Reedgrass Complex

This operational summary provides information about vegetation management in the reedgrass complex. This complex is dominated by almost pure stands of reedgrass (*Calamagrostis canadensis*). Herbaceous and shrubby species consitute only a minor component of this complex.

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
- Mixed-shrub Complex
- Pinegrass Complex
- Wet Alder Complex
- Willow Complex

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Operational Summary for Vegetation Management

Reedgrass Complex

British Columbia

Forest Practices Branch
Ministry of Forests

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Operational Summary for Vegetation Management
Reedgrass 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 reedgrass 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

This complex is comprised almost entirely of reedgrass (*Calamagrostis canadensis*) alone. Once a reedgrass complex develops, few other species can establish or survive. Herbaceous and shrubby species constitute only a minor component of the reedgrass complex.

While the interior and northern variety of this species (*C. canadensis* var. *canadensis*) has been described by some as Scribner's reedgrass (*C. scribneri*), traditionally it has been included with discussions of reedgrass (*C. canadensis*) and thus will be treated in the same manner in this summary.

Occurrence

The reedgrass complex has minor localized competitive impacts on wet sites throughout all biogeoclimatic zones; however, it is on moist to wet sites in the BWBS, SBS, and the higher elevations of the ICH and the ESSF of the southern interior that this complex has a significant competitive impact. The reedgrass complex in the SBS, ESSF, and ICH usually becomes a significant problem only when there has been considerable mineral soil exposure. In all zones, the reedgrass complex obtains its greatest domination on early seral disturbed sites.

While the reedgrass complex occurs on a wide range of sites with both mineral and organic soils, it is predominantly found on nutrient-medium, moist, fine-textured soils or sandy soils with high water tables. Reedgrass is able to tolerate both flooding and, once established, drought.

2. Development

Reproduction

Reedgrass is able to reproduce both through the production of seed and through the vegetative expansion of underground rhizomes. The ability of reedgrass to produce seed and rhizomes is influenced by a number of environmental factors.

Under a closed forest canopy with very low light levels (e.g., spruce-dominated overstory), flower and rhizome production is low. The majority of the plant's energy is directed at survival of the parent plant, and few resources are transferred for the production of reproductive structures. Under these conditions, reedgrass plants produce very little to no seed. Rhizome production under low light conditions is the main method of reproduction; however, the number of rhizomes produced and the amount of stored carbohydrate reserves is low.

After canopy removal — either by logging or after a light burn — the surviving reedgrass plants and rhizomes rapidly expand to dominate the site. When grown under full light, reedgrass is able to produce abundant viable wind-dispersed seed that readily germinates under a range of moisture and temperature regimes. Individual plants that survive the disturbance will rapidly produce seed, thus allowing for the potential colonization of adjacent areas. As well, the easily transported seed is capable of colonizing recently disturbed areas from distant undisturbed areas. Reedgrass also has moderate seed banking capabilities and is able to retain some seed viability for up to 5 years of storage in the soil.

The majority of localized spread of reedgrass on disturbed sites occurs through the underground lateral spread of rhizomes, which allows rapid colonization of adjacent areas. Intact and severed rhizomes have the ability to rapidly produce new plants. Parent plants are able to subsidize the

growth and extension of rhizomes into new areas for the production of new plants. The storage of carbohydrate reserves in the rhizomes allows for the production of new plants even after the rhizome has been severed from the parent plant. Even small rhizome segments containing only one bud can produce a new plant.

Rate of Development

Under the reduced light levels of a closed forest canopy, the above- and belowground biomass production of reedgrass is severely reduced. When the forest canopy is removed, either through logging or natural disturbances, reedgrass rapidly expands. Tiller (upright stem) and rhizome production significantly increase under full light conditions, and ground coverage rapidly expands. Reedgrass can form continuous mats within 3 to 4 years following harvest when grown in optimum conditions.

Treatments that Affect Development

Development of the reedgrass complex is promoted by treatments that increase light levels and create ground disturbance. Once established, the reedgrass complex is relatively long-lived, and few other species can colonize and out-compete an established reedgrass stand. Therefore, establishment of the reedgrass complex should be inhibited and desired crop trees established prior to full complex development.

Treatments that favour the development of the reedgrass complex include:

- increased light levels created through natural disturbances or harvesting
- light to moderate burning
- ground disturbances which expose mineral soil
- removal of other non-crop vegetation (e.g., non-crop trees and shrubs)
- low- to medium-impact mechanical site preparation (MSP)
- fertilization.

Treatments or factors that can impede or delay reedgrass complex development include:

- complete or partial shading
- very intense burns
- dry site or soil conditions
- large mineral soil mounds
- crop release with hexazinone (Velpar® L or Pronone® 10G) or glyphosate (Vision®) in late summer
- chemical site preparation with hexazinone (Velpar® L or Pronone® 10G) or gylphosate (Vision®) prior to site domination by reedgrass
- prescribed grazing with sheep
- high infestation levels of snow mould (not yet registered for operational use).

Interactions with Crop Trees

Increases in light levels and nutrient availability associated with forest canopy removal result in an increase in the biomass production of reedgrass. Under full light conditions, the grass plants will produce numerous tillers that will, presumably, decrease the amount of light reaching the soil surface and delay soil heating in the spring. Delays in soil heating can reduce crop tree seedling root development and growth. A thick canopy of reedgrass will also reduce the amount of light reaching crop tree seedlings. Reduced light levels will then reduce stem caliper and height growth of the crop tree. The thinner crop trees produced under these conditions are more susceptible to snowpress from the large amounts of aboveground litter produced by reedgrass.

Thick mats of reedgrass litter, which can accumulate on well-developed grass communities, create an insulating effect which delays soil heating and results in prolonged soil frost retention and, potentially, the desiccation of crop tree seedlings in the spring. These thick mats of organic litter can also prevent the seeds of other vegetation from reaching the soil surface, thus inhibiting natural revegetation of the site with a variety of species. Seeds falling into this litter may be suspended above the soil and the germinants desiccate as the litter layer dries in spring.

The large root biomass produced by reedgrass may reduce the amount of soil moisture and nutrients available to crop tree seedlings.

Beneficial effects of reedgrass may be the control or reduction of soil surface erosion, the contribution of large amounts of soil organic matter to the site, and the exclusion of other competitive species.

3. Non-timber Values

Due to the moderate palatability of reedgrass, domestic livestock and wildlife do not readily utilize it when more palatable forage is available. Reedgrass may provide some winter and spring forage for elk and rabbits but is a minor component of their diet. Reedgrass may also provide cover for small mammals. A negative impact is that the dense sods of reedgrass may prevent the establishment of deciduous browse species utilized by moose.

Soil surface erosion may also be reduced with a cover of reedgrass. Thick mats of reedgrass litter intercept and dissipate raindrop impacts and reduce rill (small brook or streamlet) formation. The large amounts of above- and belowground organic matter produced can also be beneficial to sites that lose organic matter content through heavy disturbance.

4. Pre-harvest Considerations

Silvicultural System

The photosynthetic system of reedgrass is most efficient under high light levels such as those in forest clearings. Large openings create conditions that will lead to rapid full site occupancy by reedgrass. To deal with

reedgrass under such conditions, site preparation, regeneration (e.g., with large stock) and brushing must be prompt and aggressive.

In open canopy forests with moderate understorey light levels, reedgrass has moderate aboveground growth and a significant amount of rhizome production. However, under reduced light levels of a closed forest canopy, above- and belowground biomass production of reedgrass is severely reduced. Also, rhizome production or total rhizome mass under these low light conditions is small. Since reedgrass presence under these conditions is minimal, the number of plants surviving harvest may not lead to rapid full site occupancy through rhizome extension. As well, any soil disturbance following the harvest of a closed canopy low light stand will not readily promote the spread of reedgrass through rhizome fragments. Reedgrass colonization of large openings created in closed canopy forests may be slow enough to allow for the establishment of desired crop trees.

Therefore, the silvicultural system chosen must take into consideration the level of understory light and the level of reedgrass site occupancy existing prior to harvest. When an open canopy structure exists, systems that promote some shading (e.g., shelterwood or selection) may reduce the level of reedgrass competition that will occur on the site. In conditions of closed canopies where low pre-harvest understory light levels and low numbers of reedgrass plants exist prior to harvest, large openings may be created through clearcutting, retention, patch clearcutting, or seedtree systems.

Advance Regeneration

The retention of advance regeneration may reduce some of the competitive impacts of reedgrass. Advance regeneration of sufficient size will not be subjected to snowpress or light competition, and the larger root system may be better able to withstand colder soils and compete for moisture and nutrients with reedgrass. High levels of advance regeneration may also provide some shading of the site, thus reducing the competitive impacts of reedgrass.

Method of Reforestation

Natural regeneration is not a viable option on established reedgrass communities due to thick litter layers of reedgrass preventing seedling establishment. Crop tree seed falling onto the grass litter may be suspended above the soil and the germinants can desiccate as the litter layer dries out in the spring. As well, the delayed crop tree establishment associated with natural regeneration will allow the reedgrass complex to fully develop before the majority of crop tree seedlings is large enough to withstand its competitive impacts.

Since the grass competition-free window is relatively short, planting has been determined to be the most effective means of rapidly establishing a crop of desired tree species. Plantations should be established prior to site domination by reedgrass.

Timing

In order to minimize reedgrass impacts, site preparation and subsequent planting should occur as soon after harvest as possible.

5. Vegetation Management Strategies for Current Sites

Site Preparation

General

Natural regeneration tends not to establish at sufficient numbers on both site-prepared and untreated reedgrass sites. Planting is recommended with site preparation.

Mineral soil exposed by site preparation will, over time, be invaded by reedgrass from seed and through rhizome sprouting and extension from pre-existing plants and rhizome segments. However, appropriate site preparation can provide a 2- to 3-year window within which seedlings can be successfully established with initial growth to reach a size where they will be able to better withstand the competitive impacts of re-invading reedgrass. The most effective way to improve seedling survival and growth is to completely remove reedgrass from around the seedlings.

A combined strategy of utilizing the lower light levels under shelterwood with large mounding may reduce the overall ground coverage of reedgrass so that successful establishment of desired crop trees can occur.

Mechanical

Since the majority of reedgrass complex sites occurs on fine-textured mineral soil, extreme caution should be employed with the use of heavy machinery for mechanical site preparation.

Light- to medium-impact mechanical site preparation treatments can create conditions that favour the spread of reedgrass and increase its coverage of the site. Treatments that expose and mix the upper mineral horizons will sever and spread rhizomes throughout the treatment area. When buried within the first few centimetres of the soil surface, these rhizomes can quickly establish new plants, thus compounding the competitive impacts of reedgrass. Rhizome elongation from existing plants has been found to be greatest through soils with low bulk density. The exposed mineral soil can also create conditions that may allow for the germination of reedgrass seed and the establishment of new plants.

High- to very high-impact mechanical site preparation can control the establishment of reedgrass. However, in most cases, as with the low- to medium-impact site preparation, the freshly exposed and mixed mineral soil creates conditions that favour the establishment of reedgrass.

Disking (e.g., breaking disks) and some types of plowing (e.g., bedding plows) treatments are inappropriate for reedgrass. These treatments cause light mixing of the upper mineral soil horizons and the organic layer. They also sever large rhizome segments from the parental plants and spread them throughout the treatment area. The well-mixed and exposed mineral

soil associated with these types of mechanical site preparation can also provide excellent seed beds for the establishment of reedgrass. Thus, these treatments may effectively increase the rate of spread of reedgrass across the treatment area.

Mounds with >10 cm mineral soil caps can give effective control of reedgrass. Mineral soil caps of this depth have been found to delay the re-establishment of the reedgrass for 2 to 3 years, which is sufficient to allow for establishment and initial growth of the crop tree. After this period, the crop tree may better handle the impacts of re-invading reedgrass. Mounds of this size may inhibit buried rhizome penetration, and the mineral soil surface of the cap is usually sufficiently dry to prevent the germination and establishment of new grass plants.

Breaking plows have the ability to create these thick caps; however, in operational settings, the number and distribution of stumps can prevent the production of mounds large enough to provide suitable reedgrass-free sites over the entire area.

Screefing

Planter patch (30 cm × 30 cm) scarification does not usually provide enough of a reedgrass-free clearing to allow establishment of desired crop trees. Like some forms of mechanical site preparation, screefing may promote the spread and establishment of reedgrass by creating a favourable growing site and promoting spread through rhizome severing.

Prescribed Fire

Light to moderate burning has been found to have little negative impact on reedgrass. The fire may remove the grass litter, but has little impact on the underground rhizomes. The re-sprouting of the rhizomes and establishment of new plants may increase the coverage of reedgrass over that present prior to treatment. Only very intense burns that consume the majority of the organic layer, thus rhizomes, give effective control of reedgrass.

Chemical

Some chemical treatments have successfully controlled reedgrass and may be the only option on sites where machinery cannot be used. A foliar application of glyphosate (1.5–2.1 kg ae/ha) can control reedgrass for up to two growing seasons. This treatment may be more successful in early summer than late summer. Foliar application of glyphosate at 3 kg ae/ha can give 3 to 4 years of control. However, early summer application of glyphosate or the use of rates above 2 kg ai/ha is suitable only for site preparation treatments since these can cause serious damage when applied to conifer seedlings. For site preparation involving perennial grass control, the registration allows 7–12 litres of Vision® per ha.

Broadcast applications of liquid hexazinone (2.0–4.0 kg ai/ha) have provided moderate to excellent control of reedgrass; however, with increasing organic matter depths, results become less consistent. Application of granular hexazinone (Pronone®) at 4 kg ai/ha in spring has also provided excellent control for 5 years after treatment.

Seeding
Where a suitable seedbed has been created (e.g., continuous MSP, broadcast burning) and reedgrass rhizomes are not present, seeding of agronomic grasses or legumes may prevent or reduce the establishment of reedgrass. If reedgrass rhizomes or established plants are already present on-site, the seeding of agronomic species may be ineffective since reedgrass may be able to out-compete the agronomic species and dominate the site.

Biological Control
Livestock Grazing
Early growth of reedgrass is moderately palatable to sheep but becomes less favoured as the season progresses. When little other forage exists, sheep grazing appears to provide moderate to excellent control in the year of grazing if at least two grazing passes are made over the site. Several years of grazing on a site may actually increase the dominance of reedgrass as plant species that are preferred forage are eaten more readily, thus favouring the growth and dominance of reedgrass.

Snow Mould
Though snow mould fungi are currently not registered for operational use as a biological control agent, research results have indicated that a fall application of snow mould may provide control of reedgrass for up to 3 years. Inoculation of reedgrass with snow mould can reduce its aboveground biomass production and its ability to produce new plants by rhizome sprouting. The snow mould may also increase the rate at which reedgrass litter decays, thus reducing thatch thickness.

Physical Barriers
Large (120 cm × 120 cm or larger) plastic mulches, when firmly anchored to the ground, may provide a competition-free microsite for the first few years after planting, and prevent mechanical damage from vegetation press for up to 2 years if placed promptly after disturbance.

Planting

Timing
In order to take full advantage of the competition-free window, crop tree planting should occur immediately after harvesting and site preparation. The longer reedgrass is on site prior to crop tree establishment, the lower the success of reforestation efforts.

Stock Type
Large (415D or larger) vigorous stock with well-developed root systems improves seedling survival on reedgrass sites. Larger caliper seedlings may be better able to withstand mechanical damage of vegetation press. Stock types that exhibit little check in growth following planting will maximize post-planting growth, allowing exploitation of the competition-free window and aiding in the successful establishment of desired crop trees.

Species Selection
White spruce, paper birch, or aspen are the preferable crop species on moist BWBS and SBS sites. Engelmann spruce, lodgepole pine, subalpine fir, paper birch, or aspen may be more suitable in the ESSF.

If a silvicultural system which results in lower than full light levels in the understory is employed, white spruce, Engelmann spruce, or sub-alpine fir may be more suitable choices. Aspen should be used only where there is full sunlight and the microsite of seedling establishment is relatively free of reedgrass. Aspen seedlings have a very low tolerance to the competitive impacts of reedgrass.

Brushing

General
The need for brushing treatments will largely depend on the success of the site preparation treatment. Since reedgrass is able to rapidly re-occupy a site from underground rhizomes, and the active growing point for tiller development is near ground level, few brushing techniques will provide anything but short-term competition relief.

Manual
Manual cutting of reedgrass has little impact. Two to four cuttings in a growing season may reduce aboveground biomass by only 20%. The re-sprouting from rhizomes and parental bases rapidly replaces the ground coverage of reedgrass lost to cutting. Manual cutting of reedgrass may prevent some vegetation press damage to seedlings if cutting is done late in the growing season prior to snowfall.

Chemical
As described under **Site Preparation (Chemical),** herbicide treatment may control reedgrass between 2 to 5 years. Foliar applications of glyphosate or hexazinone (Velpar® L at 2–4 kg ai/ha or Pronone® 10G at 4 kg ai/ha) in broadcast or grid pattern may provide sufficient competition-free windows to ensure crop tree establishment and survival. Care must be taken to ensure that damage to the desired crop trees does not occur during application. This limits foliar application to the late summer window after conifers have hardened off but before complete senescence of the grass. Glyphosate can be applied to spruce plantations at rates below 2.1 kg ae/ha in late summer. Hexazinone should not be applied on pine plantations. The use of glyphosate or hexazinone is likely to negatively impact aspen, birch, and cottonwood.

Livestock Grazing
The use of sheep grazing must be timed appropriately to ensure the greatest amount of reedgrass is consumed with minimum amount of damage to desired crop trees. Careful herding is necessary to prevent browsing damage of crop trees since this period may coincide with active growth period of trees. The later in the growing season that the grazing is implemented, the lower the palatability of the reedgrass.

6. Vegetation Management Strategies for Backlog Sites

General

Since little change occurs to a reedgrass complex over time, once it is established there is little difference between the complex on current and backlog sites. The same vegetation management strategies employed on current sites can be applied to backlog sites.

7. Summary of Treatment Efficacy

The most effective methods for the control of reedgrass appear to be treatments that inhibit or remove the ability of the grass to spread by rhizomes. Reduction of the competitive impacts of reedgrass must begin with the silvicultural system employed and all subsequent treatments must consider the potential growth response of reedgrass under the resulting microsite environment. While one treatment alone may provide some control, the most effective control of reedgrass should be viewed as a system or series of treatments.

Efficacy of all potential control methods is reduced the longer reedgrass is on site prior to crop tree establishment. Successful plantation establishment in this plant community is consistently associated with prompt initiation of reforestation activities after disturbance.

Among non-chemical options, effective treatments appear to start with choosing a silvicultural system that retains a high level of shade on the site, such as shelterwood. Harvesting should be followed immediately by preparation of large (>10 cm deep) mounds and prompt planting on the top or middle of the mound with a large, vigorous, fast-growing seedling stock type.

Among chemical treatments, hexazinone (Velpar® L or Pronone® 10G) applied in grid pattern or as a broadcast spray, or a foliar application of glyphosate (1.5–2.1 kg ae/ha) can provide between 2 to 5 years of control. For site preparation, application rates of glyphosate (Vision®) can be up to 4.27 kg ae/ha (12 litres/ha); an application rate of 9 litre/ha Vision® has been found to be very effective on reedgrass.

Broadcast burning and low impact MSP treatments can promote the growth of reedgrass and should be avoided.

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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