
Annual Status of Reforestation in Alberta Report

2018 - 2019



Annual Status of Reforestation in Alberta Report

Alberta Agriculture and Forestry

March 2021

© 2021 Government of Alberta.

This publication is issued under the Open Government Licence – Alberta (<http://open.alberta.ca/licence>).

This publication is available online at <https://open.alberta.ca/publications/annual-status-of-reforestation-in-alberta-report>

For more information regarding this content visit: <https://open.alberta.ca/documentation/pubguidedraft>

Table of Contents

What is this report about?	4
What is reforestation?.....	5
Why reforest?.....	7
What does the law require?	7
How is the status of reforestation determined?.....	10
What are Alberta’s reforestation results?	12

What is this report about?

The Government of Alberta, through the Ministry of Agriculture and Forestry (AF), regulates forest management on the Crown Land of Alberta. Reforestation in Alberta is the responsibility, by law, of those who harvest trees on Crown land. Companies that harvest trees are required to report the result of their reforestation activities to the government annually (by May 15). Reforestation activities and their associated results are audited annually by AF and this information is used to ensure that forestry activities are conducted in a sustainable manner and in compliance with legislation.

This report provides an overview of reforestation status for areas harvested during the 2004/2005 timber year¹ for which final reforestation results have been reported to AF by May 15, 2019. This report includes both background information about reforestation in Alberta and the reported measure of reforestation status.

Measures of the reforestation status (the rate of forest re-growth) contained in this report are based on data from openings² harvested³ in the 2004/2005 timber year. This measure is an area-weighted average percentage of the target re-growth rate that has been achieved. The target re-growth rate is prescribed in the approved Forest Management Plan, based on the capabilities of the site and the desired future forest. It cannot be expressed simply as a single number for all openings, as not all forests grow at the same rate. Each will differ depending on their climate, soils, tree species and level of management (controlling density, managing competing vegetation, size of seedlings planted or natural regeneration). The reforestation status measure in this document reports on the “level of success” that has been achieved relative to the “expected” target re-growth rate. Therefore, if all the assessments of forest re-growth rate exactly meet the target re-growth rate, the reported measure would be 100 per cent.

Final reforestation status for openings must be provided to AF no later than 14 years after the year of harvest. This performance metric value was calculated using the new 2012 method for

¹ Timber year – The period between May 1 to April 30 as defined in s.2 (20) of the Timber Management Regulation.

² Opening – The area or small management unit within a forest where mature trees have been harvested and reforestation is occurring.

³ Harvest – Removal of standing trees from a forested area. In Alberta, all harvesting on public land are carried out under the authority of a timber disposition (Forest Management Agreement, timber license, timber permit) and must be approved prior to the removal of any trees.

Reforestation Standard of Alberta (RSA) mean annual increment (MAI) surveys (refer to the How is the Status of reforestation determined? Section for further information).

For more information about forest management and reforestation, please visit:

<https://www.alberta.ca/forest-management.aspx>. Contact information for AF regional offices can be found on this website or call the Forest Stewardship and Trade Branch at 780-427-8474 or toll free (from within Alberta) at 310-0000.

What is reforestation?

Reforestation is the re-establishment of trees after an event such as harvesting, wildfire, or insect and disease outbreaks. Reforestation is the act of replacing trees that were removed during a harvesting event or other disturbance. The newly developing forest is managed such that it will establish and successfully grow into a future forest that can sustain the supply of goods and services provided prior to the event that removed the trees.

Forest managers utilize both natural processes and artificial methods to regenerate Alberta's forests. These processes help to keep forestland productive and maintain the flow of valuable goods and services. All tree species native to Alberta are capable of natural regeneration from seed. The amount of seed produced changes yearly, with periodic high yielding seed crops ("mast years") occurring, which affect the success of natural regeneration. Trees like lodgepole pine, however, often carry multiple years of unopened cones in the crown, with the cones releasing their seeds only after a disturbance that creates suitable conditions. Local site conditions, such as exposed mineral soil and amount of sunlight, moisture and nutrients, must be optimal in order for seed germination to occur. Some deciduous tree species, such as trembling aspen, are also capable of vegetative reproduction, as are many non-tree species. In aspen, root "suckers" (new shoots produced from roots just below the soil surface) are a common reproductive means and

Commercial tree species native to Alberta

Coniferous ('C')

Lodgepole pine*

Jack pine*

White spruce*

Black spruce*

Engelmann spruce

Balsam fir

Subalpine fir

Tamarack

Douglas fir

Deciduous ('D')

Trembling aspen*

Balsam poplar*

White birch

*predominant species harvested

exceedingly dense stands of young suckers are often produced following wildfire or harvesting. No additional actions are necessary to initiate these aspen suckers, other than careful harvest practices. Following harvesting, forest managers often use natural regeneration techniques to regenerate stands of trembling aspen as well as lodgepole pine. On average, about 23 per cent⁴ of harvested forests are regenerated using natural regeneration techniques.

In areas where reforestation using natural regeneration is less certain, “artificial” regeneration techniques such as seeding or planting of seedlings are used. Artificial regeneration techniques are commonly used to reforest harvested areas dominated by white or black spruce, or balsam or subalpine fir. They may also be used in lodgepole pine harvested areas, where cone crops are poor or the sites are not suitable for successful natural regeneration methods.

All reforestation material (i.e. seeds, seedlings, cuttings, etc.) used to reforest public land are regulated to ensure that the materials are adapted⁵ to the site and climate in which it is to be used. Alberta has seed zones based on natural regions, climate and elevation that regulate how far reforestation material may be moved from its place of origin. The material deployed in reforestation is limited to specified seed zones in order to ensure better survival and sustained growth. The Forest Genetic Resource Management and Conservation Standards (2016) regulate how reforestation material may be used on public land. Seeds extracted from cones collected by each forest company must be registered by AF and are stored at the Alberta Tree Improvement and Seed Centre (ATISC). Each year, the department conducts an analysis of current seed inventory and potential future seed requirements to support reforestation. If seed shortfalls are anticipated, the department works with the forest companies to enhance the seed supply.

Forest companies request specific amounts of seed to support their next year’s reforestation activities. The seed is then sent to commercial nurseries to grow seedlings, which are finally shipped to the reforestation site and planted. Not all reforestation material, however, starts out as seed. The use of cuttings and other vegetatively produced material, particularly for deciduous species, is increasing. This material must be adapted to the areas where it will be deployed.

⁴ From Provincial 2016 Reforestation Statistics, “Reforesting Harvested Area: Current Facts and Statistics 2016” on the AF website: <https://open.alberta.ca/dataset/b2b15310-17b0-4975-8c67-ddd87a84936a/resource/ea2c8768-714e-4a12-bd01-743ba1d078c1/download/af-forest-management-stats-2016-reforesting-harvested-area.pdf>.

⁵ For more information on the movement of seed in Alberta, search for the *Alberta Forest Genetic Resource Management and Conservation Standards Manual* (2016) on the AF website at <https://www.alberta.ca/forest-management-manuals-and-guidelines.aspx>.

Why reforest?

It's the law! In Alberta, the law requires that when trees are harvested from public land, the area must be reforested to provincial standards. Reforestation is a key component of sustainable forest management.

It makes sense! Reforestation makes sense for the environment and for the economy. Approximately 58 per cent of Alberta's land area is considered forested⁶. These forests provide multiple benefits to Albertans including clean water; fish and wildlife habitat; employment; raw materials to produce wood products such as lumber, pulp, and oriented strand board; cultural and traditional uses; and opportunities for recreation. Alberta's forests also absorb greenhouse gases that contribute to global climate change. Reforestation is a key activity in re-establishing forests and sustaining these multiple benefits.

What does the law require?

The *Forests Act* enables forest management in Alberta. The Act authorizes the Minister to allocate forest areas for harvesting. The Timber Management Regulation (TMR) is used to implement and administer the *Forests Act*. Under the TMR (Part 6), reforestation is required to be carried out within two years of harvest and to a level that ensures that reforestation standards will be met. Reforestation standards and timing of surveys are established in the Regeneration Standard of Alberta⁷ (RSA).

The purpose of the regeneration standard is:

1. To ensure prompt reforestation following harvest;
2. To ensure adequate stocking, density, and growth rates; and,
3. To ensure acceptable growth performance that emulates natural yields found in Alberta.

Alberta's forests are classified into four broad cover groups: Coniferous ('C'); Deciduous ('D'); Coniferous leading mixedwood ('CD'); and, Deciduous leading mixedwood ('DC'). These are then

⁶ Sustainable Forest Management Current Facts & Statistics: General Boundary Information 2016. Agriculture and Forestry. AF website: <https://open.alberta.ca/dataset/5dab6b68-d6d5-402d-8c60-f946520681cf/resource/7cd822c8-9d2a-40f4-9680-4bcea12f1bde/download/af-forest-management-stats-2016-general-boundary-information.pdf>

⁷ Search for the *Reforestation Standard of Alberta*, on the AF website at <https://www.alberta.ca/forest-management-manuals-and-guidelines.aspx>.

further defined into 10 basic leading-species forest types. White spruce, black spruce, lodgepole pine (Alberta's official tree), and Douglas fir (common in southern Alberta only) make up the four "C" types. There is one "D" type, which is made up of combinations of trembling aspen, balsam poplar and white birch. Mixedwood types of either lodgepole pine, black spruce, and white spruce together with aspen make up the three "CD" types, while aspen together with either white spruce or lodgepole pine make up the two "DC" types. Depending on the actual composition of forest in specific areas of the province, additional forest types may be recognized, but they are all assigned to one of the "base 10" forest types.

A Forest Management Plan (FMP) is a 10-year plan produced by the forest companies, and approved by government, for Forest Management Agreement areas where forest harvesting is to be conducted. Each FMP provides for the basis upon which sustainable forestry is permitted in each area. Each FMP establishes the rate at which forests grow and may be harvested such that the forests will continue to provide a flow of ecological goods and services for current and future Albertans. FMPs are the basis upon which reforestation growth rates are established and thus set the basis for creating reforestation re-growth standards. "Yield curves" are projections of how the forest growth will occur and how much "yield" can be expected with respect to harvested wood volume (measured in cubic meters). Some forest types (e.g. aspen) grow very quickly with little to no management actions, while others, like white spruce, grow more slowly and often require more active reforestation activities to establish the forest. As a result, reforestation re-growth rates for aspen are often higher than for white spruce. Similarly, if forest companies commit to aiding the forest to regenerate faster and more uniformly, by preparing the soil for the planting of healthy large seedlings, their re-growth expectations are higher as compared to areas where reforestation is enabled primarily through seeding or planting of small seedlings without preparing the site. As a consequence, the management approach of active reforestation activities may result in higher re-growth rates than areas where reforestation is supported through a lower level of management. This is a concept that gardeners are keenly familiar with, as often a bigger crop is directly related to how much care (water, weeding and fertilization) you put into managing the garden.

The forest types recognized in an FMP are managed through reforestation activities that meet Alberta standards, so that each forest type and its respective area is maintained across the managed landscape. In this way, tomorrow's forests span the range of forest types and growth rates approved in the FMP.

There are two types of surveys used in Alberta to ascertain the status of the reforestation treatments: '**establishment**' and '**performance**'. The purpose of the establishment survey is to determine if the harvested area has enough trees of the right size and species composition evenly distributed across the opening. The establishment survey is conducted between four and

eight years after harvest. If an establishment survey finds the reforestation effort to be inadequate, additional treatments are required within one year, which will remediate the site to meet the standards. The purpose of the performance survey is to determine if the trees present are likely to demonstrate sufficient growth to meet the expectations of the FMP for the area. Performance surveys are conducted between 12 and 14 years after harvest. Should insufficient reforested conditions be found at this later survey, adjustments are made to future harvest levels.

Alberta uses the average annual re-growth rate as the measure of reforestation adequacy. This measure was developed for reporting of reforestation status in 2010 and has been included in Agriculture and Forestry's Annual Report from 2011-12 to the current 2019-2020 reporting period. The measure utilizes data from recently re-developed regeneration standards implemented in Alberta for all forest companies effective May 1, 2010. The re-growth rate accounts for the species present, the degree to which the available growing space is occupied by commercial tree species, and the measured rate of individual tree growth. These three characteristics of the young reforested area are a function of the sunlight, nutrients and water resources that are captured by the newly established trees. These variables of species, occupancy and tree growth are integrated through the use of a mathematical model ("GYPSY"- Growth and Yield Projection System) to forecast the rate of re-growth expected for each forest type identified. The GYPSY model used to forecast the re-growth rate has been built using long-term monitoring data from forested areas across the province and has been developed and reviewed by many scientists.

The new growth rate reforestation standard (known as the Reforestation Standard of Alberta (RSA)) was phased in, with the pure deciduous forest types retaining the stocking standard as prescribed in the previous reforestation standard. "Stocking" describes the spatial distribution of regenerating trees in an area and, until the 2010 growth rate standard was introduced, this was the measure of success in regenerating openings. A minimum stocking level of 80 per cent is evidence that the site is "fully occupied" with trees. Stocking is a measure of the presence of a suitable vegetation community, which will support a functional ecosystem and is also a useful measure of reforestation condition. Openings with less than 80 per cent stocking are considered not fully occupied by trees, either due to gaps in their distribution (i.e. localized areas of excessive moisture) or generally a lower density of trees across the area. The "standard" is the minimum acceptable amount of trees re-growing on a site.

Since 2010, most openings for which a final regeneration survey is required have been assessed for re-growth rate performance. Each opening has a re-growth rate assigned to it based upon the regeneration survey results. For forest management purposes, the growth rates are separated into a deciduous and coniferous component. Each opening has a re-growth rate target for both the deciduous and coniferous growth, and the forecasted re-growth rate is compared to the target

re-growth rate. While growth rates may exceed or fall short of expected growth rates, for the purposes of this report, all growth rates are capped at 100 per cent.

All opening reforestation status data (either stocking or growth rate) is submitted to the department and reviewed and audited for consistency and accuracy. The department's Forest Operation Monitoring Program (FOMP) standardizes how AF's inspections of active timber harvesting and reforestation activities are conducted, including internal audit requirements and enforcement provisions. In 2009, FOMP was awarded the International Organization for Standardization (ISO) 9001 certification and was recently recertified for an additional three years. A total of 1,319 FOMP Inspections have been completed in the past year⁸. FOMP conducts both field and office reviews of submitted reforestation data. In addition, numerous automated data checking routines control the quality of submitted data, which together with mandatory quality assurance programs used by the forest companies, helps to ensure the data submissions are of high quality.

How is the status of reforestation determined?

The Alberta Regeneration Information System (ARIS, an electronic database containing information on all harvested areas in Alberta) was queried for reforestation results based on the final mandated survey for all openings harvested during the 2004/2005 timber year. The final mandated survey was selected as the criteria because additional reforestation activities are required for earlier surveys that may have been found to have deficient reforestation results. For the purpose of this report, the status of reforestation was determined using data collected under two different monitoring systems, as Alberta transitioned from the historic stocking standard to the new regeneration standard (RSA).

Following an audit by the Office of the Auditor General (OAG) and the publishing of the 2011 version of this report, the method used to calculate the percentage of target achieved for MAI surveys was reviewed and minor changes made to the calculations for 2012 and applied in the metric calculations from 2013 onwards. These changes mean that the coniferous and deciduous components measured for an opening with an MAI survey are assessed separately and weighted according to their proportion in the opening. These two values are then summed at the end to give a total percentage of target for that opening. This is in contrast to the 2011 method where the coniferous and deciduous components were assumed to contribute equally within each opening.

⁸ Forest Operations Monitoring Program (FOMP) Annual Report 2018-2019. Agriculture and Forestry, Forest Stewardship and Trade Branch.

A total of 3,425 openings are included in this report, of which 90 per cent were surveyed to the new growth rate standard and the remaining 10 per cent were assessed using the historic stocking assessment technique. Both types of assessments were then converted to describe the status as determined from the surveys relative to the target status.

The following outline details calculations performed to determine the Reforestation Status:

I. Calculation of % Target

A. For Openings Surveyed to the Stocking Standard (historic) and Understory Protection:

$$1. \text{ \% of target} = \frac{\text{Measured Total Stocking \%}}{80\% \text{ minimum}}$$

OR

$$\text{\% of target} = \frac{\text{Measured Total Stocking \%}}{\text{Opening Specific Stocking Target}}$$

$$2. \text{ Weighted opening area} = (\text{\% of target}) \times (\text{Opening area})$$

B. For Openings Surveyed to the Regeneration Standard (RSA) (new)⁹

$$1. \text{ Coniferous (C) \% of target} = \frac{\text{Opening Level C standard MAI}}{\text{Target Level C standard MAI}}$$

$$\text{Deciduous (D) \% of target} = \frac{\text{Opening Level D standard MAI}}{\text{Target Level D standard MAI}}$$

$$\text{Opening Weighting Factor} = \frac{(\text{C or D Target Level standard MAI})}{(\text{C Target Level MAI}) + (\text{D Target Level MAI})}$$

⁹ Formula Glossary:

- “Opening Level” refers to values that are measured in the field by the party reforesting an opening.
- “Target Level” refers to values that are assigned to opening based on geographic location and modeling.

2. $C \text{ weighted MAI} = (\text{Coniferous \% of Target}) \times (\text{Opening Weighting Factor})$

$D \text{ weighted MAI} = (\text{Deciduous \% of Target}) \times (\text{Opening Weighting Factor})$

3. $\text{Total \% of target} = C \text{ weighted MAI} + D \text{ weighted MAI}$

4. $\text{Weighted opening area} = (\text{Total \% of target}) \times (\text{Opening area})$

II. Final Calculation of Reforestation Status

$$\text{Performance Metric} = \frac{\text{Sum of all weighted opening areas}}{\text{Sum of all areas for all openings in population}}$$

Where “population” refers to all openings within the target year of

2004/2005 that meet requirements

As reforestation status is assessed at the opening level, all openings achieving the same outcome are deemed “equal”. However, the size of an opening is important to consider since small areas with low reforestation success have less impact on the total forest condition, as compared to a large area with low reforestation success. Each opening’s success is area-weighted to account for variable opening size. To assess the reforestation status at the provincial level, the results for all openings are compiled to present an overall average condition.

What are Alberta’s reforestation results?

For the 2004/2005 timber year, on average, the re-growth rate was found to be 97.3 per cent. This means that on average, regenerating forests in the areas reported upon for both those Timber Years (some 75,000 ha) are very close to achieving the re-growth rate target. Forest growth, like a farmer’s crop, is different in different locations (due to weather, soils, plant genetic make-up, etc.). For this reason, an average re-growth measure has been reported to

acknowledge these differences and a below-expected regrowth rate on any one area is not necessarily unacceptable.

Many openings were observed to be re-growing at rates higher than targeted (i.e. >100 per cent). This may be due to prompt reforestation activities following harvesting, better early seedling growth resulting from more appropriate site preparation, and/or conservative re-growth rate targets. For the purpose of this report, even if growth rates were >100 per cent, the growth rate was capped at 100 per cent. While a few openings fell below their expected reforestation status, which could be attributed to site limitations, climatic events (e.g. drought), impacts from insects and diseases, or potentially damage caused by animals or people, Table 1 shows that the vast majority of the reforested area is performing at very near (or better) than target.

Achievement relative to Target (%)	% of Area	Area (ha)
25 or less	0.00	0.0
26-50	0.71	537.7
51-75	2.29	1,729.7
76-99	17.17	12,984.4
Met or Exceeded Target	79.83	60,375.5
Total	100	75,627.4

Table 1. Distribution of reforested area (harvested in the 2004-2005 Timber Year) by percentage of attained reforestation target¹⁰.

A very small percentage (0.71%) of the total area did not attain at least 50 per cent of the target reforestation status in this Timber Year, while the vast majority of the reforested area (about 80 per cent) has been reforested to meet or exceed reforestation targets. Successful forest

¹⁰ The values in Table 1 do not directly relate to the overall re-growth rate value. The 'Achievement relative to target (%)' is an intermediary step in the calculations. The percentage achievement for each opening goes through additional steps, which include being area weighted and summed, prior to reaching the final number. Refer to the "How is the Status of Reforestation Determined?" section for further details.

management and selection and application reforestation techniques have resulted in vigorously regenerating young forests.

As noted earlier in this report, stocking demonstrates how the trees are spatially distributed over a harvested area. However forests are not uniform in either tree distribution or tree growth. The distribution of trees and their growth rates are not even within an opening or between openings due to differences in 'hospitable' growing spots. Forests have a range of growing conditions: some sites naturally support few trees (e.g. dry sandy sites), while others support very high densities of fast growing trees (moist, nutrient rich sites). Water, nutrients, diseases and soil physical conditions can prevent trees from establishing and/or growing, resulting in patchy or low stocking and/or densities. Such forests, while they may produce lower levels of timber, contribute towards other values, such as wildlife habitat. Where the outcomes of reforestation are less than anticipated (i.e. less than the regeneration standard), future forest harvesting is adjusted to ensure that Alberta's future forests continue to produce a full range of benefits. It is important to understand, however, that year-to-year variations in climate can have significant impact on the growth rates of trees. As such, only where unsatisfactory reforestation outcomes are found consistently over a five-year period is there likely a need to adjust harvest levels. However, where trends are seen in certain forest types or certain regions of the province for poor reforestation results, the department asks forest companies to assess and adjust their reforestation practices as necessary to meet the reforestation targets.

The legislated obligation of the forest companies is complete once this standard has been achieved. From the 14-year mark forward, as long as the reforestation standard has been met, the stand is monitored through regular forest inventory updates in each planning cycle (every ten years). Subsequent inventory updates will inform the re-planning cycle. Fully stocked and reforested stands will result in maintaining or increasing the available annual allowable cut. Regenerating stands that are subsequently shown to be performing poorly (perhaps due to environmental factors like drought or hail) will also inform the forest management plan and potentially result in lower available annual allowable cut levels.