

## **FOREST RENEWAL STANDARDS**

### A. Defining The Regeneration Standards

Forest renewal standards have been developed for forest regeneration in Manitoba. These standards identify the amount of regeneration required to satisfactorily regenerate forest lands, and indicate the type of forest each site could potentially develop into. The forest renewal standards are applicable on even aged areas following fire, clear-cutting, scarification, seeding or planting. Failure to achieve the appropriate regeneration standard for the site indicates the need for reforestation activity (planting, replanting).

The standards reflect the number of stems required at the end of the regeneration period to produce forest stands at maturity. The number of stems required was calculated using survival rates derived from the results of studies. A 90 percent survival rate over ten year intervals following the end of the regeneration period was used for softwood seedlings. This calculation results in approximately 50 percent of the 10 year old softwood trees surviving to maturity. Hardwood survival rates range between 65 and 74 percent during ten year intervals for aspen stands. The number of softwood, hardwood and total stems required at the end of the regeneration period to produce forest stands at maturity have been shown in Table 1.

Regression curves were used to determine stocking levels that would reflect the number of stems required at the end of the regeneration period to produce forest stands at maturity. These regression curves express the specific stocking and density relationships that have been developed from regeneration survey results for each species (black spruce, jack pine and white spruce) on three site types; naturally regenerated softwood, planted softwood and naturally regenerated hardwood sites.

Three categories of standards have been identified; one for softwood sites regenerated naturally (Table 2), one for sites that have been planted (Table 3), and a third for hardwood sites regenerated naturally (Table 4). The forest renewal standards include minimum softwood stocking and minimum total (including hardwoods) percentages required for each species on each site type.

The specific standard to apply is determined by the original species occupying the site for natural regeneration and the species planted on the site for plantations. For example on naturally regenerated sites that were previously black spruce the forest renewal standard for black spruce natural regeneration is selected. On sites that have been planted with jack pine the forest renewal standard for jack pine plantations is selected.

For each site some latitude in the forest renewal standard to be achieved is allowed because of the approximations involved. The number of stems in

mature stands of the same cover type, the subtypes identified by the Forest Resource Inventory, and the stocking required to produce mature forest stands are all approximations. Because of this sites will be deemed satisfactorily regenerated if they achieve the forest renewal standard which matches the cover type of the original stand or either standard immediately above or below the original standard.

**Table 1. Estimated number of stems per hectare required at age seven in Manitoba**

ORIGINAL SITES	SOFTWOOD "S"				MIXEDWOOD "M"				MIXEDWOOD "N"		H	
DOMINANT SPECIES	BS	JP	WS	BS	JP	WS	JP	SPRUCE	PINE OR SPRUCE			
SOFTWOOD	2746	2256	1660	1718	1193	1235	645	754	164			
HARDWOOD	907	770	1385	3335	3491	3315	5324	4690	6299			
TOTAL STEMS	3653	3026	3045	5053	4684	4550	5969	5444	6463			
AVERAGE	3241				4762				5619			6

A.1. Softwood Natural Regeneration

Naturally regenerated and scarified sites must achieve the forest renewal standard that relates to the previous cover type that occupied the site. The sites will be deemed satisfactorily regenerated if they achieve the forest renewal standard which matches the cover type of the original stand or either standard immediately above or below the original standard. If they do not achieve these standards the sites are considered not satisfactorily regenerated even though they may be forested.

Naturally regenerated softwood "S" sites require a minimum 65 percent total stocking, mixedwood "M" sites a minimum 70 percent total stocking and mixedwood "N" sites 75 percent stocking (Table 2). Each standard requires different amounts of softwood stocking depending upon the standard and the major species on the site before disturbance.

**Table 2. Forest renewal standards for softwood natural regeneration ("S" and "M" sites)**

Original Site	Black Spruce		Jack Pine		White Spruce	
Forest Renewal Standard	Softwood Stocking	Total Stocking	Softwood Stocking	Total Stocking	Softwood Stocking	Total Stocking
Softwood "S"	≥ 55%	≥ 65%	≥ 50%	≥ 65%	≥ 50%	≥ 65%
Mixedwood "M"	≥ 40%	≥ 70%	≥ 25%	≥ 70%	≥ 35%	≥ 70%
Mixedwood "N"	≥ 15%	≥ 75%	≥ 15%	≥ 75%	≥ 25%	≥ 75%

A. 2. Softwood Plantations

The softwood forest renewal standard for black spruce and jack pine plantations is 75 percent total stocking. The softwood forest renewal standard for white spruce plantations is 70 percent total stocking (Table 3). Each standard requires different amounts of softwood stocking depending upon the standard and the species planted on the site. Differences in the stocking to density relationship for each species and the growing space they require account for the different stocking requirements. The management intent for a site planted with softwoods is to regenerate the site to a softwood or mixedwood "M" cover type. For that reason there is no Mixedwood "N" standard for planted sites. A plantation must achieve either the softwood or mixedwood "M" forest renewal standard to be classified as satisfactorily regenerated.

**Table 3. Forest renewal standards for softwood plantations**

Planted Species	Black Spruce		Jack Pine		White Spruce	
Forest Renewal Standard	Softwood Stocking	Total Stocking	Softwood Stocking	Total Stocking	Softwood Stocking	Total Stocking
Softwood "S"	≥ 75%	≥ 75%	≥ 65%	≥ 75%	≥ 65%	≥ 70%
Mixedwood "M"	≥ 50%	≥ 80%	≥ 45%	≥ 80%	≥ 55%	≥ 75%

### A.3. Hardwood Natural Regeneration

Hardwood stocking to density relationships have been calculated for softwood and mixedwood sites in Manitoba, however these relationships are unavailable for formerly pure hardwood sites because relatively few of these sites have been harvested and surveyed in Manitoba. The relationships between stocking and density, on planted and naturally regenerated softwood and mixedwood sites in Manitoba has been determined.

Although the hardwood stocking to density relationships developed on softwood and mixedwood sites is a good starting point, further investigation is required to refine the relationship between hardwood stocking and density on purely hardwood sites. Because a single aspen is capable of producing a large number of suckers it is possible that hardwood sites with relatively low stocking will produce more than 6000 stems per hectare. The forest renewal standard for hardwood must be concerned with guaranteeing a minimum distribution (stocking) and a minimum number of stems per hectare. Sites incapable of achieving this standard may be made up of deteriorating clones or result from the cutting of decadent hardwood stands.

The application of survival rates inferred from data collected on aspen stands in Alberta indicates that approximately 6300 stems per hectare at age seven may be required to provide adequate aspen stocking in hardwood stands in Manitoba. Stocking to density relationships indicate that sites that are naturally regenerated to hardwood must achieve 80 percent stocking to secure 6300 stems per hectare. Table 4 indicates the forest renewal standards for hardwood natural regeneration on sites originally mixedwood "N" or hardwood "H".

Naturally regenerated hardwood ("N" and "H") sites should achieve the forest renewal standard that relates to the previous cover type that occupied the site. The sites will be deemed satisfactorily regenerated if they achieve the forest renewal standard which matches the cover type of the original stand or either standard immediately above or below the original standard. If they do not achieve these standards the sites are considered not satisfactorily regenerated even though they may be forested.

**Table 4. Forest renewal standards for hardwood natural regeneration ("N" and "H" sites)**

	Black Spruce "N" Sites		Jack Pine "N" Sites		White Spruce "N" Sites	
Forest Renewal Standard	Softwood Stocking	Total Stocking	Softwood Stocking	Total Stocking	Softwood Stocking	Total Stocking
Mixedwood "M"	≥ 40%	≥ 70%	≥ 25%	≥ 70%	≥ 35 %	≥ 70%
Mixedwood "N"	≥ 15%	≥ 80%	≥ 15%	≥ 80%	≥ 25 %	≥ 80%
All Hardwood Sites "H"	n/a	≥ 80%	n/a	≥ 80%	n/a	≥ 80%

## B. Defining The Free To Grow Standards

### B.1 Softwood Free To Grow

The description of a 'Free To Grow' tree, is a well established softwood tree that is free from hardwood competition and is at least 1.5 metres from other free to grow trees.

A free to grow tree must not have any hardwood stems that are >66 percent the height of the free to grow tree within the competition threshold distance for that species. Research in Manitoba (Maclsaac 1995) has determined the threshold distance between hardwood competitor and softwood crop trees beyond which crop trees are free to grow is 1.0m for spruce and 1.25m for pine.

Hardwood trees outside the plot must be considered in the selection of free to grow trees. Hardwoods less than one metre tall (ie. not tallied in stocking assessment) may also render softwood trees not free to grow.

Surveyors may use their own discretion to classify some trees as 'Not Free To Grow' if shrubs within the plot, or branches from trees outside the competition threshold distance overtop the top third of the crop tree.

The softwood free to grow standards indicate the minimum number of acceptable, well spaced, free growing softwood trees per hectare. It is expected that sites classified as softwood "S" by Manitoba's forest resource inventory prior to harvest or sites that have been planted to softwoods will meet the softwood FTG standard.

**Table 5: Softwood FTG Standards**

Site Description	Black Spruce	Pine	White Spruce
Original FRI Subtype code	13 - 17	01 - 06	10 - 11
# FTG stems per ha	800	730	510

The formula used to determine number of FTG stems/ha for an individual species is as follows:

$$\text{FTG stems/ha} = \frac{\# \text{ FTG stems tallied by spp.}}{\text{total plots}} \times 250$$

### B.2. Mixedwood Free To Grow Standards

The mixedwood free to grow standards indicate the minimum number of acceptable, well spaced softwood trees per hectare and total hardwood trees per hectare. It is expected that sites classified as mixedwood "M" by Manitoba's forest resource inventory prior to harvest will meet the mixedwood FTG standard.

After the initial reconnaissance survey has been performed the mean number of well spaced stems per hectare is calculated. If the number of well spaced softwood stems per hectare is more than 300 stems above the minimum standard and there is sufficient hardwood stocking the site is considered "Free To Grow" to mixedwood. If the number of well spaced stems per hectare is within + 300 stems of the standard FTG, mixedwood status can not be confirmed and an additional survey line is necessary. If the number of well spaced softwood stems per hectare is more than 300 stems below the standard, no further plots are necessary and the site is classified according to the Free To Grow standards.

The formula used to determine number of well spaced stems/ha for an individual specie is as follows:

$$\text{Well spaced stems/ha} = \frac{\# \text{ well spaced stems tallied by spp.}}{\text{total plots}} \times 250$$

**Table 6: Mixedwood FTG Standards**

Site Description	Black Spruce	Pine	White Spruce
Original FRI Subtype code	53 - 58	41 - 49	50 – 51
# Well Spaced (WS) softwood stems per ha	1120	860	850
# hardwood stems per ha	2000 - 4000	2000 - 4000	2000 - 4000

B.3 Application Of The Free To Grow (FTG) Standards

The provincial FTG standards indicate the status of each block surveyed. The total number of trees per hectare may be much higher. Sites will be described in one of several classifications based upon the FTG survey results.

The reforestation goal for sites originally classified as softwood and sites planted to softwood is to achieve the FTG-S standard. The reforestation goal for sites originally classified as mixedwood is to achieve the FTG-M standard. If a site does not meet the appropriate FTG standard, the chart in table 7 is consulted to determine which standard best describes the site.

**Free To Grow Softwood (FTG -S-spp)**

- enough well spaced, black spruce, jack pine or white spruce, FTG stems to ensure the site will develop into a softwood forest

**Free To Grow Mixedwood (FTG-M-spp)**

- enough well spaced black spruce, jack pine or white spruce stems and total hardwood stems so that the site will develop into a predominantly coniferous mixedwood stand

**Not Free To Grow Mixedwood (NFTG-M-spp)**

- enough well spaced black spruce, jack pine or white spruce stems to meet the FTG-M standard but with enough hardwood stems so that the site will develop into a predominantly hardwood mixedwood stand

**Not Free To Grow Softwood (NFTG-S-spp)**

- enough well spaced black spruce, jack pine or white spruce stems worth releasing so that the site will develop into a softwood forest

**Mixedwood N**

- enough well spaced conifers (spruce or pine) and total hardwoods to ensure development to mixedwood forest

**Hardwood**

- enough hardwood to develop into hardwood forest

**Softwood Regeneration (REGEN-spp)**

- enough black spruce, jack pine or white spruce regeneration for a site to potentially develop into a mature softwood forest although there are not enough well established conifers to meet the Softwood or Mixedwood M FTG standards.

**NSR**

- insufficient hardwoods or softwoods to develop into fully stocked forest.

APPLICATION OF FREE TO GROW STANDARDS