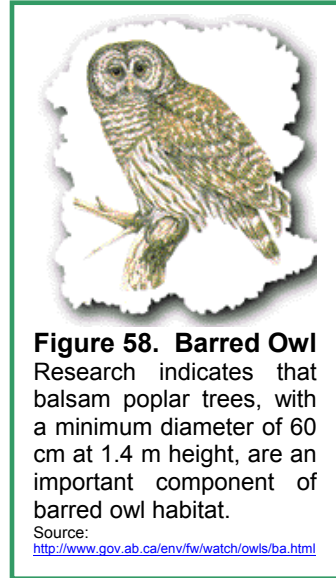
Habitat constraint modelling is used for 3 of the 7 selected indicator species: woodland caribou, trumpeter swan and bull trout. The following sections provide more detail regarding management of these species.

5.3.3.1 Woodland Caribou (*Rangifer tarandus caribou*)

Only the woodland subspecies resides in Alberta. Both males and females grow antlers, but those of cows are shorter and have fewer points. Mature bulls grow large racks that they use during the breeding season (rut) to defend their group of cows from other bulls. The mature, breeding bulls drop their antlers in December, while young bulls usually retain their antlers until late winter. Cows drop their antlers during or just after calving (Figure 59).

Woodland caribou inhabit the boreal forest of northern Alberta and mixed coniferous forests and alpine regions of west central Alberta. Pure pine, pine/black spruce forests and treed muskegs are the main habitats woodland caribou use in winter, and in the spring through fall, they use open muskegs as well as mature coniferous forests²¹.

Woodland caribou is listed as "At Risk" (Alberta Environment 2000a) and is considered a "Threatened" species under Alberta's Wildlife Act.



²⁰ <http://www.gov.ab.ca/env/fw/watch/owls/ba.html>

²¹ <http://www.gov.ab.ca/env/fw/threatsp/index.html>

Canfor is committed to maintaining woodland caribou habitat within Canfor's FMA area. To achieve this objective, Canfor is participating in the caribou research initiatives as follows:

- Participation in the West Central Alberta Caribou Standing Committee Caribou Research Project; and
- Development and implementation of a Track Monitoring Program in the FMA area.

There are 2 woodland caribou herds within and adjacent to the FMA area: A La Peche and the Little Smoky. Their total range is 466,127 ha. The total amount of woodland caribou range within the FMA area is 70,228 ha as depicted in Figure 59 (representing 15% of the total area and 10.8% of the total FMA area).

5.3.3.1.1 Little Smoky Herd (boreal ecotype)

This herd is primarily present in the southeast portions of the FMA area (Figure 59) and also ranges into the FMA areas of Alberta Newsprint Company Ltd. and Weyerhaeuser. The Little Smoky herd, comprised of approximately 60 animals, is non-migratory and remains on their range year-round. The *Status of the Woodland Caribou in Alberta – Status Report No. 30* (Dzus 2001) indicates poor recruitment in calf survival, raising the concern for the viability of this herd²².

5.3.3.1.2 A La Peche Herd (woodland ecotype)

The A La Peche herd occupies summer range in the caribou area but generally migrates to the mountains of Alberta and B.C. in the winter. The herd is present and uses habitat primarily in FMAs allocated to Weyerhaeuser and Weldwood, but also in an extremely small portion of the southwest region of Canfor's FMA area (Figure 60). For the last 2 years, this herd has not migrated, possibly due to low snowfalls and warm winters.

5.3.3.1.3 Caribou Research

Caribou management in Alberta is an evolving process. In 1993 the Alberta Woodland Caribou Conservation Strategy Development Committee (AWCCSDC), comprised of stakeholders representing a variety of industries, conservation groups, Aboriginal groups, academics and government agencies, was formed in response to a draft conservation strategy document circulated by Alberta Sustainable Resource Development. The AWCCSDC prepared the document, "*Alberta's Woodland Caribou Conservation Strategy*" (1996), at the request of the Director Wildlife Management, and submitted it for endorsement in July 1996.

Canfor has been an active member of the West Central Alberta Caribou Standing Committee (WCACSC) process since 1993. The mandate of the Committee, formed in 1992, is to provide a forum for multi-stakeholder communication, and decision making with regard to industrial land-use guidelines that would help conserve caribou in west central Alberta. The WCACSC established *Operating Guidelines for Industrial Activity on Caribou Range* in 1996. In 1998, WCACSC initiated a 5-year caribou research project (1998 to 2003).

The WCACSC Caribou Research Project will address 3 areas:

²² <http://www.gov.ab.ca/env/fw/status/reports/caribou/index.html>



1. Response of caribou to human infrastructure;
2. Forest renewal and long-term survival of caribou populations; and
3. Indirect effects of habitat fragmentation through predation. Field data will be collected to address current management issues, and the chosen sampling design will provide estimates for parameters needed in management models.

The following questions will be addressed to investigate the response of caribou to human infrastructure:

- How do caribou move in the landscape in relation to human infrastructure?
- At what threshold level of development will caribou avoid certain portions of the winter range?
- Are caribou more sensitive to human infrastructure in certain habitat types than in others?
- How can negative effects of human infrastructure be mitigated by changes to their design?

Questions of how spatial and temporal scale in forest renewal will affect caribou are posed as follows:

- What is the return time for cutblocks to become sustainable caribou habitat?
- How do caribou use cutblocks as a function of age?
- How do the costs and benefits of habitat to caribou change with the age of a forest stand?
- How can harvest operations be modified to shorten the return time of cutblocks to become sustainable caribou habitat? What is the relationship between lichen biomass and stand type?
- Do caribou prefer certain stand types and, if yes, what are the consequences for harvest planning?

Concerns about indirect effects of habitat fragmentation lead to the following questions relating to the potential of increased predation on caribou:

- What are the predation mortality, winter survival rates, recruitment rates and population trends of caribou in west central Alberta?
- What are the habitat use and spatial overlap of caribou and wolves in west central Alberta?
- Does industrial development increase the spatial overlap of wolves and caribou, and what spatial arrangement of cutblocks and linear corridors is compatible with the long-term conservation of caribou populations?

The project has been collecting data on the above issues since 1998. Canfor will be evaluating the resultant manuscripts to determine their use in development of future management strategies for caribou. An objective has been established to identify ranges and type of stands that are being utilized by woodland caribou to assist in development of a strategy compatible with West Central Alberta Caribou Standing Committee objectives (refer to Section G Objective 9).



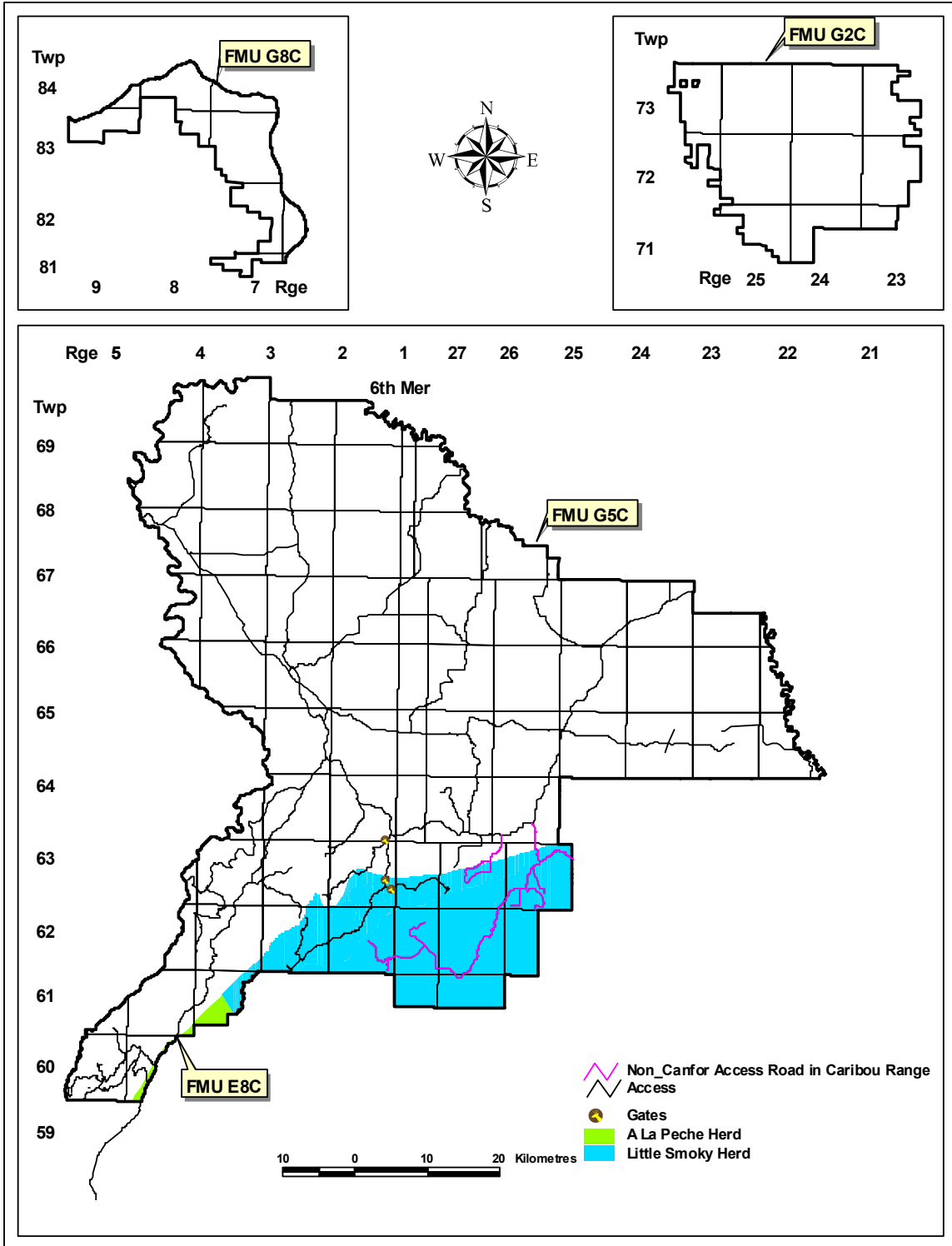


Figure 60. Caribou Area

The ranges of the A La Peche and Little Smoky herds within the FMA area.

The Caribou Area is also monitored, through Canfor's Track Monitoring Program, to determine the habitat use by caribou, wolf, deer and moose (Brown 2000). The program is a periodic approximate measure of caribou distribution within the Little Smoky range. Copies of the reports are provided to Alberta Sustainable Resource Development, Natural Resource Service (NRS) and West Central Alberta Caribou Standing Committee (WCACSC). With the ability to overlay track surveys on AVI, Canfor intends to use the data for operational planning. The data will also be used to identify ranges and the type of stands that are being utilized and, in conjunction with other research, will assist in development of the Company's caribou habitat constraints (refer to Section G, Objective 9).

5.3.3.1.4 Strategic Planning for Caribou

Canfor is applying habitat cover constraints within the *Resource and Timber Supply Analysis* to forested stands identified within the Caribou Area as follows (Appendix 3 Section 6.2.5.2).

- No more than 20% of the area can be in pioneer or young seral condition;
- No less than 20% of the area can in old seral stage;
- Maximum opening size of 1,000 ha; and
- 30 year green-up.

Canfor monitors the habitat conditions in the Caribou Area to ensure the target percentage of pioneer or young and old seral stages are achieved. The acceptable variance is to have no more than 25% of the area in pioneer/young seral condition and no less than 15% of the area in the old seral condition. Table 18 indicates the distribution over the planning horizon.

Table 18. Percentage of Pioneer/Young and Old Seral Stages in the Caribou Area

ORM_DFMP_Tables.xls
Table 1

Year	Pioneer/Young (%)	Old (%)
1999	13	10
2009	18	11
2019	22	15
2049	24	32
2099	24	38
2199	25	42

Source: ORM compiled data

Although the amount of area in old seral within the Caribou Area is currently below the 20% level specified in the SFMP, no constraint was applied to these stands. Early model runs indicated, and subsequent analysis confirmed, that the old seral class could support some harvesting without delaying the time that it takes to recover to the lower



limit of the SFMP-prescribed range (15%). The 20% old seral stage requirement will be achieved by 2021.

Canfor continues to provide support for research on caribou habitat. Until this research provides better information about actual habitat usage by Caribou, the SFMP targets, within the 5% will be used as guidelines. During this period, particular attention will be paid to managing caribou habitat at the operational level through such measures as:

- Adherence to *1996/97 Operating Guidelines for Industrial Activity in Caribou Ranges in West Central Alberta* (WCACSC 1996).
- Access control (gates);
- The use of existing roads and linear structures rather than the construction of new roads;
- Habitat evaluation during pre-harvest assessments; and
- The judicious selection of old seral stands for harvest so as to defragment the land base with respect to age class.

Canfor and ASRD recognize that the habitat constraints identified in this section are an interim step for provision of long-term caribou habitat until such time that 'new' caribou habitat constraints are developed. The Company and ASRD will work cooperatively to develop a caribou habitat supply review that will evaluate the current management strategies. This process will identify issues and determine the appropriate courses of action.

Canfor is committed to the development of a Caribou Management Strategy based on the results of research efforts that are currently underway and through an adaptive management approach, will use the research results to update current plans and strategies. (refer to Section G Objective 9).

5.3.3.1.5 Operational Initiatives

According to Dyer (1999), human activity has been shown to affect caribou demography through direct increases in mortality, while developments may cause displacement of caribou, act as barriers to movement and have energetic consequences through harassment and disturbance. As a result, Canfor minimizes its intrusions into the Caribou Area by implementing the following initiatives:

- Concentration of operations in a localized area;
- Minimizing access development by utilizing existing linear corridors wherever possible. When a "new" road must be constructed it will be built to a Class V (winter use) standard (for more information regarding minimization of road construction refer to Section F 4.1.2.3.3 and Section F 12.1);
- Removing the bridge planned for Deep Valley Creek (NE7-62-26-W5M) annually after harvest is complete (end February).



- Erecting gates²³ on the 3 main License of Occupation (LOC) roads that access the Caribou Area to restrict access for wildlife management purposes (Figure 60):
 - Norton Creek Road (LOC 910567, 62-01-W6M);
 - Boulder Road (LOC 920512, 62-01-W6M); and
 - Camp 9 Road (LOC 890636, 62-01-W6M).
- Adoption of an “early in/early out” management philosophy to reduce the effects of sensory disturbance to caribou. Harvest operations in the Caribou area are limited to November 1 to February 28 each logging season.
- Participation in the Caribou Range Recovery (CRR) program initiated in 2001 by WCACSC. The program is designed to modify the characteristics of existing linear disturbances (roads, seismic lines, and pipelines) to lessen and eventually eliminate their detrimental effects on woodland caribou and other sensitive species. A variety of techniques, such as scarification, grade removal, recontouring, and reforestation, will be used to speed the recovery of linear disturbances. In 2001, Canfor reforested 10 kilometers (10 ha) of linear corridors in the Caribou Area using approximately 6,000 seedlings. In 2002, approximately 47 km (approximately 35 ha) of seismic line were reforested requiring approximately 60,000 seedlings.
- Involvement in development of a combined map with all the FMA holders in the Little Smoky caribou range. This map will be based on AVI and 20-40 year harvest projections, which will provide a long-range projection of the industrial footprint upon the landscape. The map will be used to analyze the medium-term strategies of the FMA holders. By showing the development of all FMA holders in the Little Smoky Caribou range, it will be possible to co-ordinate harvesting activities within this area. It may be necessary for FMA holders to alter plans as new knowledge and research becomes available.
- Operation of a visual sighting program for both woodland caribou and grizzly bear. The sightings report is provided to the Government and the grizzly bear study group as supplemental information for operational planning. Refer to Section F 16.1.1 for additional information regarding grizzly bear research.

5.3.3.2 Trumpeter Swan (*Cygnus buccinator*)

Trumpeter swans are the largest and rarest swan in the world (Figure 61). In the *Alberta Policy for the Management of Threatened Wildlife*, they are listed as a vulnerable species, found near the edge of their range in Alberta. Without active management and protection, this species could easily become threatened or endangered in the province.

Trumpeter swans used to breed in boreal, parkland and prairie habitats throughout Canada and the United States from James Bay to the Rocky Mountains and south to

²³ Under Alberta legislation, any roads that are constructed on public lands must be open to the public. Gates cannot be erected without the approval of the Government and then only for wildlife management purposes. These gates are locked when the log haul is inactive; however, other resource users have access when actively working in the area. As a further step, temporary erosion control and roll back of internal roads takes place immediately after harvest or silviculture to return the land base to production. Gates on “new roads” that are planned for the Caribou Area will be discussed with Alberta Sustainable Resource Development.



Missouri and Wyoming. In Canada, the birds once nested throughout the central regions of Alberta, Saskatchewan and Manitoba as well as along the James Bay coast of Ontario and Quebec²⁴.

Trumpeter swans are migratory waterfowl and are found in Alberta during the spring, summer and fall. However, they are not long distance travellers and fly only far enough to reach suitable habitats for nesting or wintering. Any swan nesting in Alberta or seen here between late May and late August is probably a trumpeter swan. The birds arrive in Alberta in April and move north as the lakes and sloughs open in the spring.

The swans require shallow lakes with an abundant supply of aquatic plants, insects and snails (for nest sites and food) and a low level of human disturbance. The water must be a constant level throughout the summer and have little wave action or currents. Most of the trumpeter swans in the Grande Prairie area flock stop (stage) at Bear Lake or Sinclair Lake early in the spring and then move to other lakes in the area.

Fall migration starts at freeze-up in late October or November. The swans again gather in the staging areas, then fly south until they reach an area of shallow lakes and streams with food and open water. In the early winter, most birds from Grande Prairie stay on the Yellowstone Lake in Yellowstone National Park. The major limiting factor affecting Alberta trumpeter swans appears to be the size of their wintering area. Critical shortages of key winter habitat in the TriState area (Idaho, Montana, Wyoming) are still limiting population growth. Existing breeding habitat is carefully managed and relatively secure. Efforts are underway to create second wintering area²⁵.

There are 45 areas within the FMA area that have been identified by Alberta Sustainable Resource Development, Natural Resource Services (NRS) and which have been buffered to protect nesting sites (Section G Figure 134). Two hundred meter “no harvest” buffers are maintained around identified trumpeter swan areas to protect nesting sites, unless changes are recommended or approved by the LFD. The nesting sites will be verified within active Annual Operating Plan areas and any “new” nest sites will be incorporated into future plans.

5.3.3.3 Bull Trout (*Salvelinus confluentus*)

Bull trout are a native fish found throughout the eastern slopes of the Rocky Mountains. Bull trout are known to thrive in cold mountain lakes and streams, where they can reach ages of



Figure 61: Trumpeter Swan

Canfor protects all trumpeter swan nesting areas within the FMA area with a 200 m “no harvest” buffer.

Source:

<http://www.gov.ab.ca/env/fw/threatsp/swan/sta.html>

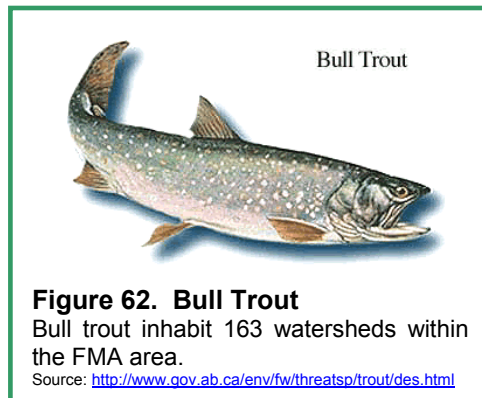


Figure 62. Bull Trout

Bull trout inhabit 163 watersheds within the FMA area.

Source: <http://www.gov.ab.ca/env/fw/threatsp/trout/des.html>

²⁴ <http://www.gov.ab.ca/env/fw/threatsp/swan/sta.html>

²⁵ www.gov.ab.ca/env/fw/status/index.html

more than 20 years and lengths of 30 to 70 cm depending on the food available and growing conditions in their environment (Figure 62). They prefer cold waters (18°C or lower) and usually can be found in the deeper pools and slower backwaters. Bull trout require stable, flowing water to reproduce successfully. They seek out small, spring-fed streams that can provide a continuous supply of oxygen for their developing eggs (in water with too much sediment, silt may cover the eggs and suffocate them). Therefore, suitable spawning streams will have steady winter flows, free flowing spring-time flash floods, and clean gravel areas²⁶.

In Alberta, bull trout are listed as "sensitive"²⁷ (Alberta Environment 2000a). However, based on the Cooperative Fisheries Inventory Program (ACA 1998), local populations in the FMA area appear to be healthy. The total Bull trout area identified within the FMA area is 242,828 ha as indicated in Section G (Figure 132). This represents 37% of the total FMA area. There are a total of 163 watersheds in the bull trout area.

Bull trout habitat is, in part, dependent on the amount of vegetated cover within a watershed. Vegetated cover removal must therefore be managed to maintain adequate habitat. If too much is removed at one time, the resultant water yield increases (quantity and timing of run-off) may affect bull trout habitat.

Water yield increases can be directly modelled, but equivalent clearcut area (ECA) is often used as a surrogate (refer to Section F 4.1.1). ECA is a primary factor considered in an evaluation of the potential effect of past and proposed forest harvesting on water yield. ECA is usually expressed as a percent of watershed area. The index takes hydrological recovery, the initial percentage of crown removal and the recovery through regrowth of vegetation since the initial disturbance into account (Various 1997).

An objective for bull trout has been established to not exceed a range of 20-40% of forest cover removal, above the "H60" line, in relationship to the total vegetated area within a defined watershed as per the DFMP (Section G "Critical Element 3c, Objective 2.1a.1"). The H60 is the elevation above which 60% of the watershed lies. The watershed area above H60 is considered as the source area for the major snowmelt peak flows (B.C. Ministry of Forests 1999).

To meet the bull trout objective, ECA values for watersheds will be monitored as follows:

- The H60 was determined for all watersheds in the FMA area (Section G Figure 133) by aggregating watersheds in the bull trout area up to a minimum of 500 ha;
- ECA% values were calculated based on the most recent resource and timber supply analysis; and
- A report was prepared summarizing watersheds above the ECA of 35% flagged for concern as presented in Table 19 (Canfor 2001m).

Any watershed that exceeds 35% ECA in the bull trout area or 40% ECA outside the bull trout area was noted and will be evaluated operationally to determine if adjustments to harvested areas are required to meet ECA objectives. Operational evaluations will commence with the 2002 Annual Operating Plan. Table 19 provides a summary of watersheds flagged for evaluation.

²⁶ <http://www.gov.ab.ca/env/fw/threatsp/trout/des.html>

²⁷ <http://www.gov.ab.ca/env/fw/fishing/fishstat.html>



Table 19. Watersheds Flagged for EvaluationDMP_Tables.xls
Table 10

Watershed ID	1999 ECA %	2009 ECA %	2019 ECA %
1500 ¹	–	–	41
2057 ¹	48	–	–
4257 ¹	36	–	–
5642 ¹	37	–	–
Combined ECA (ha)	606	0	195
Notes: 1. Bull trout watershed			

Source: ORM compiled data

5.3.3.4 Amphibians as a Selected Indicator Species

The current list of selected indicator species includes representatives of birds, mammals and fish. The Forest Management Advisory Committee (FMAC) has noted that amphibians are not part of the list and they should be considered in future planning. Canfor has made a commitment to review the list of selected indicator species regarding potential addition of an amphibian species. The process for selection of an amphibian species requires further assessment and consultation with experts (Section G “Critical Element 1b, Objective 1.2d.2”). The progress made in selection of an amphibian species will be reported in the *Annual Performance Monitoring Report*.

5.4 Variable Retention

Variable retention is an approach to forest harvesting and silvicultural systems that respects nature's model by retaining a part of the forest after logging. It recognizes the complexity of the forest ecosystem and the importance of diversity in flora and fauna. Features such as standing or fallen trees or snags, large pieces of dead wood and a variety of living trees are retained as habitat for a host of forest organisms. The retention system leaves individual trees or groups of trees in a cutting area in a variety of configurations, hence the name "variable".

The configurations include a range of removal of trees from single tree retention to no retention (Figure 63):

- Single green tree;
- Tree patches;
- Understorey retention;
- Wildlife zones;
- Watercourse buffers; and
- No retention.

An objective has been established to evaluate the range of variable retention configurations and develop a strategy by May 2002 (refer to Section G Objective 8).

The steps to achieve the objective will include:



- Review the range of management systems;
- Evaluate their use; and
- Develop strategic and operational plans for a variable retention management system.



5.4.1 Wildlife Trees and Snags

An important component of ecosystem-based management is the dead and dying trees, known as snags, found in forest stands. The terms snags, residual trees and wildlife trees are frequently used interchangeably (AFPA Wildlife Working Group 1995). Logging operations can emulate the natural process of fire, and provide habitat in regenerating stands by retaining some residual live and dead trees on cutovers (Figure 64). During block layout, any wildlife trees that are found by operational personnel are identified and marked so that they will not be harvested. Wildlife trees could be snags, old mature trees, limby overgrowth trees, etc. During the fall of each season, feller buncher operators will be trained to identify wildlife trees.



Figure 64. Wildlife Trees

Often called coarse woody debris, wildlife trees play an important role as nesting and denning sites for birds and small mammals. It is important that these wildlife features are available on the landscape.

Any standing trees left during and after harvesting may pose a safety hazard; therefore, snags and wildlife trees have to be evaluated with an eye to the safety of people who may be working adjacent to them. Since most harvesting operations are conducted mechanically, worker safety objectives are generally met by the design of the machine. Care must be taken to ensure that other forest activities, such as tree planting, take worker safety into account when working around snags and wildlife trees.

5.5 Top Piles

Debris is accumulated by roadside processing (limbing and topping of trees) of tree-length timber on both sides of the road. Canfor has made a commitment to work with Alberta Sustainable Resource Development, via the ground rule process, to develop an acceptable range of debris that can be left on site but does not create a fire hazard.

The question of whether or not top piles make good animal habitat is debated among researchers. Some believe a small pile of debris, particularly if it is mixed with wood and soil, does indeed make good habitat. Canfor has made a commitment to work closely with Alberta Sustainable Resource Development to evaluate how top piles should be managed (Figure 65).



Figure 65. Top Piles

Top piles are currently burned in accordance with government regulations. Canfor has made a commitment to work closely with Alberta Sustainable Resource Development to evaluate how top piles should be managed.

5.6 Wildlife Mineral Licks

Mineral licks are an important source of nutrients for many species of wildlife within the FMA area. Significant wildlife mineral licks are identified operationally during pre-harvest assessments and block layout. Licks are protected with a 100 m “no harvest” buffer. Refer to Section F 8.2.2 for additional information regarding wildlife mineral licks.

6. Rare Plants

A rare plant is one that either occurs in a limited area or in small numbers over a large area. On a provincial basis, a rare plant species is one that has a small overall population or is highly restricted to specific habitats and which is susceptible to human changes to the environment (Harms et al 1992). The definition of a rare species in Alberta follows that of the Alberta Natural Heritage Information Centre (ANHIC). This system is based primarily on the number of occurrences of a given element (i.e. taxonomic rank – usually species) within the province and, to a lesser extent, by factors that influence their ability to sustain the population (i.e. life history factors, responses to disturbance, etc.).

Canfor recognizes the value and importance of rare plants and has initiated several projects to compile data for management. Dr. Joan Snyder prepared a report that identified the rare plants from the provincial tracking lists and literature that could potentially be found in the FMA area (Snyder 1998). Geographic Dynamics Corp. (GDC) expanded this preliminary report (Canfor 2001f) by:

- Developing a predictive model to map the “likelihood of encounter” of rare plants (the FMA area ranked “very low” overall, except for scattered areas where ranking was considered to be “low”: this is true at both ecosite and vegetation complex levels of resolution);
- Evaluating plant biodiversity where data was sufficient, and species richness where data was sparse; and
- Analyzing how specific plant species, either alone or in groups, can be surrogate measures of ecosite, site and soil conditions and successional stages. Indicator plants of environment were summarized on fact sheets that identified individuals as specialists or generalists and showed specifically what site or soil conditions they indicate are present on site.

This following section describes the results of the predictive model. Refer to the report, *Plant Resource Evaluation* (Canfor 2001f).

The status of rare plants within the FMA area was classified using the ANHIC classification system whereby Provincial (S) and Global (G) ranks of plant species were reported (Table 20 and 21).



Table 20. Provincial Rank (S)

DFMP_Table part 2.xls
Table 200

Provincial Rank (SRank)	Classification
S1	Critically imperiled due to extreme rarity (5 or fewer occurrences)
S2	Imperiled because of rarity (6 to 20 occurrences)
S3	Rare or uncommon (21 to 100 occurrences)
S4	Apparently secure, with many occurrences
S5	Abundant and secure, with many occurrences
SR	Reported but without persuasive documentation to either accept or reject the report
SU	Uncertain status, possibly in peril; more information is required

Source: *Plant Resource Evaluation* (Canfor 2001f).

Table 21. Global Rank (G)

DFMP_Table part 2.xls
Table 201

Global Rank (GRank)	Classification
G1	Critically imperiled due to extreme rarity (5 or fewer occurrences)
G2	Imperiled because of rarity (6 to 20 occurrences)
G3	Rare or uncommon (21 to 100 occurrences)
G4	Apparently secure, with many occurrences
G5	Abundant and secure, with many occurrences
T	Rank for subspecific taxon (subspecies or variety)
Q	Taxonomic problems involved; more information is required
HYB	Hybrid taxon that is recurrent in the landscape
?	Rank tentatively assigned; no information is available or the number of occurrences is estimated

Source: *Plant Resource Evaluation* (Canfor 2001f)

A total of 59 rare plants were identified in and around the FMA area from a combination of all sources. An example is provided in Figure 66. A list of all 59 individual species is presented in Appendix 8 along with their associated provincial and global ranks from the ANHIC. Of the 59 rare plants, there are 5 shrubs, 33 forbs, 10 grasses, and 11 mosses. A quarter (25%) of the total rare plants found are in the composite, grass, and willow families (Table 22). The remaining 75% of plants had representation in 27 other families for a total of 30 observed families.

Of the 59 plant species identified within the FMA area, the majority of species (56) are categorized as being S1, S1S2, or S2 at the provincial level (Figure 67). These 56 plants are considered to be rare (less than 20 known occurrences) in the province. In addition, 1 plant is classified as being rare or uncommon (S2S3) with fewer than 100 occurrences in the

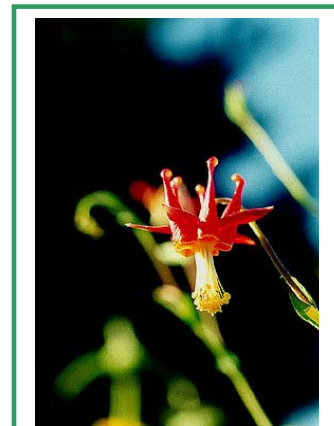


Figure 66.

Aquilegia formosa

A predictive model is used to map the “likelihood” of encountering rare plants, such as *Aquilegia formosa* shown in the photograph.

Province but with at least more than 5. Two rare plant species are reported but with uncertain (SU) or questionable (SR) status.

Global status (GRank) is also reported for the same 59 plants. The majority of these (35 total classified as G5) is apparently abundant and secure with many occurrences throughout the plants' known range (Figure 68). Only 1 plant is considered to be imperiled at the global level because of its rarity (G2). The remaining plants are characterized as secure with many occurrences (G4 or G5), with some indication of problems (Q) or not enough information (?) to provide an accurate assessment of global rank.

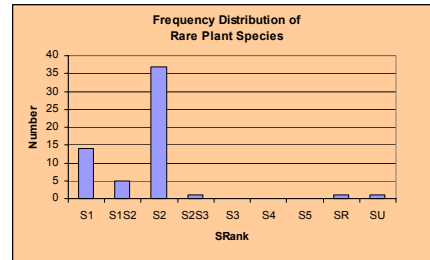


Figure 67. S Rank
Frequency Distribution of Rare Plant Species According to their Provincial Rarity (S Rank).

Source: DFMP_Tables ver 1.xls

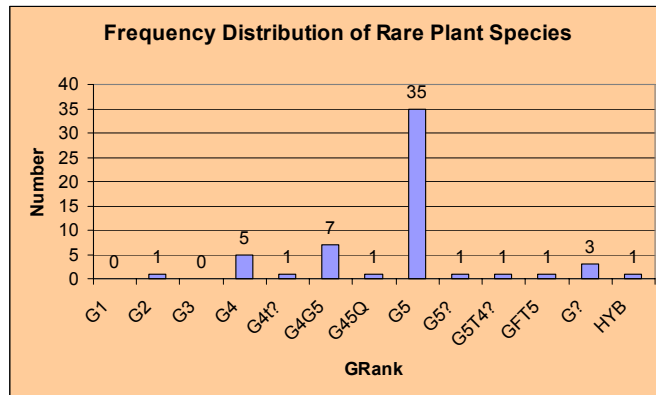


Figure 68. G Rank
Frequency Distribution of Rare Plant Species According to their Global Rarity (G Rank).

Source: DFMP_Tables part2..xls

Table 22. Number of Rare Plant Species Found in and near the FMA Area by FamilyDFMP_Tables.xls
Table 69

Taxonomic Name	Common Family Name	No. of Species
Compositae	composite family	6
Gramineae	grass family	5
Salicaceae	willow family	4
Brachytheciaceae	grass mosses	3
Cyperaceae	sedge family	3
Liliaceae	lily family	3
Rosaceae	rose family	3
Juncaceae	rush family	2
Lycopodiaceae	club-moss family	2
Ophioglossaceae	adder's-tongue family	2
Orchidaceae	orchid family	2
Polypodiaceae	fern family	2
Pyrolaceae	wintergreen family	2
Ranunculaceae	crowfoot family	2
Scrophulariaceae	figwort family	2
Umbelliferae	carrot family	2
Bryaceae	thread mosses	1
Caryophyllaceae	pink family	1
Droseraceae	sundew family	1
Ericaceae	heath family	1
Fontinalaceae	water mosses	1
Gentianaceae	gentian family	1
Grimmiaceae	beard mosses	1
Mniaceae	leafy mosses	1
Onagraceae	evening primrose family	1
Orthotrichaceae	bristle mosses	1
Polytrichaceae	hair-cap mosses	1
Potamogetonaceae	pondweed family	1
Rhytidiaceae	droop-branch mosses	1
Thuidiaceae	fern mosses	1
Total		59

Source: *Plant Resource Evaluation* (Canfor 2001f).

Figure 69 indicates the likelihood of finding a rare plant species within the FMA area. The map is an index map. A large-scale map depicting the information is available for viewing at Canfor's Grande Prairie administration office. Table 23 is provided as a companion table and provides similar information for each Natural region in tabular form.

Canfor has developed a procedure to identify and report rare plants found during routine operational activities. Geographic Dynamics Corp. (GDC) presented a rare plant identification and reporting course to operational personnel in June 2001. Skills learned at this course will be used to identify rare plants. Canfor's procedure for reporting a rare plant discovery is as follows:

- Map and mark the field location;
- Describe the plant in detail;
- Describe the surroundings with details;
- Take a photograph, if camera available;
- Collect a specimen only if there is an abundant number of species; and



- Fill out the Native Rare Plant Report Form and submit it to Alberta Natural Heritage Information Centre (ANHIC).

When "rare" plants are found within operational areas, harvest will be deferred until an expert can be retained to provide management recommendations. The recommendations will be evaluated and implemented based on the specifics of the case.

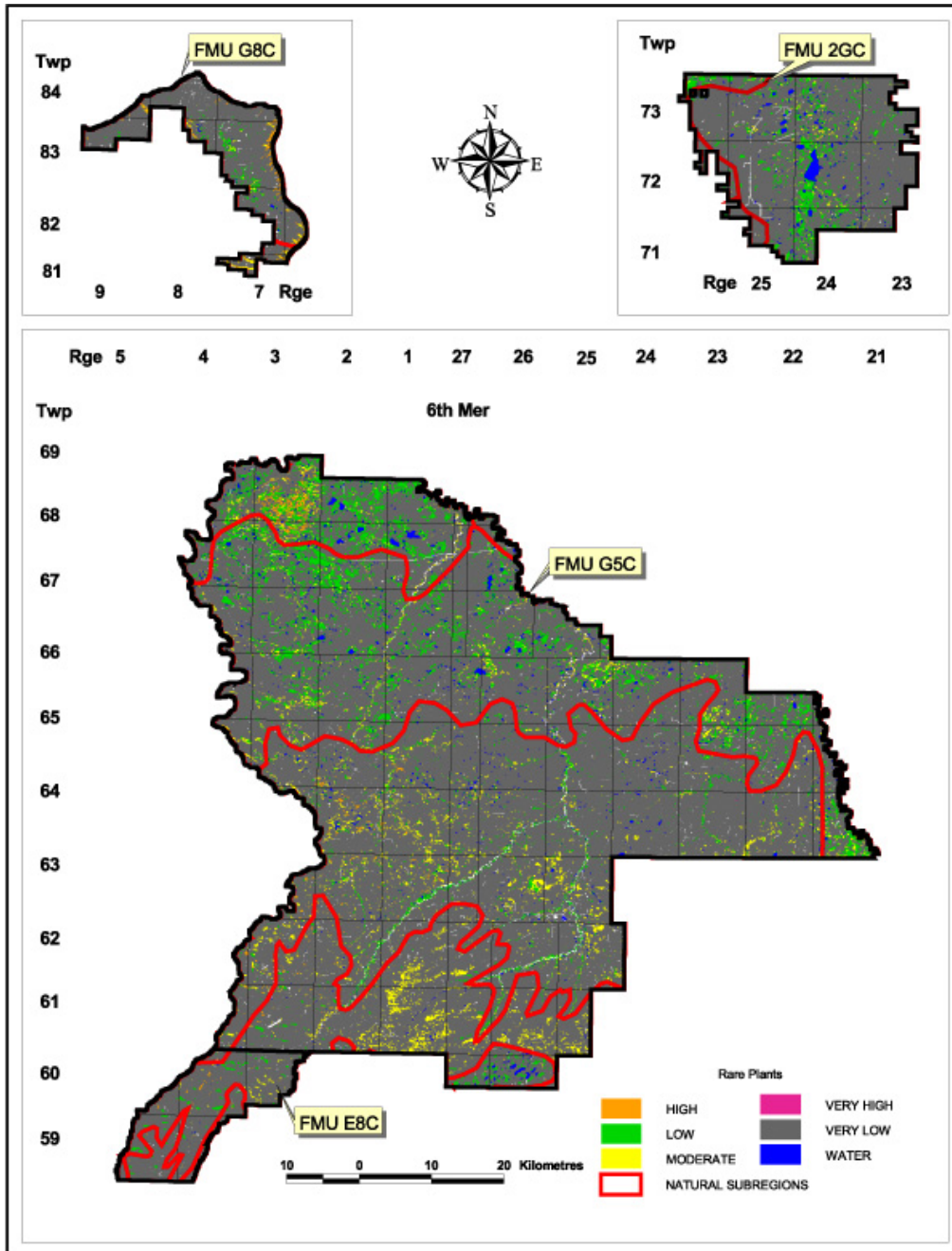


Figure 69. Frequency Distribution of the Likelihood of Finding a Rare Plant Species Within the FMA Area

Table 23. Summary of Rare Plant Likelihood Classes for the FMA Area

DFMP_Tables.xls

Table 75

Ecosite by Natural Subregion	Final Ecosite Score (ECS _{final})	Standardized Ecosite Score (ECS _{stand})	Total Ecosite Area (ha)	Ecosite Proportion of Subregion	Standardized Ecosite Proportion of Subregion (EP _{stand})	Adjusted Ecosite Score (ECS _{adjusted})	Likelihood Class ¹
BOREAL MIXEDWOOD							
blueberry (b)	10.8	116.31	605	0.002	94.97	1.22	VH
lichen (a)	10.8	116.31	940	0.003	95.04	1.22	VH
horsetail (f)	9.6	110.79	8,203	0.026	96.78	1.14	H
Labrador tea/horsetail (h)	9.6	110.79	10,641	0.033	97.31	1.14	H
Labrador tea/subhygric (g)	8.3	104.80	4,911	0.015	95.95	1.09	H
Labrador tea-mesic (c)	6.3	95.59	2,748	0.009	95.50	1.00	M
grassland (n)	6.2	95.13	991	0.003	95.04	1.00	M
meadow (m)	6.1	94.67	2,571	0.008	95.42	0.99	M
marsh (l)	5.8	93.29	37	0.000	94.82	0.98	L
rich fen (k)	6.1	94.67	8,049	0.025	96.71	0.98	L
poor fen (j)	5.8	93.29	17,928	0.056	99.05	0.94	L
bog (i)	3.6	83.16	11,358	0.035	97.46	0.85	VL
low-bush cranberry (d)	6.3	95.59	98,208	0.306	117.98	0.81	VL
dogwood (e)	6.3	95.59	140,451	0.438	127.97	0.75	VL
LOWER FOOTHILLS							
bearberry/lichen (b)	12.5	119.69	328	0.001	94.29	1.27	VH
hairy wild rye (c)	12.5	119.69	513	0.002	94.37	1.27	VH
grassland (a)	8.5	104.69	258	0.001	94.29	1.11	H
horsetail (i)	8.5	104.69	3,185	0.014	95.39	1.10	H
Labrador tea/horsetail (j)	8.5	104.69	11,590	0.051	98.51	1.06	H
Labrador tea-subhygric (h)	7.3	100.19	13,151	0.058	99.10	1.01	M
marsh (n)	5.9	94.94	22	0.001	94.29	1.01	M
meadow (g)	5.9	94.94	1,745	0.008	94.88	1.00	M
rich fen (m)	5.9	94.94	2,050	0.009	94.97	1.00	M
poor fen (l)	5.9	94.94	9,684	0.043	97.84	0.97	L
Labrador tea-mesic (d)	5.7	94.19	16,536	0.073	100.37	0.94	L
bog (k)	3.0	84.06	3,886	0.017	95.64	0.88	VL
low-bush cranberry (e)	5.7	94.19	71,171	0.315	120.79	0.78	VL
bracted honeysuckle (f)	5.7	94.19	83,245	0.368	125.27	0.75	VL
UPPER FOOTHILLS							
bearberry/lichen (b)	12.5	117.14	4	0.000	93.18	1.26	VH
hairy wild rye (c)	12.5	117.14	1,064	0.012	94.26	1.24	VH
horsetail (j)	9.3	105.75	321	0.004	93.54	1.13	H
grassland (a)	9.1	105.04	200	0.002	93.35	1.13	H
Labrador tea/horsetail (i)	9.3	105.75	2,464	0.028	95.72	1.10	H
meadow (g)	7.2	98.28	283	0.003	93.44	1.05	M
rich fen (m)	7.2	98.28	348	0.004	93.54	1.05	M
poor fen (l)	6.9	97.21	839	0.009	93.99	1.03	M
Labrador tea-subhygric (h)	7.7	100.05	12,718	0.143	106.20	0.94	L
bog (k)	3.8	86.17	1,701	0.019	94.90	0.91	L
Labrador tea-mesic (d)	4.8	89.73	15,912	0.179	109.48	0.82	VL
tall bilberry/arnica (e)	4.8	89.73	23,907	0.269	117.69	0.76	VL
bracted honeysuckle (f)	4.8	89.73	26,857	0.302	120.69	0.74	VL
SUB-ALPINE							
bearberry/lichen (b)	16.5	113.10	0	0.000	0.00	-	-
hairy wild rye (c)	16.5	113.10	123	0.009	93.54	1.21	VH
grassland (a)	11.6	101.21	2	0.000	92.95	1.09	H
meadow (e)	9.4	95.88	16	0.001	93.01	1.03	M
fen (i)	9.4	95.88	497	0.036	95.33	1.01	M
horsetail (g)	12.7	103.88	2,678	0.195	105.85	0.98	M
rhododendron-subhygric (f)	12.7	103.88	3,541	0.258	110.03	0.94	L
bog (h)	4.0	82.77	530	0.039	95.53	0.87	VL
rhododendron-mesic (d)	7.1	90.29	5,773	0.421	120.82	0.75	VL

Note 1. VH = Very High Likelihood, HL = High Likelihood, ML = Moderate Likelihood, LL = Low Likelihood, VL = Very Low Likelihood

Source: *Plant Resource Evaluation* (Canfor 2001f)



7. Endangered and Threatened Wildlife

The goal is to maintain flora and fauna on the landscape (Section G “Critical Element 1b, Goal 1.2”). This can be achieved by providing habitat for their life requisites: food, shelter, escape and breeding. An objective has therefore been established to develop management strategies to address the identified endangered or threatened wildlife species within the FMA area (Section G “Critical Element 1b, Objective 1.2c.1”).

For this plan, endangered or threatened wildlife species are designated as the provincial ‘At Risk’²⁸ and ‘May be At Risk’ listed species (refer to Section F 5.3.1 regarding information on the status of Alberta’s wildlife). The wildlife species that are classified as endangered or threatened are those species that no longer have the capability to withstand the cumulative effects of habitat loss, isolation and increased competition. These species also tend to be sensitive to human disturbance. Their populations have either declined or are in danger of declining to non-viable levels throughout their distribution ranges, making them the most vulnerable portion of Alberta’s biodiversity (Alberta Environmental Protection 1996b).

Canfor commissioned a report on the habitat requirements for selected indicator species in 1997. Included within the report is a status ranking of species that may occur within the FMA area and a preliminary management recommendation written up for each species (Snyder 1997). This list was used to assist in development of the 7 selected indicator species discussed in Section G “Critical Element 1b, Indicator 1.1b”. Also refer to Section F 5.3.

Since that time, specific management strategies have been developed for woodland caribou and trumpeter swan, which are ‘At Risk’ and “May Be At Risk’ listed respectively (refer to Section F 5.3.3.1 and F 5.3.3.2 for information on woodland caribou and trumpeter swan respectively). Strategic and operational strategies will be developed and implemented for species that have not currently been addressed to ensure the Company’s operations do not adversely affect their habitat. In the interim, Canfor will continue the coarse-filter approach to wildlife management for those species. This approach assumes that if habitat is maintained and available for the 7 identified selected indicator species, then the FMA area will contain a wide range of habitat conditions suitable for many other species.

The preliminary step towards development of the strategies to address the provincial ‘At Risk’ and ‘May Be At Risk’ listed species within the FMA area will be to confirm species presence. From there, strategies for confirmed species will be developed by May 2002. Progress towards developing the strategies will be reported in the *Annual Performance Monitoring Report*.

8. Physical Environments

Physical environments are a combination of rare physical environments and areas of special interest. However, these sites may have different management objectives.

²⁸ According to *The General Status of Alberta Wild Species 2000*, “At Risk” means any species known to be “At Risk” after formal detailed status assessment and designations as “Endangered” or “Threatened” in Alberta. ‘May Be At Risk’ means any species that “May Be At Risk” of extinction or extirpation, and is therefore a candidate for detailed risk assessment.



8.1 Rare Physical Environments

The desired condition or management strategy is to provide a degree of protection by not harvesting fiber in areas that are officially classified as rare physical environments.

The areas protected from harvest are the Parabolic Sand Dunes and Alberta Special Places designation Dunvegan West Wildland (O.C.508) (comprising areas formerly known as Cactus Hills, Peace Parkland, and Peace River Dunvegan) (refer to Section G Figure 115). These areas, also referred to as rare physical environments, have been excluded from the landbase in the net-down process for calculation of the annual allowable cut (AAC) (Table 4).

To conserve ecological diversity, a goal has been established where 100% of identified and validated rare physical environments will not be harvested (Section G “Critical Element 1a, Goal 1.1a.1”).

In addition, a commitment has been made to maintain a combination of managed and rare physical environments within the FMA area (Section G “Critical Element 3a, Objective 2.3a.1”). A combination of protected areas and managed areas are currently maintained within the FMA area, with 10,585 ha designated as rare physical environments (Table 24). Any candidate site for rare physical environment status that arises in the future will be evaluated based on merit.

Table 24. Rare Physical Environments

DMP_Tables.xls
Table 60

Rare Physical Environment	Area (ha)
Alberta Special Places (Dunvegan West Wildland):	
Cactus Hills (84-9-W6M)	214.8
Peace Parkland (81-7-W6M)	1,172.3
Peace River Dunvegan (81 to 83, 7 & 8 - W6M)	3,084.0
Subtotal	4,471.1
Parabolic Sand Dunes	6,114.2
Total	10,585.3

Source: Canfor compiled data

8.1.1 Alberta Special Places

The Alberta Special Places Program, initiated by the Alberta Government, aims to complete a network of protected areas to preserve the environmental diversity of the province's 6 Natural regions and 20 subregions. The program balances the preservation of Alberta's natural heritage with 3 other cornerstone goals: heritage appreciation, outdoor recreation and tourism/economic development. Although preservation is the main goal, each site is

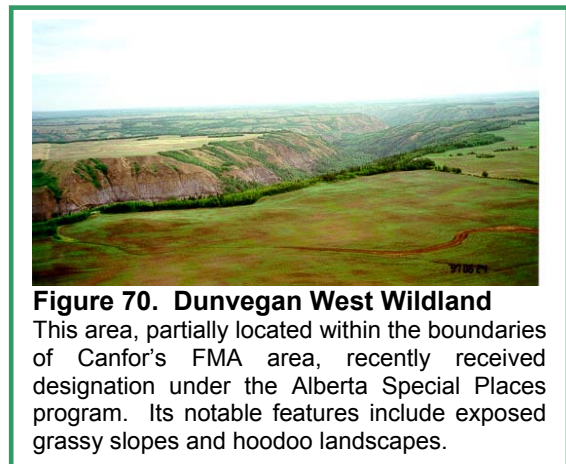


Figure 70. Dunvegan West Wildland
This area, partially located within the boundaries of Canfor's FMA area, recently received designation under the Alberta Special Places program. Its notable features include exposed grassy slopes and hoodoo landscapes.

unique in balancing this with the other 3 program goals. Not all activities are appropriate within each site²⁹.

With the approval of the Forest Management Advisory Committee, Canfor nominated 2 sites for Special Places status including Cactus Hills (84-9-W6M) and Peace Parkland (81-7-W6M). Following a request by the Dunvegan West Local Committee, Canfor also included an area called Peace River Dunvegan (contained in the FMU G8C) (Figure 70). On December 20, 2000, these areas received official designation as a special place as part of the Dunvegan West Wildland (O.C. 508). The Dunvegan West Wildland, which comprises 20,968 ha, contains 4,471 ha within the FMA area and 16,497 ha outside the FMA area (Table 25). Notable features of the Wildland include hoodoo landscapes, exposed grassy slopes, fossil beds and habitat for geese, moose, elk, deer and birds of prey.

Table 25. Dunvegan West Wildland Within and Outside the FMA Area

DMP_Tables.xls
Table 19

Alberta Special Places	Area (ha)
Dunvegan West Wildland Within the FMA Area	
Cactus Hills (84-9-W6M)	214.8
Peace Parkland (81-7-W6M)	1,172.3
Peace River Dunvegan (81 to 83 - 7 & 8 - W6M)	3,084.0
Subtotal	4,471.1
Dunvegan West Wildland Outside the FMA Area	16,496.9
Total	20,968.0

Source: Canfor GIS

8.1.2 Parabolic Sand Dunes

Parabolic sand dunes comprise 6,141 ha within the FMA area (68 and 69-3-W6M). (refer to Section G Figure 115 and Table 24). These dunes are crescent-shaped, with their long axis transverse to the dominant wind direction. They form when scattered vegetation stabilizes sediments and a U-shaped pattern of sand develops between clumps of plants (Figure 71). This uncommon landform is stabilized by lodgepole pine stands. Drainage between the dunes is poor, which has allowed black spruce to establish on the fens.

8.2 Areas of Special Interest



Figure 71. Parabolic Sand Dunes

This rare physical environment, comprising 6,141 hectares within the FMA area, is protected from harvest.

²⁹ http://www.gov.ab.ca/env/parks/sp_places/

Four areas within the FMA area are classified as areas of special interest: historical resources, wildlife mineral licks, grasslands and low productive sites. The following sections describe each area in more detail.

8.2.1 Historical Resources

Protection of Alberta's archaeological, palaeontological and other historic resources are provided under the *Historical Resources Act*. Alberta Community Development is responsible for administering the Act. Under the Act, every developer who creates impacts upon the landscape, including the forest industry, is expected to undertake historical resource overviews, impact assessments and mitigation measures in order to properly identify, evaluate and manage any recorded or unrecorded historical resources. In November 2000, Alberta Community Development issued a directive (correspondence dated November 14, 2000) requiring the forest industry to develop a formal process for meeting the intent of the *Historical Resources Act*.

Quick Facts	
Protection of Historical Resources in Canfor's Fma Area	
1998 –	Historical and archaeological resource overview assessment conducted on FMA
Pre 2000 –	Informal protection of historical resources
2000 –	Manual heritage potential evaluation of operational practices conducted
2001 –	Manual heritage potential evaluation of operational practices conducted
2002+ –	Heritage evaluation conducted using a regionally specific model.

In 1998, Canfor conducted a Historical and Archaeological Overview Assessment on the FMA area. The overview provided a general indication of where high potential sites may occur on the landscape (mainly close to rivers and high points).

An objective has been established to reassess the status of the existing archaeological overview assessment that was completed on the FMA area and update, if necessary (Section G "Critical Element 6c, Objective 1.3a.1").

As a result of the 2000 directive and the above-mentioned objective, Canfor retained Alberta Western Heritage in July 2000 to develop a plan for meeting the requirements of the *Heritage Act*. The plan will be implemented in 2 stages:

1. Utilize a manual approach in selecting sites to be assessed for heritage evaluation of harvesting, road building and silviculture plans with regard to the heritage resource potential on lands within the FMA area. This approach will be used until a heritage management model is fully functional in March 2002; and
2. Implement an Alberta Community Development approved heritage management model to determine sites to be assessed with regard to heritage resource potential.

The focus of the heritage evaluation (Gibson 2001), whether it is manual or by model, is to evaluate an area's potential as being high, medium or low in terms of a presence of historical resources. Over the years, archaeologists identified a number of key factors that may indicate a high or medium potential and these key factors were incorporated into a heritage management model. To evaluate the potential for historic resources, the model compares information about operational activities, such as slope, aspect, soils and hydrology, with other sites where historical finds were made. Based on the type of



activity and level of ground disturbance, as well as the site potential calculated by the model, Canfor personnel can assess whether or not a detailed heritage survey is required prior to commencing any planned activity. Any site that has a high potential for historic resources requires that an archaeologist be retained to assess the site.

Alberta Western Heritage has arranged a partnership with a number of the forest companies within and near the FMA area to enhance the application of the management model. All companies that participate will have access to this management model approach. Alberta Community Development is supportive of this approach.

8.2.2 Wildlife Mineral Licks

Wildlife mineral licks are areas that tend to be relatively wet and have a concentration of mineral salts that provide nutrition to various wildlife species. (Figure 72) In order to be significant, licks must be used by wildlife on a regular basis.

Significant wildlife mineral licks are identified during the operational planning stages. Licks are protected with a 100 m “no harvest” buffer and recorded into the Company’s spatial database.

An objective has been established to protect 100% of the identified significant wildlife mineral licks (Section G “Critical Element 1b, Objective 1.1c.1”). Protecting wildlife mineral licks is a current practice. Commencing in May 2001, a monitoring procedure will be implemented to verify that the objective is being achieved. New field staff will require training in the identification of wildlife mineral licks.

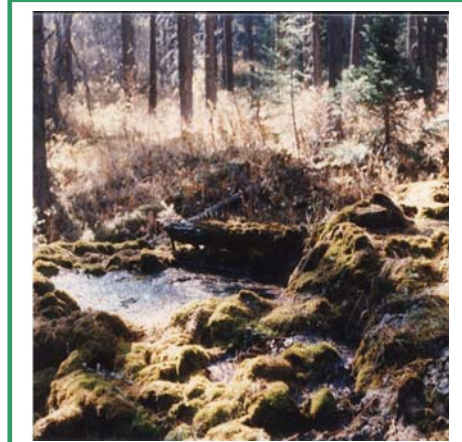


Figure 72. Wildlife Mineral Licks
Canfor protects all significant wildlife mineral licks with a 100 m “no harvest” buffer.

8.2.3 Grasslands

Grasslands possess ecological values that make them important (Figure 73). To ensure these areas remain in their natural state, an objective has been established to have no active reforestation of grasslands (Section G “Critical Element 3a, Objective 2.1a.2”).

There are 4,654 ha of grasslands (0.72% of the gross landbase) within the FMA area. Grasslands are defined in the Alberta Vegetation Inventory version 2.1 as naturally non-forest vegetated land having less than 6% canopy cover and are greater than 4 ha in area. These sites are not included in the *Resource and Timber Supply Analysis* (Appendix 3).

The target is to ensure no grasslands are reforested; however, an acceptable variance of less than 0.5 ha of grasslands adjacent to a harvested area being reforested is considered acceptable.



Figure 73. Grasslands
There are 4,654 ha of grasslands within the FMA area. These ecologically important sites will not be reforested.

Source: Canfor 2001a

Based on a database query for the period 1998–1999, approximately 1.9 ha of grassland were reforested (representing 9 separate harvested areas, averaging 0.2 ha per incident, which is within the acceptable variance). It should be recognized that these areas have not been field verified and may be a result of the inherent variability of AVI typing.

To ensure that no reforestation of grasslands occurs in the future, the existence of grasslands (greater than 4 ha) located adjacent to or within proposed harvest areas will be confirmed and identified in operational plans.

8.2.4 Low Productive Sites

A number of stands within the FMA area were identified, based on overstorey and understorey tree canopy composition and density from AVI data as being unsuitable for timber production due to low productivity (Figure 74). Productivity generally refers to the innate capacity of an environment to produce plant and animal biomass. Within forestry specifically, it is the wood volume or yield that trees can produce within a given period of time. An objective has been established to designate all low productive yield groups as “no harvest” zones, subject to operational verification (Section G “Critical Element 4c, Objective 1.1c.1”).

In terms of the resource and timber supply analysis done for this Detailed Forest Management Plan (DFMP), low productive sites are identified as yield group 13; basically black spruce and larch stand types (25,816 ha) (Canfor 1999h). These stands are frequently wet sites. If harvested, establishment of regeneration on these sites can be problematic due to high water tables and vegetation competition. Irrespective of their productivity levels, leaving low productive sites on the landscape enhances ecological diversity and provides other important attributes (i.e. wildlife habitat, thermal cover, travel corridors, etc.). These areas have been excluded from the landbase in the net-down process before the calculation of annual allowable cut (AAC) for the DFMP.

Canfor delineates all low productive sites (>1 ha) within harvested areas as “no harvest” zones (Section G “Critical Element 4c, Objective 1.1c.2”). These areas are delineated and verified operationally and recorded on 1:5,000 scale block maps.

It should be noted that, when making comparisons from overlaying actual harvested areas to the AVI map base, it may appear that some of these low productive sites were harvested. This is a result of differences between the interpreted area versus the actual area.



Figure 74. Low Productive Sites

These are typically black spruce and larch areas that are wet and, if harvested, they are difficult to regenerate. They play an important ecological role for wildlife habitat, thermal cover and travel corridors.

Source: Canfor 2001a

9. Soil Productivity

Forest or stand productivity can be directly attributed to both the intrinsic and extrinsic environmental conditions of the site. One of the primary factors that significantly influences forest or stand productivity is soil or edaphic conditions (moisture and nutrients) (Grier *et al* 1989; Beckingham *et al* 1998). Anthropogenic disturbances that modify the physical soil processes also affect soil productivity. These modifications (disturbances) are primarily classed into 3 categories: compaction, erosion and soil chemical alteration (McNabb 1995).

9.1 Strategic Initiatives

Soil productivity is conserved when site quality is maintained. The goal is to minimize the impact on soil productivity (Section G “Critical Element 3b, Goal 1.1”). To achieve this goal, 3 objectives have been established:

To develop a methodology to measure coarse and fine woody debris (CWD) on site after harvesting (Section G “Critical Element 3b, Objective 1.1b.1”);

To develop a predictive model of site quality (includes soil productivity) to aid in the formulation of site-specific forest management (Section G “Critical Element 3b, Objective 1.1a.1”); and

To meet the forest soil conservation guidelines (Section G “Critical Element 3b, Objective 1.1c.1”) by minimizing soil disturbance.

9.1.1 Coarse Woody Debris (CWD)

As part of the Detailed Forest Management Plan (DFMP) process, a target range of CWD will be established. The targets will be based on an assessment of the existing CWD data (ORM 2001c). Refer to Section G “Critical Element 3b, Objective 1.1b.1” for details.

9.1.2 Predictive Model of Site Quality

Soil productivity is directly related to tree productivity (growth and volume). Thus, maintenance of soil productivity is an important consideration for short-term operational planning and long-term sustainable forest management. Canfor conducted a forest productivity evaluation project (Canfor 2001) to develop a model to predict site quality and potential soil productivity for the FMA area. The model became available April 2001. It ties tree productivity (site index) to ecological function (ecosite), providing a framework for an ecologically based evaluation of site-specific forest management activities. The model will be evaluated and tested to determine its use in strategic and operational planning. It has the potential for:

- Identifying “high quality and high return” areas;
- Identifying areas for intensive forest management;
- Incorporation of productivity ratings into growth-and-yield program;
- Assessing stand level productivity; and
- Evaluating soil, site and vegetation parameters as potential indicators of site productivity.



9.1.3 Minimize Soil Disturbance

Woodlands operations are conducted in a manner that maintains soil productivity by minimizing soil disturbance caused by road construction. Refer to Section F 4.1.2.2 for additional information on those initiatives (prevention of rutting and compaction).

9.2 Plants as Indicators of Soil Nitrogen

Minimizing disturbances that negatively impact nitrogen cycles was identified as an important goal by the Forest Management Advisory Committee (Section G “Critical Element 4a, Goal 1.3”). To achieve that goal, an objective was established to understand, through modeling, the role of vascular plants as indicators of potential nitrogen levels (Section G “Critical Element 4a, Objective 1.3b.1”).

Canfor retained Geographic Dynamics Corp. (GDC) to investigate and summarize some of the relationships that have been identified between vascular plants and nitrogen parameters. There were 2 main objectives for the project:

1. Extract and compile data concerning the relationship between plant species and nitrogen parameters from the Plant Resource Evaluation report (Canfor 2001f), and rank plant species from high to low nitrogen concentration; and
2. Investigate the relationship between ecosite and nitrogen parameters, and develop a map of potential nitrogen concentration across the FMA area.

A draft report *The Role of Vascular Plants as Indicators of Potential Nitrogen Levels* (Canfor 2001j), has been produced and is being reviewed by Canfor. A final report is scheduled for completion in August 2001.

10. Logging Aesthetics

Logging aesthetics have been defined from the FMAC *Issues List* as:

- Aesthetics (unpleasant) of cutblocks when viewed from a distance (landscape perspective);
- Aesthetics of debris left within cutblocks located immediately adjacent to main roads. Although down woody debris may look visually unappealing, the debris plays an important role in nutrient cycling and provides microsites for coniferous seedlings and habitat for wildlife);
- Aesthetics of roads into cutblocks;
- Aesthetics of garbage left on site such as barrels, oilcans, hoses, etc. This needs to be cleaned up and the roads need to be reclaimed upon completion; and

Aesthetics of Company signs along main roads indicating year of harvesting and year of successful reforestation are very positive and Committee would like to see this practice continue.

Canfor's Public Involvement Plan (Canfor 2001b) makes provisions for obtaining and incorporating input from stakeholders into forest management plans as far as reasonably possible. If a localized (site-specific) visual aesthetic concern arises, Canfor evaluates the alternatives and develops plans for addressing the issue.

To address the issue of cutblock aesthetics, the Company utilizes the following methods to improve the general appearance of harvested areas, and to address debris and road



issues as indicated above:

- Variable retention (refer to Section F 5.4 for additional information regarding variable retention);
- Irregularly shaped boundaries;
- Burning top piles (refer to Section F 5.5 for additional information on top piles);
- Proper erosion control measures and roll back of temporary roads; and
- Clean-up policies to ensure proper disposal of garbage.

11 Access

The FMA area has a network of roads used by the forest industry, petroleum industry, hunters, trappers, outfitters, and the public.

Access is discussed in this plan in two contexts. "Access" in this section refers to the network of road systems that are used to extract timber from the forest. "Access" is also discussed in various parts of this document in other contexts such as access for recreation or predator access. While strategies pertaining to "Access" as road systems are mostly operational in nature (ground rules), "Access" as a management strategy is usually expressed as part of a larger ecological objective. These are discussed in Section G in relation to specific management objectives (refer to "Critical Element 3a, Objective 1.1a.1", "Critical Element 3a, Objective 1.1b.1", "Critical Element 3b, Objective 2.1a.1", "Critical Element 3c, Objective 1.1a.1", "Critical Element 3c, Objective 1.1b.1", "Critical Element 4c, Objective 1.1a.1" and "Critical Element 4c, Objective 1.3a.1").

There is a high volume of traffic using Canfor's road system in the FMA area, and safety is a key concern. Canfor employs a "road patrol" contractor who checks and monitors traffic on the roads and communicates safe driving practices to the many users. There is a posted speed limit of 80 kph (maximum) which is enforced by radar. All Canfor roads that are used for log haul are radio controlled. Most commercial users are required to have the Company's radio frequency when traveling within the FMA area. Road reclamation and deactivation is discussed in Section F 4.1.4

11.1 Road Classes

Canfor constructs a range of road classes. Refer to Table 26 for a more detailed description of each of the different road classes:

- Main access roads are Classes I - IV (permanent) and require a License of Occupation (LOC) from the Alberta Government (Figure 75);
- "R-roads", which are temporary roads that access harvested areas, are road Classes IV or V (temporary); and
- Internal cutblock roads are road Classes IV or V (temporary).

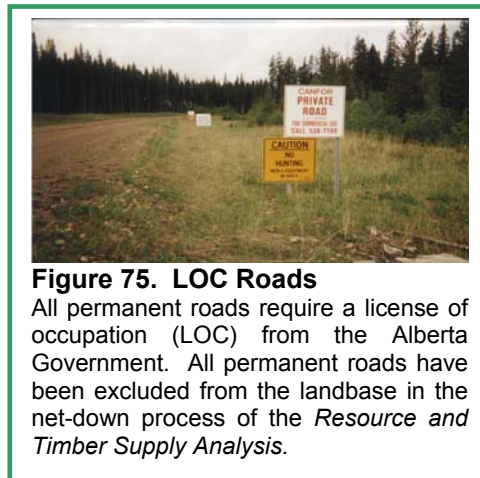


Figure 75. LOC Roads

All permanent roads require a license of occupation (LOC) from the Alberta Government. All permanent roads have been excluded from the landbase in the net-down process of the *Resource and Timber Supply Analysis*.