32 Extension Note

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Clumpy Spacing

Juvenile Spacing Douglas-fir into Clumps to Imitate Natural Stand Structure

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Introduction

Drybelt Douglas-fir is a moderately shade-tolerant species that grows in multi-aged stands on dry sites in the southern Interior of British Columbia. These stands may include aspen and scattered or patchy lodgepole pine as well as the Douglas-fir in distinct or mixed layers. Stand structure between and within stands often varies greatly.

These drybelt stands have high timber values and, if well managed, can provide opportunities for regular

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What are the Benefits of Clumpy Spacing?

- ***Helps accelerate stand development in areas where high timber volumes have been harvested.*** *Spacing Douglas-fir saplings into clumps helps to restore the stand's natural structure.*
- ***Helps prepare the stand for future harvest entries.*** *Clumpy spacing, which has objectives similar to low-volume selection harvesting, facilitates future harvest entries while enhancing winter range habitat for mule deer.*
- ***Increases litterfall.*** *The more crowded tree tops within the clumps rub together in the wind, abrading and knocking down branchlets that increase wildlife forage.*
- ***Maximizes snow interception.*** *The tighter spacing of trees within each clump combined with the opportunity for crowns to expand at the clump edges reduces the amount of snow that reaches the ground, which in turn helps to reduce the energy needed by mule deer for winter movement.*
- ***Stimulates growth of forage species.*** *The 5-m wide, open patches between conifer clumps provide spaces where forage species (such as willow, rose, and saskatoon) can be released and established.*
- ***Increases potential to maintain and enhance wildlife habitat diversity in managed Douglas-fir stands.*** *More than improving the stand's timber yield, the clumps and open spaces contribute to habitat diversity, which benefits other wildlife species.*
- ***Emulates the natural stand structure of drybelt Douglas-fir.*** *Clumpy spacing can help maintain natural stand-level biodiversity.*

harvest entries approximately every 30–50 years. At the same time, many stands are important winter habitat for mule deer, providing forage, thermal cover, security cover, and snow interception cover. Retaining certain stand attributes is therefore critical to mule deer survival during average to severe winters (Armleder et al. 1986).

For centuries, drybelt Douglas-fir stands experienced light wildfires every 7–20 years, on average (Daigle 1996)—a natural process that regularly thinned out the lower layers. Fire suppression over the last 60 or so years has left stands dense with thickets of small Douglas-fir saplings.

Such thickets create high inter-tree competition for moisture, light, and nutrients. The result is trees with small crowns that intercept snowfall poorly and reduced diameter growth that leaves the thickets vulnerable to snowpress damage. This means not only that it takes longer for trees to reach a valuable size for timber and wildlife, but also that high-density stands in fact *decrease* habitat quality for mule deer by impeding movement, reducing accessible area, and eliminating ground forage production.

The need for a method of stimulating stand development on mule deer winter range led, in 1987, to a series of trials with "clumpy spacing" in the Cariboo Forest Region. Operational use and further evaluation have followed. The work is a joint project of the Ministry of Forests and the UBC Alex Fraser Research Forest at Williams Lake.

Observations and recommendations from that work are summarized in this publication.

What Is Clumpy Spacing?

Clumpy spacing is a way to establish early density control in a stand by using juvenile spacing to concentrate selected crop trees into clumps. Specific standards for clumpy spacing treatment are applied using the normal provincial juvenile spacing contract which is modified as required for each prescription.

Clumpy Spacing Prescriptions

Clumpy spacing has many goals similar to those of standard juvenile spacing. Both methods aim to establish a stand of healthy crop trees by minimizing the competition for light and moisture and thus increasing the stand's merchantable volume at the next harvest. The main difference is that standard or uniform spacing produces a stand of fairly evenly spaced trees, whereas clumpy spacing—working more in harmony with the natural spacing of Interior Douglas-fir natural regeneration—leaves a stand of "clumped" selected crop trees. The clumps differ in size (number of stems) and tree height, according to the pre-treatment stand characteristics.

Like uniform spacing in drybelt Douglas-fir stands, clumpy spacing promotes Douglas-fir as the preferred species and allows for the retention of small conifers (Douglas-fir and spruce < 1.0 m tall and lodgepole pine < 0.5 m tall). As well, large trees of good form are left for harvest at the next stand entry. These provisions aim to promote the layered structure of these stands and ensure that future crop tree selection and timber extraction options are available.

Stand Density and Stocking Factors

The goal of clumpy spacing is to use the growing space fully and obtain timber volume yields similar to those achieved by standard spacing on similar sites. The total stand density for clumpy spacing is 1000 ± 250 stems/ha. Clumpy spacing prescriptions can result in a wide range of post-treatment densities, which will vary according to pre-treatment stand structure, the prescription, and the contract specifications.

Planning for Clumpy Spacing

Clumpy spacing in drybelt Douglas-fir stands is best planned and prescribed at both the landscape and stand levels when mule deer winter range is present or similar management objectives exist. To confirm suitability of the treatment, it is particularly important to establish stand-level objectives before clumpy spacing is prescribed. Other biodiversity requirements (Park and McCulloch 1993) may also be met with clumpy spacing treatments.

Practitioners using clumpy spacing have learned that the prescription must be carefully planned on a stand-specific basis. Contract standards must be set to minimize the number of merchantable or near-merchantable stems that are cut to create the gaps. Stands that have been heavily harvested or that have a large area of skid trails will benefit from clumpy spacing if the prescription encourages retention of the remaining larger stems and use of existing gaps. Proper collection and interpretation of stand data is therefore a critical prerequisite to any prescription of clumpy spacing.

Retention of unspaced strips and patches within and adjacent to the treatment block is highly recommended in conjunction with clumpy spacing. This aspect of a stand-level prescription should be included in the context of landscape-level management objectives and the condition of adjacent stands.

*The **clumpy spacing Schedule C** for a juvenile spacing contract includes the following objectives and requirements:*

1. *The objective of clumpy spacing is to space to produce clumps of trees of approximately equal height.*
2. *Optimum spacing between trees within each clump is 2.1 m, with allowable spacing of 0.5 – 2.5 m. This usually yields three to nine trees per clump, or an average of seven trees in a 6-m diameter clump (although the clump may be as large as 6 x 10 m). The aim is to leave the best trees in each clump.*
3. *Clumps will be 5 m apart, as measured between the outer stems of adjacent clumps.*
4. *Clump height will be determined by the dominant layer's height in that portion of the stand.*
5. *Trees more than 3 m higher than the average height of the clump will be left without regard for their spacing, provided there is no apparent mechanical damage indicating crown competition. If crown competition exists, the smaller tree must be cut.*
6. *Deciduous trees in each clump must be felled if their crowns are judged to be in contact with the conifers, but must be left uncut between clumps.*
7. *Conifers over a maximum specified diameter will be left uncut and will not affect the inter-clump distance or the number of crop trees in that clump.*
8. *Clumps with a height differential of more than 3 m will be left, regardless of the required inter-clump spacing.*

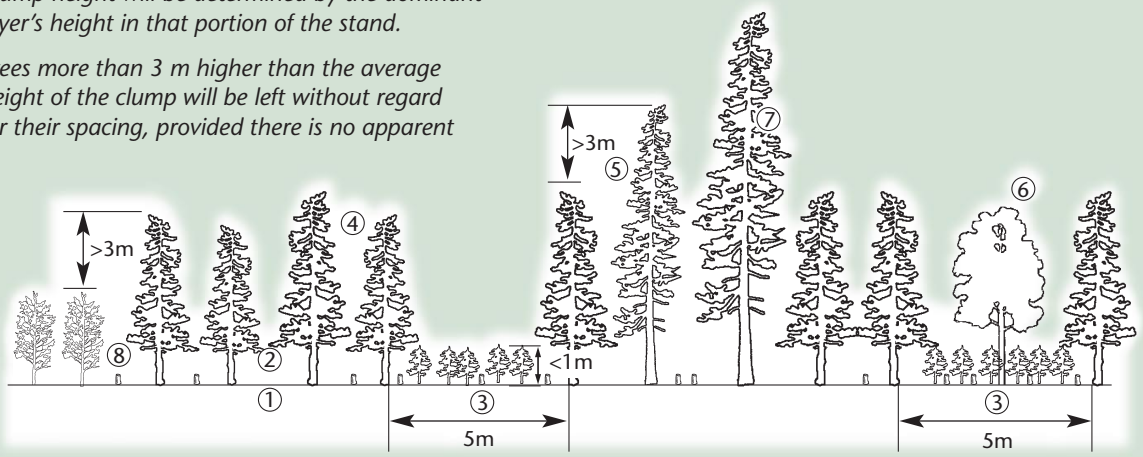

FIGURE 1 *Clumpy spacing Schedule C.*

Additional Recommended Practices for Juvenile Spacing

To maximize the habitat and biodiversity benefits of both standard and clumpy spacing, the following practices should be planned and implemented together:

- ***Leave unspaced strips or patches between and within blocks.** The need for untreated areas must be considered together with landscape-level wildlife management objectives, habitat availability, stand adjacency, and silviculture management plans. Unspaced areas may be planned for later treatment.*

  Studies have shown that unspaced strips 30 m or wider receive the highest direct use by snowshoe hares, red squirrels, and some species of birds. Mule deer also use these unspaced strips indirectly for security cover and protection from the wind. As well, unspaced areas surrounding wildlife tree patches serve as buffers for mule deer.

  Connectivity between unspaced areas should also be considered in the pre-treatment planning stage. For further information, refer to the Forest Practices Code Spacing Guidebook *(B.C. Ministry of Forests 1995) and* Guidelines for Maintaining Biodiversity During Juvenile Spacing *(Park and McCulloch 1993).*
- ***Keep discernible trails free of slash.** To maintain travel routes for wildlife and livestock, slash must be cleared from trails. New trails should also be created in areas larger than 0.25 ha that have deep (> 0.5 m), continuous slash.*
- ***Reduce slash loading through parallel falling.** Slash should be limited to a maximum height of 0.5 m.*
- ***Maintain snags.** Workers' Compensation Board requirements allow snags that are up to 5 m tall and do not pose a hazard to be left without surrounding no-work zones. In some cases, high-value snags over 5 m tall may also be left if identified by a certified snag assessor.*
- ***Retain deciduous cover.** All deciduous trees should be left uncut if they are not competing with conifers.*
- ***Distribute any type of juvenile spacing over time and the land base.** Hundreds of hectares should not be spaced in one area in a short period of time. All spacing programs should be planned and implemented at the landscape level.*

How to Implement Clumpy Spacing

- *Review landscape-level goals to maintain mule deer winter range and biodiversity.*
- *Determine the potential of clumpy spacing to meet defined management objectives.*
- *Assess the stand's suitability for clumpy spacing.*
- *Lay out the treatment block boundaries, being sure to include clearly marked unspaced areas.*
- *Use the clumpy spacing Schedule C with the juvenile spacing contract.*
- *Ensure that the contractor is experienced with clumpy spacing or at least fully aware of the treatment objectives and standards.*
- *Monitor contractor quality carefully, especially in the early stages of the contract.*
- *Evaluate the short- and long-term effects of clumpy spacing, compare them with results of standard spacing, and determine the site-specific applicability of clumpy spacing to other stands in the specific management area.*
- *If required, contact the individuals listed on the back page for further information. Consider viewing the clumpy spacing demonstration area at the Knife Creek block of the UBC Alex Fraser Research Forest.*

Associated Issues

Treatment Costs

Treatment costs for clumpy spacing of drybelt Douglas-fir are currently equivalent to costs for standard spacing, or up to one-third higher. As the contracting workforce becomes more familiar with clumpy spacing methods and more efficient, costs are expected to be consistently closer to those for standard spacing.

Growth and Yield

Clumpy spacing is intended to enhance the mule deer habitat characteristics of a stand while significantly increasing the timber value. To achieve this, the prescription must address full site occupancy, particularly by trees over 12.5 cm dbh. This means that the Schedule C standards of the clumpy spacing contract will need to be adjusted, based on pre-treatment stem density and distribution.

Early growth and yield measurements comparing standard spacing with clumpy spacing (and using distances between clumps of either 3 m or 5 m) showed that the 5-m spacing between clumps produced the lowest rate of natural mortality, a basal area growth similar to that resulting from standard spacing, and the highest diameter growth and vigour of all the treatments (Marshall and Bugnot 1997). The 5-m spacing treatment showed no significant reduction in overall volume per hectare. Wider testing as an operational treatment is under way to evaluate these promising results further.

Other Potential Treatment Areas

Clumpy spacing may be used outside mule deer winter range where stand-level objectives include producing an aggregated stem distribution that more closely simulates natural stands. Notably, it may be applied in Douglas-fir stands located in areas classified as Natural Disturbance Type 4 (ecosystems with frequent stand-maintaining fires), where management objectives are similar to those in mule deer winter range.

Further Work

Clumpy spacing is being examined as a new density control method to meet specific management objectives. Further study at this operational testing stage is required to assess the long-term effects. Foresters and biologists will continue to study the applicability of clumpy spacing through field observations and research trials. Modifications may be required in future treatment prescriptions to ensure that clumpy spacing prescriptions properly address the unique structure of each drybelt Douglas-fir stand.

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For more information on research in the Cariboo Forest Region: **http://www.for.gov.bc.ca/cariboo/research/research.htm**

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