

White Spruce Management Guidance for DNR Forestry-Administered Lands

Version 1

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Background

In January 2012 a group of field and staff foresters met to discuss white spruce management with particular emphasis on intermediate treatments. The discussions covered many aspects of white spruce management and it was obvious that a more comprehensive guidance was necessary.

In response to that meeting and a white spruce management tour in February 2012, this management guidance was developed. It is not a draft; it is a first version. It is posted on the silviculture program web page in the silvics section.

As part of the process of developing the next version by January of 2013, comments will be solicited from DNR staff in the Divisions of Forestry, Fish & Wildlife, and Ecological and Water resources, as well as silvicultural experts outside of DNR. Beyond that, it will be updated as comments and additions are received.

Purpose

To provide information and guidance to forestry field staff as they develop silvicultural prescriptions for stands where white spruce is a significant component, or where they are considering white spruce as a species choice to help meet planned stand objectives.

Changes from the Previous Version (Division Of Forestry Development Manual, 1994)

- Incorporates Ecological Classification System (ECS) information
- Links prescription objectives with Subsection Forest Resources Management Plan (SFRMP) goals
- Emphasizes the importance of managing white spruce in mixed stands
- Includes recommendations for treatment of existing plantations
- Recognizes the importance of live crown ratio in assessments of stand and individual tree vigor
- Provides suggested thinning regimes, incorporates pre-commercial thinning
- Acknowledges that stand size, access, local markets, and availability of cut to length logging equipment can all affect the site prescription
- Adds considerations for establishing white spruce from seed

General Management Direction

White spruce provides important forest products, wildlife habitat, and biodiversity benefits. White spruce may be managed to produce pulpwood and/or sawtimber products while providing habitat and ecological benefits. Because of its shade tolerance, all-aged, two-aged, or even-aged systems may be used.

Mixed-species stands are likely to be more resilient than pure stands in the face of climate change and other threats to forest health; an important management objective in most situations is to promote within-stand diversity.

White spruce is an important component of conifer restoration in some landscapes.

Recommended Rotation Ages

(From the Division Of Forestry Development Manual 1998)

Site Index (SI)	Pulp	Sawtimber
45-55	60	
55-65	60	70-80
65+	70	80-90

Rotation ages should be shorter on coarse acidic soils or shallow soils to minimize volume loss from butt rot and root rot.

Managing Existing Plantations

White spruce plantations vary widely in stocking, composition, and vigor. Local timber markets and available logging equipment also vary. There is no single prescription that will fit all cases. The main treatment options are pre-commercial thinning, commercial thinning, clearcut with reserves, or a combination of these.

Stand exams should be conducted as planned in SFRMP, typically beginning at age 25-30. Assessment should include inventory of understory composition by species and size class, as well as merchantable timber. Determine site index (SI) and the live crown ratio (LCR) of dominant and co-dominant white spruce. Make note of any forest health issues. Determine native plant community (NPC) and soil type if possible. Note that if a hard pan is present it will reduce rooting depth and will limit operability to frozen ground only in most cases.

White spruce does not naturally grow in pure stands in Minnesota; such stands are vulnerable to attack by a variety of insect and disease agents. Periodic monitoring for growth, health and vigor is recommended. The goal is to keep the LCR greater than 40% to ensure continued growth and plantation health.

Prescription Options

1. SI less than 60: Manage without any intermediate treatments; cut products will be mostly pulpwood.
2. SI greater than or equal to 60: Manage with or without intermediate treatments. A combination of pulpwood and sawlogs can be produced.

Intermediate Treatment Considerations

Pre-commercial thinning. If stand age is between 5 and 20 and white spruce density is high, the site is of small acreage, and/or access is poor, such that a commercial thinning will be unlikely, consider a pre-commercial thinning. Monitor growth; if satisfactory, grow to rotation age without re-entry.

Commercial thinning. Thinning is beneficial by releasing crop trees, allowing them to develop larger crowns with more needles and larger live crown ratios making them better able to survive stresses like spruce budworm defoliation.

Stand age = 30+ years: Consider a commercial thinning if the stand is of good health, LCR of dominants and co-dominants are greater than or equal to 40%, good marketability (enough merchantable volume, adequate tree size, good access) and if suitable logging equipment is locally available.

White spruce has a relatively shallow root system and the roots are easily damaged by heavy equipment. Most stands will not support thinning more than once or twice before final harvest. Tracked equipment has been shown to cause root damage. No work should be allowed when soils are wet.

The thinning operator should leave 3' or more between tires and trees.

If available equipment is too wide to fit between planted rows of white spruce, consider running skid trails perpendicular to the rows.

A combination of strip thinning and thinning from below is recommended. The average diameter after thinning should be greater than the pre-thinning average diameter.

Suggested first-entry thinning prescription: cut strip access rows about 15 feet wide, laid out at a 45 degree angle to the road/landing, every 45-48 feet (herring bone layout). Timber between the strips should be thinned from below. Thin to a BA of 110-120.

Variable density thinning (irregular shelterwood) between the access strips may be another viable option.

LCR of trees being left should be 40% or greater.

Discriminate against balsam fir in the thinning to reduce problems with spruce budworm.

Stand age = 50+ and has never been thinned: Consider thinning only if the stand is healthy and has large enough crowns to respond to the thinning.

LCR of dominants and co-dominants should be greater than or equal to 40%.

If the stand is showing evidence of mortality of dominants or co-dominants from I&D pests like northern spruce engraver beetle, small spruce weevil, or heavy spruce budworm defoliation, etc, the stand is showing early stages of decline and is unlikely to respond favorably to thinning. Decline is likely to continue after thinning, possibly at an accelerated rate.

If the stand is not thinned, due to low LCR or poor health, consider scheduling it for clearcut harvest and regeneration. See below.

Clearcut with reserves (no intermediate treatment) is a viable option for some stands. This is true particularly if the stand is not likely to respond to thinning, or if intermediate treatment is not economically viable due to low volume per acre, small DBH, small acreage, poor access, or if appropriate logging equipment is not available locally. Final harvest (clearcutting) age will vary depending on SFRMP recommendations, LCR, and health of the white spruce in the plantation, as well as future plans for the site.

If final harvest is prescribed, try to leave pockets of healthy spruce, buffered by other residual trees, to serve as a seed source for the next stand.

Reinitiation

- Focus on NPCs where white spruce is rated good or excellent, unless timber production is not an important objective. Consult the NPC silvicultural interpretations for information on additional species likely to grow well on the site.
- White spruce is not a pioneer species; establishment under partial shade is likely to be more successful than in full sunlight and results in fewer problems with yellow headed spruce sawfly and white pine weevil
- Avoid establishing pure stands of white spruce; manage for a mixed stand, typically with aspen or other hardwoods
- Until the white spruce seedlings are free to grow, regular monitoring is necessary, starting 2 or 3 years post-harvest, to allow for scheduling follow up treatments if required

Planting

- Planting cutover sites (without site prep) with containerized stock at 400 to 500 per acre, has been shown to be successful and cost effective. Typically these are sites where the preceding stand was dominated by aspen, and the prescription is to manage for both spruce and aspen together.
- Site prep (brush raking or shearing) and planting can also be successful, but be aware of the potential for soil compaction especially on medium or fine textured soils. Avoid trenching on medium or fine textured soils, since trenches may promote ponding around the seedlings, which can kill them.
- Avoid broadcast herbicide application, but do plan for mechanical release of spruce and spacing of aspen/hardwood regen 4 to 7 years after planting. A second mechanical release may be necessary approximately five years after the first release.

Seeding

- Establishment from seed is more cost effective than planting, but is only recommended if adequate seed trees, and a receptive seedbed, are present. One-time direct seeding attempts have not shown consistent success.
- On clearcut sites, seed trees should be retained within clumps of residuals to protect them from windthrow.
- Rotted logs, feather mosses, and exposed mineral soil can all be effective as a seedbed.

- White spruce seed tree retention within the transition zone between lowland and upland is preferred, because seedbed conditions are likely more favorable there.

Major Wildlife Considerations (from Forest Development Manual, 1992)

Shrubs and forbs in young plantations provide browse for deer and moose. (A partial canopy of shrubs or hardwoods also reduces insect, disease, and frost damage to seedlings.) The value of a fully stocked white spruce stand for browse decreases as the tree canopy closes because shrubs and forbs are shaded out. Older stands may provide thermal cover for deer and moose when balsam, white cedar, or other mixed conifer stands are absent.

For more information on white spruce management –

Management of White Spruce, Government of Alberta, Agriculture and Rural Development

[http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/apa6261](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/apa6261)

White Spruce, Extension Notes, Ontario Ministry of Natural Resources

http://www.lronline.com/Extension_Notes_English/pdf/wht_sprce.pdf

A preliminary white spruce density management diagram for the Lake States, 2000, Saunders & Puettmann, U of MN, Dept. of For. Resc., Staff paper # 145

http://www.forestry.umn.edu/prod/groups/cfans/@pub/@cfans/@forestry/documents/asset/cfans_asset_184456.pdf

White Spruce Plant Guide, USDA NRCS

http://plants.usda.gov/plantguide/pdf/pg_pigl.pdf