4.0 Maintenance of Ecosystem Condition and Productivity

4.1 Background

Maintenance of ecosystem condition and productivity, is a reflection of the need to maintain forests in a healthy and productive state enabling them to support the diversity of life that occurs within them. An interwoven complex of biological processes operating at both temporal and spatial dimensions determines how forests function. Measures of these processes indicate whether levels of energy transfer, nutrient cycling, recovery potential and species productivity are sufficient to ensure sustainability (CCFM 1997a). The boreal forest that comprises the region occupied by FML 01 is adapted to incidents of disturbance and stress for its rejuvenation. Disturbances from forest fire and insect infestations and disease outbreaks provide the opportunity for new stands to become established. The proper balance of these processes is important to maintain forest ecosystem condition and productivity.

Maintenance of ecosystem condition and productivity can be viewed in the context of two values:

- Disturbance and stress
- Biomass

A single matrix is utilized to cover the maintenance of ecosystem condition and productivity and is presented at the end of this Section in Table 4:

Table 4 Maintenance of ecosystem condition and productivity

4.2 Disturbance and Stress

4.2.1 Introduction

Disturbance and stress, is reflected in the measurement of the intensity and extent of disturbances and stresses that impact upon the forest ecosystem. These components are represented in Table 4. As noted earlier, forest ecosystems rely on these processes to undertake the natural cycle of death and renewal Youngblood and Titus (1996) state that the major boreal forest tree species have developed several physiological characteristics allowing them to regenerate and perpetuate following a major stand replacing event. In the case of the boreal forest of which FML 01 is comprised, the principal agents of disturbance are forest fire, insect infestation and timber harvesting (CCFM 1997b).

Natural disturbance agents, particularly fire and insect infestation, shape the landscape mosaic of the boreal forest. Natural levels of disturbance and stress exist in any system and will continue to shape the landscape despite interference by man. Disturbance from harvesting

contributes to the forested landscape mosaic significantly and impacts to the components of ecosystem condition and productivity are considered in context to natural disturbance.

As noted on Table 4, impacts of forest management activities upon components related to ecosystem resilience have been incorporated into Table 1 and the associated text discussion, particularly discussion related to landscape level ecological diversity components.

4.2.2 Data Adequacy and Gaps

FSP sources of information include:

- Historical review of insect attacks for FML 01 (Section 3.1.6) and accompanying maps (Figure 3.8a and 3.8b) and table (Table 3.7).
- Historical review of forest fires for FML 01 (Section 3.1.6) and accompanying map (Figure 3.7) and table (Table 3.6).
- Historical review of timber harvesting for FML 01 (Section 5.1.1.1) and accompanying maps (Figure 5.3 and 5.4) and table (Table 5.1).
- Historical review of forest renewal activities for FML 01 (Section 5.1.3) and accompanying table (Table 5.5).
- Manitoba FEC V-type description for FML 01 (Sections 3.1.9)
- MC Forest Inventory including forest tree species and age class description (Sections 3.1.7 and 5.9.4) and accompanying maps (Figure 3.10, 5.26 and 5.27) and tables (Table 3.5, 5.15, 5.16 and 5.17).
- MC Parks and Natural Areas enduring features analysis for Ecoregion 90 Section 3.5.2) and accompanying maps (Figure 3.18 and 3.19).
- Description of other biophysical features for FML 01 such as climate, geology, soils, forest associations, carbon budget and water resources (Section 3.1).

Other sources of information include:

- On-going update of MC Forest Inventory by the Province including forest tree species and age class (cutting class)
- Manitoba FEC system (V-types and S-types) in place for Provincial forest resource including FML 01
- High Conservation Value Forest Assessment report (Kotak et.al. 2009) for FML 01.

On-going Operational Data Sources include:

- PHA (WDS – 002) including any noted insect, disease and fire incidences, tree and understory vegetation, volumes, age class, FEC V-type, soils description and other values
- On-going monitoring (and reporting to MC) of timber harvest and forest renewal levels by reported by Tembec in Annual Reports for FML 01 and monitoring of insect, disease and forest fire levels by MC
- Local Level Indicator reports of sustainable forest management (Tembec 2009)

These sources of information represent the best information currently available for the monitoring and reporting of incidences of disturbance and stress on FML 01. Regular updating of the MC Forest Inventory by Tembec (WDS – 001) for harvest and renewal activities and by the Province for forest fire and insect/disease depletions will continue to provide one tool for monitoring disturbance and stress. This information also provides Tembec and MC with the necessary data to undertake wood supply modeling which allows for projection of sustainable harvest levels and possible forest management regimes (FSP Section 41 and 4.3).

4.2.3 Forest Management Activities Assessment

Planning

Planning activities generally have positive impacts to natural disturbance and stress agents of forest ecosystems. The disturbance and stress agents include insect infestation, disease incidence, forest fires and introduction of exotic species. To a large extent these natural agents significantly influence the boreal forest mosaic. Forest harvesting also plays a role in shaping the boreal forest landscape and it is through the planning process that efforts are made to operate within the range of natural disturbance patterns. Gluck and Rempel (1996) suggest that landscape ecology deals with ecosystem function and ecological structure and comparisons should be made of trends in patch density, shape and interspersion between natural and artificial disturbance patterns. In addition to planning harvest and subsequent renewal operations to approximate natural patterns, the planning process also allows incorporation of the outcome of natural disturbance events in determining planned harvest levels.

Road and watercourse crossing planning has positive impacts on insect and disease incidence through access development into areas for monitoring and control activities of insect and disease and access into areas of insect infestation or disease outbreaks for salvage operations. Such actions are limited to areas where road access is available or can be facilitated by use of existing roads and are dependant upon extent of damage and the wood specifications for the product being processed.

- Based upon survey information available from MC and the input from PHA, planning can incorporate the risk of future losses of timber and related values into decisions regarding

route locations. Subsequent harvest planning in such areas can assist in control of disease and insect infestation spread into adjacent areas.

Harvest renewal and planning has positive impacts on insect, disease and forest fire through the consideration of risk of these disturbance factors to timber and other values in determining the location and scheduling of cutblocks. In addition, planning of forest renewal incorporates consideration of risk factors for re-infection of disease, and susceptibility of insect attack, in setting out renewal prescriptions for species selection for renewal of affected areas (WDS – 008 and FSP Section 5.14.3).

- Through scheduling of cutblocks for salvage harvest of damaged stands (WDS – 010), insect infestation and disease incidence is positively impacted by reducing the further spread of the organism. Such actions are limited, as described earlier, to areas where road access is available or can be facilitated on an economic basis using existing roads. Indicators 2.1.1.4, 2.1.1.5 and 2.1.1.6 of the LLI framework provides for on-going monitoring of the level of productive forest salvaged from forest fire and insect and disease infested areas. Planning for harvest of stands susceptible to spruce budworm, as identified through PHA, provides a positive impact by minimizing the extent of insect infestation or disease outbreak.

- Scheduling of cutblocks to salvage insect or disease damaged timber positively impacts forest fire incidence by reduction of potential fuel sources from such areas.

- Harvest of timber susceptible to fire i.e. mature or overmature stands with a high fuel load of standing and downed woody debris, positively impacts forest fire incidence by reduction of fuel source.

- For renewal of cutblocks in locations susceptible to re-infection from adjacent infected areas, renewal planning will make use of information from the PHA to set out prescriptions for planting of non-susceptible species (WDS – 008).

- Planning of cutblocks to follow natural boundaries to the extent possible and the utilization of VRL practices will assist in the maintenance of natural disturbance patterns (WDS – 010 and WDS-WI-048).

Information collection and application positively impacts insect, disease and forest fire through identification of areas already infected or susceptible to future losses from adjacent areas and tracking of the particular resources available for fire protection.

- PHA data collection obtains information on stand conditions including insect and disease incidence and susceptibility (WDS – 002). This information can be used to reschedule or modify harvest operations for harvest of stands susceptible to attack. In addition, Tembec communicates with MC to assist in the identification of potential areas of infestation for consideration of MC in their survey and treatment programs. Related to this, LLI Indicator 2.1.1.4 and 2.1.1.5 identifies the status of insect and disease incidence and tracks areas recommended for treatment, as identified in MC insect surveys.

- Regeneration and FTG surveys at 7 and 14 year intervals, monitors performance of the growing stock and competition, as well reports on insect and disease incidence of regenerating stands. This information can be used to assist MC in monitoring insect and disease incidence.

- Several indicators from the C & I framework provide information useful in sustainability modeling and determination of sustainable harvest levels by allowing for incorporation of information related to natural disturbances in decision making:

    - Indicator 2.1.1.1 tracks the average area of productive forest depleted through forest fire.

    - Indicator 2.1.1.4 tracks the status of insect infestations and diseases.

    - Indicator 2.1.1.5 tracks the area treated for insect infestation and disease control as compared to the area recommended for treatment by MC.

- The collection of information associated with the preparation of the *Tembec Forest Fire Protection Plan* provides positive benefits to improve readiness for the protection of timber and non-timber values from fire. In addition, Indicator 2.1.1.2 tracks MC fire detection and suppression success to assist in understanding the application of these fire fighting resources in conjunction with those described in the *Forest Fire Protection Plan.*

Access management may impact forest fire and introduction of exotic species as a result of the control of traffic along specified routes.

Public use of the road network does provide potential for increased risk of man induced forest fires. It is reported by the CCFM (1997b), that on a national basis, people start 58% of the total number of fires. However, it is also reported that 85% of the total area burned is a result of lightning strikes (CCFM 1997b). While there is an increased potential for artificial starts, there is also improved access available to detect and action forest fire starts.

- Mitigation to this impact is provided through the terms of the Tembec FML Agreement, which provides for closure of roads to the public in times of high fire risk to help prevent such fire starts. Further mitigation is provided through the activities of MC, the agency with overall responsibility for management of forest fires in Manitoba. MC utilizes public education, restrictions, and forest closures in times of high forest fire hazard to alleviate concerns related to man-made starts of forest fires. Given these factors this impact is significant but mitigable.

Public use of all-weather roads can provide potential for the introduction of exotic species via the new road corridors. This includes the introduction of seed of evasive plant species. Given the intended use of these roads for delivery of wood to the mill, the

majority of the traffic is expected to be local to the area with low risk of introduction of exotic species. It is expected that most users of these roads will limit their travel to the road corridor itself with little opportunity for any potential exotic plant species to be transported beyond the road right-of -way.

Infrastructure Development

Infrastructure development, with the exception of camps, has positive impacts upon the capability to identify and protect timber and non-timber values from disturbance and stress agents. Camps present potential risk of forest fire starts as a result of human activities in the area.

All-weather and dry-weather road construction and road maintenance can have positive impacts to forest protection from insect, disease and forest fires.

- Construction of all-weather roads can have a positive effect in reducing the effects of insect infestation, disease outbreaks and forest fires by providing access that enables earlier detection of outbreaks and quicker and more cost effective response. Roads built into previously inaccessible areas of FML 01 allows salvage opportunities in areas subjected to insect and disease infestations with subsequent forest renewal to rapidly regenerate the area. Improved access throughout FML 01 generally will allow scheduling of stands for harvest to minimize the impact of insect and disease outbreaks.

- Maintenance of roads and particularly ROW, provides a significant fire break to minimize the spread of fire.

Camp development can have similar impacts to road construction in terms of forest fires. Placing people in these areas creates potential for man-made fire starts; while at the same time provides manpower in place for detection and initial attack of fire starts in the vicinity. Camp development can also impact through introduction of exotic species.

- Mitigation is provided through education, and regulation, both through Tembec and MC. As described above, Tembec produces a *Forest Fire Protection Plan* on an annual basis that is provided to MC. All contractors and Company employees must follow the requirements for fire prevention, detection and suppression as outlined in this plan and WDS – WI - 022. These steps provide mitigation to this potentially significant impact.

- Location of people in these camps also provides a similar positive impact to that described earlier in that proximity of these workers and equipment to the forest operating areas allows for earlier detection and fire fighting response to any potential fire starts, either man-made or lightning caused.

- For similar reasons to those described for road corridors, development of camp areas with associated cleared areas may provide opportunity for introduction of exotic plant

species. Given the local nature of travel in and out of these camps and the limited opportunity for these species to establish along roadside, this potential impact is insignificant.

Decommissioning through road closure or deactivation provides positive impacts to the introduction of exotic species through reduction in public access and promotion of conditions that limit the ability of such species to proliferate (WDS – WI – 035, 036, 037 and 039).

Harvesting

Harvesting activities impact disturbance and stress agents mainly through the potential of increased incidence of pine/sawyer beetle populations and the increased potential for fire starts.

Logging, slashing and woody debris management activities can promote conditions favorable for insect attack while also being useful treatments for the control of disease and insect infestations.

- Through the provision of a food source in the logging slash remaining in the cutover after harvest, this activity can increase the risk of insect infestation. When adults are abundant *Monochamus* sawyer beetles will move out into the surrounding perimeter causing damage to the standing timber (Rose and Lindquist 1973). Such attacks normally occur in stands of overmature trees with weak defense mechanisms to fight off the beetles and are insignificant in a landscape context.

- Logging can have a positive impact in terms of insect and disease outbreaks through scheduling of harvest blocks for salvage of damaged stands thereby minimizing losses and curtailing spread of the outbreak (WDS – 010). Positive effects in terms of salvage of fire damaged trees is also possible dependant upon the extent of damage to the timber and the product being processed.

- As noted, cleared areas such as those created on newly harvested sites, can provide exposed soil conditions suitable for the introduction of exotic plant species. Given the local nature of travel into these areas the potential of this is insignificant. Mitigation is provided by the prompt renewal of these areas, as outlined in the FSP section 5.14.3 reducing the opportunity for establishment of these species.

Timber storage may significantly impact upon the potential for insect attack in cases where timber is stored over a long period of time allowing the sawyer beetle to become established and move into surrounding forest, if available and if stand conditions permit.

- In most cases timber will be stored over one season only and delivered to stock pile sites effectively mitigating this potential insignificant impact within harvest areas.

- Timber stored in permanent stock pile sites, within the forested area, contains timber on a continuous basis and has the potential for significant localized impacts. The

establishment of permanent stock pile sites in upland sites dominated by hardwood species mitigates the potential for sawyer beetle infestation of adjacent timber.

Forest Renewal

Forest renewal activities generally have positive impacts to disturbance and stress agents through the application of treatments to encourage the prompt renewal of healthy forest stands.

Tree establishment can positively impact insect and disease incidence by tree planting of non-host species following harvesting of infected areas. Examples of this could include planting of spruce as a control measure in areas of jack pine previously infected by pine dwarf mistletoe or black spruce in areas of balsam fir attacked by spruce budworm (WDS – 008). Forest renewal activities assist in the overall resilience of the ecosystem promoting the establishment and growth of healthy new stands which helps to balance the depletions resulting from harvesting and natural disturbances.

- Any potential insignificant impact for planting non-host species is mitigated through the use of locally derived seed stock for tree seeding and tree seedling propagation, as described earlier.

- Forest renewal activities are followed up with monitoring processes to track and report upon progress made in achieving targets including indicators from the LLI:

    - Indicator 2.1.2.1 tracks harvested area successfully reforested and certified as achieving site renewal targets at 7 year regeneration survey.

    - Indicator 2.1.2.2 tracks harvested area successfully reforested and certified as achieving site renewal targets at 14 year FTG survey.

Site preparation and tree establishment through renewal of cutover areas has a positive impact on the introduction of exotic plant species. Accelerating the forest renewal process decreases the opportunity for establishment of these species.

Forest Protection

Forest protection activities are put into place to control the disturbance and stress components of insect, disease and fire to provide protection for identified timber and non-timber values. The impacts of these activities assist in providing positive mitigation of harvesting activities and protection of identified human and other non-timber values.

Insect, disease and forest fire control programs described in the FSP (Sections 5.11.3) and WDS – WI – 022, and implemented by MC with the cooperation of Tembec, will continue to have a positive impact upon the effect of these disturbance and depletion agents on the forests of FML 01. Continued use of these programs is important to

maintain the balance of age classes and forest types in FML 01 in conjunction with planning for timber harvest.

- Tembec produces a *Forest Fire Protection Plan* on an annual basis that is provided to MC. All contractors and Company employees must follow the requirements for fire prevention, detection and suppression as outlined in this plan.

Equipment Use

Equipment use impacts relate to the potential to cause forest fire and the introduction of plant exotic species into operating areas.

In-block operations, fuel storage and handling and non-hazardous and hazardous waste activity can lead to significant impacts in causing forest fires under certain conditions.

- Heavy equipment use, particularly in areas of rocky soils where tracked equipment is being utilized can cause spark ignition. Mitigation of this impact is provided, as described earlier, through the Company's procedures for prevention, detection, reporting, suppression of forest fires and modifying operations in response to fire danger, outlined in the *Tembec Forest Fire Protection Plan*. Monitoring and setting of forest closure restrictions by MC further contributes to mitigation of this potential impact. Welding work on equipment will only be undertaken on mineral soils. During the fire season heavy equipment will be parked at the end of each shift on areas free of vegetation and organic debris, preferably on mineral soils to minimize the potential for ignition (WDS-WI-022 and 027).

- Fuel storage and handling has potential to cause ignition of fuel subsequently causing a forest fire. As outlined in WDS – WI - 019, mitigation is accomplished by careful storage and handling of petroleum products. The Tembec *Forest Resource Management Emergency Response Plan* specifies procedures to deal with spills during refueling or fuel storage operations.

- In-block operations present the opportunity for impacts from transportation of heavy equipment on-site for introduction of exotic plant species through plant material or seed dispersal. The use of local contractors for the most part throughout operations on FML 01 results in minimal transfer of equipment in and out of FML 01. Given the extent and magnitude, this impact is insignificant and mitigable.

Forest ecosystems have evolved with agents of disturbance and developed mechanisms to deal with the resulting stress. Boreal forest species are well adapted and in fact rely on fire disturbance for their reproduction and survival. Natural levels of disturbance and stress exist in any system and will continue to significantly shape the landscape despite interference by man. Forest management planning attempts to approximate natural disturbance patterns in

design and implementation of operations and can be sensitive to the outcome of disturbance events.

Many forest management activities impact on disturbance and stress agents and in fact are positive. Monitoring of disturbance and stress is a responsibility of MC and Tembec assists MC through their planning and operations with this monitoring role.

4.3 Biomass

4.3.1 Introduction

Biomass is reflected in measurement of the ability of the forest ecosystem in terms of biological productivity. These components are represented in Table 4. The net biomass that a forest ecosystem produces provides an indication of the ecosystem's condition and productivity (CCFM 1997a).

As noted in Table 4, components of biomass related to biological productivity of wildlife, have been discussed in concert with species diversity for representative species (Table 2) and associated text.

4.3.2 Data Adequacy and Gaps

FSP sources of information include:

- MC Forest Inventory including forest tree species and age class description (Sections 3.1.7 and 5.9.4) and accompanying maps (Figure 3.10, 5.26 and 5.27) and tables (Table 3.5, 5.15, 5.16 and 5.17).

- Mean Annual Increment (MAI) by strata type for FML 01 (Section 4.3.1, Appendix I).

- Forecasted total growing stock volume by softwood and hardwood groups for FML 01 (Section 4.1 Appendix V, Figure 4).

Other sources of information include:

- Manitoba FEC system (V-types and S-types) in place for Provincial forest resource including FML 01.

On-going Operational Data Sources include:

- On-going update of MC Forest Inventory by the Province including forest tree species and tree ages.

- On-going update of net standing timber volumes, by operating area, calculated from updated forest inventory taking into account all depletions to date.

- PHA including tree species, volumes, age, FEC V-type and soils description.

These sources of information represent the best information currently available for the monitoring and reporting of biomass on FML 01. Regular updating of the MC Forest Inventory by Tembec (WDS – 001) for harvest and renewal activities and by the Province for forest fire and insect/disease depletions can provide a basis for measurement of biomass in terms of timber.

4.3.3 Forest Management Activities Assessment

Planning

The assessment of planning activities considers the extent to which they make use of information regarding biomass production to determine the appropriate level of operations. In this regard activities of particular relevance include sustainability modeling to determine these levels and information collection and application of appropriate data to support modeling and monitoring efforts. Harvest and renewal planning for operations must then be undertaken to utilize the results of these earlier activities. The rate of biomass production, in terms of timber production, can be measured on the basis of annual growth, with the mean annual increment (MAI) by forest type. In terms of total production of biomass across the landscape, natural disturbances as well as timber harvesting impact significantly on biomass production while forest renewal and forest protection activities assist in maintenance of biomass levels. In undertaking sustainability modeling to determine sustainable harvest levels and implementing these levels in operations the outcome of natural disturbance events can also be considered in order to maintain relatively stable levels of biomass across the landscape.

Harvest renewal and planning has implications for biomass in terms of the application of sustainable harvest levels to the strategic and operational planning of harvesting and the application of appropriate forest renewal treatments for regeneration and growth of the new forest stands.

- At the landscape level, harvesting is regulated, as described in impacts under sustainability modeling**,** by application of sustainable harvest levels in the planning of harvest volumes. Through this process only the volume produced by the ecosystem in a given year is planned for harvest that year. In combination with the use of sustainability analysis **(**FSP Section 4.3) to forecast the long-term effects of harvesting on the wood supply and resulting standing forest inventory, impacts upon timber biomass can be mitigated. Planning processes that incorporate this information provides a positive benefit to the maintenance of stable levels of timber biomass.

- At the site level planning for prompt forest renewal of all areas to be initiated immediately following harvesting provides for establishment of new growth which begins the process of accumulating biomass on that particular site (FSP Section 5.14.3). This increases the overall rate at which stands are brought back into production and contributing biomass.

Sustainability modeling provides the basis for incorporation of biomass considerations into the planning process. Growth and yield information for the forests of FML 01 is an important input to the modeling process, with direct implications to the determination of the sustainable harvest level.

- Area and extent of timber harvest activities is governed in a landscape context through determination and application of the sustainable harvest level. Once determined and approved in conjunction with development of the FSP, the Company utilizes these levels as maximum harvest levels in harvest plan development (WDS – 010). Sustainability analysis undertaken in the FSP (Section 4.3) provides support for these harvest levels based upon currently available information for growth and yield. Further discussion of the sustainability analysis is provided in Section 3.2.3, 3.3.3.2, 5.3.3, 6.3.3, 7.2.3, 7.3.3 and 7.4.3 of this EIS.

- On a site level basis, practices outlined in WDS – WI – 003, 004, 005, 006, 007 and 048 provide mitigation to design and harvest cutblocks to meet SFM goals. As described earlier, mitigation of the impacts of forest renewal at the landscape level are dealt with in association with that of harvesting through modeling of the growth of the forest over time. The modeling of the wood supply and the associated projected value of wildlife habitat is undertaken with harvesting and forest renewal activities considered in unison. Through continued application of these models to the planning process potential negative impacts upon biomass levels can be mitigated.

Information collection and application has implications for biomass in terms of the data for growth and yield utilized to support the determined sustainable harvest level in sustainability modeling.

- As described in the FSP (Section 4.3), the growth and yield estimates utilized in the modeling analysis for the preparation of the FSP are based upon MC temporary sample plot data for the forest of FML 01. This is currently the best available data for FML 01 upon which to base these yield estimates. Improved data, upon which to base these estimates, will be obtained over time through a co-operative Permanent Sample Plot (PSP) program with MC. Through measurement of the growth and yield on these plots refined values of MAI can be produced to allow for refined estimates to be input to the modeling process. Indicator 2.1.3.2 of the LLI framework provides for tracking of the actual volumes harvested by operating area versus planned volumes resulting from the modeling analysis.

- On-going tracking of areas depleted through harvesting and natural disturbances, as well as areas reforested, in conjunction with improved MAI determination will allow for on-going determination of the accumulation of biomass.

On-going measurement of biomass growth and yield rates through PSP measurement in combination with tracking of harvest and natural depletion and renewal levels will provide the basis for refinements to modeling analysis over time. The application of this information in planning and scheduling harvesting and renewal activities provides positive mitigation of the potential impacts of these activities upon biomass.

Harvesting

Harvesting can have a significant impact upon the overall level of biomass from the removal of biomass from the ecosystem.

Logging operations result in the removal of standing timber biomass from cutblocks. Mitigation is achieved at both the site and the landscape level.

- At the site level prompt forest renewal of all areas immediately following harvesting provides for establishment of new growth which renews the process of accumulating biomass on that particular site (FSP Section 5.14.3).

- At the landscape level sustainability modeling to develop a sustainable harvest level for application to AORP planning and implementation of harvesting operations provides mitigation (WDS – 010).

Forest Renewal

Forest renewal activities provide positive impacts to the accumulation of biomass through the application of treatments to encourage and complement natural regeneration processes.

- These activities provide for prompt renewal of each harvested site immediately following harvesting and improve the growth rate of stands and their contribution to biomass (FSP Section 5.14.3). These activities thereby result in a positive impact upon biomass accumulation and in addition to natural regeneration processes, assist in mitigating the impacts of harvesting.

Forest Protection

Forest protection activities positively impact biomass levels through protection of standing timber biomass in concert with protection of other values.

- In terms of timber biomass, forest protection activities will have a positive impact in allowing for a healthier forest overall. As described earlier, these activities,

particularly fire control, assist in the mitigation of harvesting in an overall forest context, assisting to maintain the older age classes.

The ability of a forest to produce biomass depends on many natural and anthropogenic factors. Planning of forest management activities can positively impact biomass production and can be sensitive to natural disturbance events through consideration of rates of growth and yield in addition to areas of depletion and renewal. Forest renewal and protection activities provide positive impacts through re-establishment and maintenance of growing stock.