Mixed-shrub Complex

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This operational summary provides information about vegetation management in the mixed-shrub complex. This complex is often dominated by a combination of the following species: thimbleberry (*Rubus parviflorus*), red raspberry (*Rubus idaeus*), black twinberry (*Lonicer involucrata*), Douglas maple (*Acer glabrum*), Sitka alder (*Alnus viridus* spp. *sinuata*), false box (*Paxistima myrsinites*), red elderberry (*Sambucus racemosa*), false azalea (*Menziesia ferruginea*), willow (*Salix* spp.), birch (*Betula* spp.), snowberry (*Symphoricarpus albus*), highbush-cranberry (*Viburnum edule*), and red-osier dogwood (*Cornus sericea*). Dominant herb species occurring with this complex include: fireweed, lady fern, bracken, and grasses.

Topics covered in this summary include development of the complex and its interaction with crop trees; non-timber values and pre-harvest considerations; and management strategies for current and backlog sites.

Other Titles in this Series

Operational Summary for Vegetation Management:

- Dry Alder Complex
- Ericaceous Shrub Complex
- Fireweed Complex
- Pinegrass Complex
- Wet Alder Complex
- Willow Complex

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Operational Summary for Vegetation Management

Mixed-shrub Complex

FOREWORD

Managing competing vegetation during reforestation can be challenging. Combinations of plants that thrive in seral ecosystems are often well suited to dominating sites following harvesting or wildfire. While many treatment methods for limiting the growth and spread of these vegetation complexes have been explored, efficacy has varied widely. This is due in part to the widely varying mix of parameters from site to site, including the number, health and structure of the competing plants on site, site conditions and timing of forestry activities. In addition, while some treatments may provide suitable control, the cost in terms of site degradation, hazard to surrounding habitat or crop trees, or the cost of the treatment itself may be prohibitive.

Much work has been undertaken during the past decade by ecologists, silviculturists, and vegetation management specialists on identifying the characteristics of and the range of treatment options for major competing vegetation complexes. Until recently, however, knowledge about managing particularly challenging vegetation complexes was scattered. This series summarizes the key information needed to identify and manage important vegetation complexes in British Columbia.

INTRODUCTION

This operational summary provides information about vegetation management issues in the mixed-shrub complex. Topics include: complex development and interaction with crop trees; treatments that affect development of the complex; non-timber and pre-harvest considerations; and management strategies for current and backlog sites. Each complex includes several plant species and may be found over a wide range of ecosystems. As a result, response to treatments will vary within complexes, and prescriptions should be developed on a site-specific basis.

1. DESCRIPTION

Species Composition

Major shrub species in the mixed-shrub complex include:

- thimbleberry (*Rubus parviflorus*)
- red raspberry (*Rubus idaeus*)
- black twinberry (*Lonicera involucrata*)
- Douglas maple (*Acer glabrum*)
- Sitka alder (*Alnus viridis* ssp. *sinuata*)

- false box (*Paxistima myrsinites*)
- red elderberry (*Sambucus racemosa*)
- devil's club (*Oplopanax horridus*)
- false azalea (*Menziesia ferruginea*)
- willow (*Salix* spp.)
- birch (*Betula* spp.)
- snowberry (*Symphoricarpus albus*)
- highbush-cranberry (*Viburnum edule*)
- red-osier dogwood (*Cornus sericea*).

Major herb species include:

- fireweed (*Epilobium angustifolium*)
- lady fern (*Athyrium filix-femina*)
- bracken (*Pteridium aquilinum*)
- grasses.

Not all of the shrub and herb species listed are present on all sites.

Occurrence

This complex is widespread on fresh to wet sites in the ICH zone with fewer examples in the SBS, ESSF, MS, and BWBS zones. The complex occurs on a variety of soils, ranging from deep Regosols and Brunisols on alluvial flats, to seepage sites with more highly differentiated soils and pronounced soil organic layers (LFH).

2. DEVELOPMENT

Reproduction

The diversity of species and reproductive strategies of this complex makes vegetation management relatively difficult.

Methods of seed dispersal vary among species. Some shrub species in this complex produce abundant seed that can be dispersed readily by animals (e.g., thimbleberry, red-osier dogwood, twinberry, and raspberry). The seeds of these species will often remain banked in the soil until suitable conditions for germination occur.

In contrast, most invading competitors from adjacent areas — fireweed, birch, alders, willow, and grasses — tend to have light wind-dispersed seed and do not bank seed.

All of the major species in this complex regenerate vegetatively, many by more than one method. Thimbleberry, raspberry, false box, fireweed, bracken, and many grasses have rapidly spreading rhizomes or root suckers. Red-osier dogwood, black twinberry, snowberry, and highbush cranberry usually spread less rapidly by layering or limited rhizomatous growth. Douglas maple, alder, willow, red elderberry, and false azalea sprout mainly from the root collar. Many of the species will regenerate from detached stem, rhizome, and root fragments.

Rate of Development

Vegetation development and site occupancy following disturbance are usually rapid in this complex because the ecosystems are highly productive, and understory shrubs are normally abundant before logging. Within 1–2 years after harvesting, this complex can achieve 100% cover and a minimum height of 1–1.5 m on some sites.

Root systems are generally not destroyed by logging, and plants recover rapidly. Vegetative propagation from rhizomes, stolons, and branch fragments contribute to explosive growth. In full sunlight, crowns expand to occupy newly available growing space.

Treatments that Affect Development

In general, a species shift often occurs in this complex with some treatments. Species unaffected by treatment will tend to dominate the site. The following are some observed effects of treatments in this complex.

- prescribed fire can change the species composition and set back vegetation development by a few years. Also, prescribed fire favours seedbankers (e.g., raspberry and thimbleberry), some species that spread by rhizomes, and fireweed. Low- to medium-intensity burns appear to increase competition. While high-intensity fires can reduce competition, they may not be desirable due to long-term productivity losses.
- soil disturbance associated with logging or mechanical site preparation (MSP) allows many species to regenerate from stem, rhizome, and root fragments. Such a disturbance creates a seedbed for seedling establishment.
- severe MSP treatments, although not recommended, will reduce vegetative propagation in the upper soil horizons containing the root systems.

Interaction with Crop Trees

The mixed-shrub complex affects conifer survival and growth primarily through competition for light. The vigour and competitive ability of the complex varies with the number and type of brush species present. However, the competition is generally high because this shrub community occurs on highly productive ecosystems.

3. Non-timber Values

All of the plant species in the the mixed-shrub complex are valuable to wildlife. The more diverse the species composition and the more productive the ecosystem, the greater variety and number of animals the complex supports. Treatments that reduce the quantity and diversity of plants on these ecosystems may have some impact on wildlife.

4. Pre-harvest Considerations

Questions to consider at the pre-harvest stage include the following:

- Is the complex already well established or will the site support the complex after logging?
- Will conifer or hardwood production, or a number of attributes be emphasized?
- How productive is the ecosystem?
- How much brush of what species is on site?
- What species are considered desirable?

Silvicultural System

Overstory removal increases the cover of some species (e.g., thimbleberry), but has relatively little effect on others (e.g., twinberry).

Advance Regeneration

A pre-harvest assessment of residual trees will influence the vegetation management strategy for the site.

Method of Reforestation

Planting with large stock immediately after site preparation is recommended.

Timing

Delays in vegetation management treatments often increase competition from surrounding vegetation and prevent successful crop tree establishment. This situation may require many brushing treatments.

5. Vegetation Management Strategies for Current Sites

Site Preparation

General

The mixed-shrub complex generally requires some form of vegetation management to achieve a free growing crop. Site preparation has many advantages over follow-up brushing treatments, provided there is no need to preserve residual trees. Prompt planting following site preparation is necessary. A one-year delay can cause plantation failure due to competition.

Mechanical

Low-impact MSP is generally unsuccessful in the mixed-shrub complex because root/rhizome systems remain largely unaffected with this treatment.

High-impact MSP is often successful when combined with the planting of large stock. However, if the organic layer of the soil is completely removed by the MSP treatment, most of the nutrient capital is lost. While this treatment provides 3–5 years of control, it usually causes unacceptable soil

degradation. Conifer growth problems may become apparent on these degraded sites after 10 or more years despite the early healthy appearance of the seedlings.

Where MSP is the chosen treatment, either medium-impact blading with a small caterpillar and brush blade, or mounding is suggested. Medium-impact blading may require a follow-up manual or chemical brushing treatment. Given the vigour and height of the complex, mounds must be large.

MSP does not greatly enhance invasion by hardwood species such as alder and birch, provided seed trees are not in the immediate vicinity. However, mechanical treatments that create patches of mineral soil and leave nearby alder or birch undisturbed (such as dip-and-dive) can greatly increase hardwood establishment.

Screefing

If burning, MSP, and herbicides are not suitable treatment choices for the site, alternative options are available. Motorized screefers followed by planting of very large stock and a manual brushing program is an alternative. This treatment is ineffective with thimbleberry or raspberry, as fragments of these plants can root and completely dominate the screef within one year. In other cases, release from competition lasts for only one year.

Prescribed Burning

Following harvesting prompt burning and planting with vigorous stock provides the most effective regeneration strategy for this complex. ICH sites often require burning to improve planter access. Fire severity is the key to vegetation control.

On most sites with this complex, low-impact burns should be avoided because they provide less than one year of control and usually stimulate vigorous resprouting and suckering. Follow-up brushing is often necessary in the more productive mixed shrub complex, even when large stock is planted. A further complication following low-impact burns is the risk of mortality in subsequent plantations due to Rhizina root disease *(Rhizina undulata)*.

High-impact burns will provide over two years of vegetation control and, when combined with the planting of large stock, will usually result in successful reforestation. High-impact fire removes most surface organic material and kills the root systems of most plants. Although high-impact fire treatments provide good vegetation control, they must be implemented carefully since the treatments are done at the time when fire hazard ratings are high to extreme. Also, as the mixed-shrub complex occurs on a wide range of soil types, the use of high-impact fire must be site specific to avoid site degradation.

Chemical

Glyphosate is the only registered herbicide with a broad enough efficacy spectrum to control most of the species found in the complex. Hexazinone and 2,4-D are ineffective.

This complex can be treated in early August to maximize control, and then planted the following spring without further treatment provided existing vegetation and slash are not too heavy.

Seeding

Seeding with a grass/legume mix may successfully control competing vegetation. A site preparation treatment (MSP or fire) should be done prior to seeding. Seeding treatment should be carefully monitored as it may negatively impact seedling growth.

Livestock Grazing

The effectiveness of browsing treatments largely depends on treatment timing and the species composition on site. Vegetation on a mixed-shrub site containing a large percentage of highly palatable species, such as willow and fireweed, can be more successfully controlled than a site dominated by less palatable species, such as red-osier dogwood and alder. Species palatability changes throughout the growing season. For example, fireweed and thimbleberry become woody and unpalatable by July.

Also, treatment is not effective where the vegetation is greater than 1 m tall.

Planting

Timing

A one-season delay often reduces reforestation success by allowing competing vegetation to occupy the site.

Stock Type

Planting stock should be sturdy (2+0 PSB 415 or larger) with large caliper.

Species Selection

On sites where low to medium levels of competition are expected, a crop species with a rapid early growth rate (such as lodgepole pine where appropriate) should be chosen. On high competition sites, more shade-tolerant species (such as spruce or subalpine fir) should be planted.

Brushing

General

On the more productive sites of the complex, such as those found in wetter subzones, a brushing treatment after site preparation may be required.

Manual

At least two manual cuttings will be required to release seedlings. Often annual treatments are needed to control the vigorous resprouting of most species.

If brushsaws are used, allowances should be made for substantial damage to seedlings during each treatment. If three entries are planned, roughly half of the planted seedlings may be lost to mechanical injury. Damage from manual treatments can be substantial because crop trees are difficult to locate in sites dominated by this complex. Using large planting stock can reduce brushsaw damage as the seedlings will be more visible. Non-

motorized techniques (such as “hockey sticks” for bending competing brush) may dramatically reduce seedling damage. Staking or flagging seedlings at the time of planting may be cost effective if multiple manual cutting treatments are anticipated.

When conifers are 1–3 m tall, removal of hardwoods with chainsaws or brushsaws is feasible but costly. Larger, isolated stems of willow, aspen, maple, and birch may be manually girdled (e.g., with the Vredenburg or chain girdlers). Willow bark is particularly fibrous, making these hand tools more difficult to operate on this species than on alder, birch, or aspen. If the cambium is not completely severed, cambial bridging commonly occurs and the willow will survive.

Chemical

Glyphosate is the only registered herbicide with a broad enough efficacy spectrum to control most of the species found in the complex. Glyphosate tends to shift the species composition to grasses, raspberry, and herbaceous species such as twistedstalk, stinging nettle, and bedstraw. Two chemical brushing treatments may be needed on the more productive sites.

Hack-and-squirt with 50% glyphosate is effective for isolated stems of willow, aspen, maple, and birch.

Livestock Grazing

Sheep can reduce competition provided slash loads are low and the browsing treatment is repeated at least once. Refer to the section, *Site Preparation, Livestock Grazing* for more information.

6. Vegetation Management Strategies for Backlog Sites

General

The abundance of vegetation in this complex often makes complete site preparation mandatory for ease and success of planting. Whether existing crop trees are worth preserving should be assessed. If stocking is low or not worth preserving, an MSP or burning treatment may be appropriate for the entire area. However, if scattered trees are worth saving, a spot treatment can be followed by fill-planting.

In the backlog areas of this complex, vegetation regrowth following MSP or burning treatments tends to be vigorous because of the regrowth from established root/rhizome systems. Follow-up brushing will be required.

Mechanical

When fill-in planting is selected, a motorized patch scarifier can create planting spots for very large stock such as PSB 512s or 615s. However, thimbleberry and raspberry can completely dominate a screef within one year. Frost and flooding of the screefed depression can also decrease success.

When the existing stock is not worth retaining, medium-impact MSP can create planting spots and trails. A mid-sized crawler and brush blade, patch scarifier, or disc trencher is most effective. Studies in the southern ICH zone indicate that if the horizontal displacement of forest floor is less than 1 m, the same shrub species will rapidly reinvade the site. Larger displacements will deter the shrub regrowth but will cause a shift in species due to in-seeding.

The use of very large (PSB 512s, 615s or equivalent) planting stock immediately after site preparation, followed by manual or chemical brushing can be effective in the reforestation of these sites.

Prescribed Fire

Broadcast burning is possible without a "browning agent" such as glyphosate, but successful burns require extreme fire hazard conditions to carry through a mixed-shrub brushfield. A low, dense bed of fuels improves the success of burning. To date, prescribed fire in this complex has had variable results.

Chemical

Aerial- and ground-based applications of glyphosate are effective in managing vegetation in this complex. Where feasible, there should be no treatment or disturbance following the herbicide application. The site can be planted without further disturbance. Two-layer canopies often require two treatments — once for the overstory, and another 4–6 weeks later for the understory.

"Brown-and-Burn"

Burns to date in the very wet and cool ICH (ICHvk1) used mid-July application of glyphosate. The results were successful but somewhat spotty, and required follow-up chemical brushing treatments. A major disadvantage with "brown-and-burn" treatment is the need to burn during the high fire hazard rating period.

7. Summary of Treatment Efficacy

Among non-chemical treatments, high-impact prescribed fire or medium-impact MSP followed immediately by planting with large seedlings are leading choices in this complex. Both treatments may cause site degradation and often require follow-up manual or chemical brushing. When using manual cutting, plan for at least two or three treatments (once annually). Single manual treatments are generally ineffective and may increase cover of thimbleberry and other species.

Chemical site preparation and chemical brushing treatments have been effective without causing site degradation. Glyphosate is recommended because of its broad efficacy spectrum and minimal effect on crop species.

For More Information

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Appendix – Key to Biogeoclimatic Zones of British Columbia

AT	Alpine Tundra	IDF	Interior Douglas-fir
BG	Bunchgrass	MH	Mountain Hemlock
BWBS	Boreal White and Black Spruce	MS	Montane Spruce
CDF	Coastal Douglas-fir	PP	Ponderosa Pine
CWH	Coastal Western Hemlock	SBPS	Sub-Boreal Pine–Spruce
ESSF	Engelmann Spruce–Subalpine Fir	SBS	Sub-Boreal Spruce
ICH	Interior Cedar–Hemlock	SWB	Spruce–Willow–Birch