Extension Note

BC Journal of Ecosystems and Management

British Columbia's Northern Interior Forests

Bluejoint Stand Establishment Decision Aid

Jill Dunbar[1], Larry McCulloch[2], and Richard Kabzems[3]

Introduction

Bluejoint (*Calamagrostis canadensis* [Michx]. Beauv.), which is also known as Canada bluejoint grass, reedgrass, marsh reed grass, and Scribner's reed grass, is a commonly occurring indigenous grass found throughout British Columbia. Bluejoint is a natural part of many ecosystems, but openings caused by fire, flooding, insect outbreak, windfall, timber harvesting, or other larger-scale disturbances have locally increased its abundance. Bluejoint has become a problem weed species on some sites in the northeastern part of the province. Its major impact in forestry is at the stand establishment stage where it can aggressively invade disturbed sites, inhibiting natural regeneration and impeding root and shoot development of planted seedlings. Seedling mortality is often an outcome.

This Stand Establishment Decision Aid (SEDA) is a synopsis of key information forest managers in northern British Columbia will need to help understand how to mitigate the impacts of bluejoint. This SEDA describes susceptible site types, hazard ratings, bluejoint development, impacts on forest productivity, other values, and appropriate management practices. The synopsis also includes a short list of references for further reading and contact information for experts on the topic.

Acknowledgements

The preparation and publication of this decision aid was supported by the British Columbia Ministry of Forests, Mines and Lands through the Forest Investment Account–Forest Science Program.

KEYWORDS: *bluejoint; boreal plantation management;* Calamagrostis canadensis *(Michx. Beauv.); reedgrass; vegetation management.*

Contact Information

1 Registered Professional Forester, 6677 Lake Road, Telkwa, BC V0J 2X1. Email: jdunbar@bulkley.net

2 Principal, LM Forest Resource Solutions Ltd., PO Box 880, Smithers, BC V0J 2N0. Email: larry.mcculloch@lmfms.ca

3 Research Silviculturist, B.C. Ministry of Natural Resource Operations, 9000–17th Street, Dawson Creek, BC V1G 4A4. Email: Richard.Kabzems@gov.bc.ca

Dunbar, J., L. McCulloch, and R. Kabzems. 2011. British Columbia's northern interior forests: Bluejoint Stand Establishment Decision Aid. *BC Journal of Ecosystems and Management* 11(3):29–33. ***http://jem.forrex.org/index.php/jem/article/view/78/37***

Bluejoint – British Columbia's Northern Interior Forests

This white spruce, planted on an inverted mound in 1986, is growing through a stand of bluejoint at Iron Creek, B.C. (1993 photo)

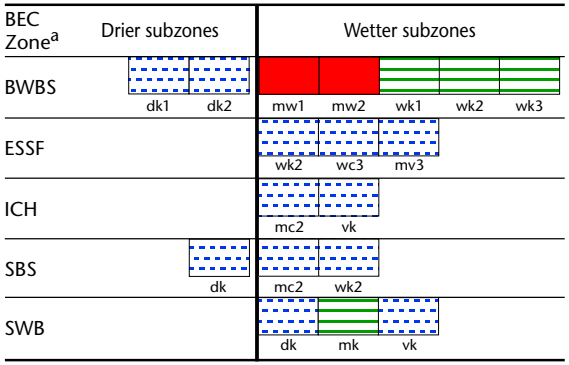
Characteristics of susceptible stands

- Although found in all British Columbia biogeoclimatic zones, from sea level to alpine, bluejoint is most vigorous in the northeastern region of the province, where recent disturbance has created mineral soil exposure and increased light levels.
- Bluejoint grows in moist to wet forests, meadows, wetlands, clearings, open sites, and floodplains. It is a moderately shade-intolerant, early seral stage, invasive species.
- It is most often associated with deep (10–30 cm) organic layers or medium- to fine-textured mineral soils with medium to rich nutrient content.
- Best growth is achieved on moist to wet sites. Bluejoint withstands flooding and, once established, drought. It can tolerate fresh to slightly brackish water.
- Most significant competitive impacts occur on moist to wet sites in the Boreal White and Black Spruce (BWBS), Spruce-Willow-Birch (SWB), Sub-Boreal Spruce (SBS), and Engelmann Spruce–Subalpine Fir (ESSF) biogeoclimatic zones.

Description and biology

- Bluejoint is a perennial grass native to boreal forests.
- Reproduction is by wind-distributed seed, sprouting of buried seed, and vegetative expansion of underground rhizomes. It has a moderate ability to store seed in the soil (about 2–6 years). Seed is small, light, and easily dispersed by wind.
- Growth of rhizomes can be rapid and extensive. Rhizome expansion into recently disturbed areas can be up to 50 cm per year. Open sites can be completely colonized in 1 year, if clones are located nearby. More commonly, it takes 3 years. Plants form dense mats with a thick layer of litter 3–4 years after disturbance. Stem heights reach 150 cm or more.
- Rhizomes are segmented and have buds at each node. Many of these buds will sprout if rhizomes are cut and distributed to new areas.
- Bluejoint can dominate areas of compacted soil for extended periods.
- Seed and rhizome production are low under low light levels. In one study, bluejoint was greatly reduced at 40% of full sunlight compared with open-grown conditions and was almost eliminated from stands with less than 10% light.
- Plant stems die back in winter, but root systems are tolerant of extremely low soil temperatures.
- A bluejoint-dominated community may persist for over 25 years; however, without further disturbance, it often loses dominance of sites in 10–20 years as the overstorey canopy develops and shades the understorey vegetation.

Hazard ratings[1]



[a] See Pojar et al. (1987) for an explanation of Biogeoclimatic Ecosystem Classification (BEC) abbreviations.

[1] Ratings represent expert opinion based on known plant biology and current climatic conditions. If a biogeoclimatic unit is not listed, bluejoint is not considered to be a significant hazard. Hazard ratings will differ by site series and the hazard indicated is for the most susceptible site series (typically 5–7, D–E on the edatopic grid).

Management considerations

Pre-harvest

- Assess cover and distribution of bluejoint at the pre-harvest stage on susceptible sites to prevent the expansion of bluejoint as much as possible. If it is already established on the site, rapid expansion will occur after harvest. One study suggested that if one clone per square metre exists before harvest, bluejoint dominance after harvest is highly likely. Apply practices that will effectively reduce competition before bluejoint spreads.

Harvest

- Consider partial cutting systems if site and stand conditions allow, since a residual overstorey can inhibit bluejoint growth more than the height growth of shade-tolerant seedlings. Patches and strips, however, may result in openings large enough to transmit sufficient light for bluejoint expansion.

Stand establishment

- Consider prevention of bluejoint infestation during the harvesting stage of forest management to reduce the invasion of this species before the stand establishment phase of the operation.

Site preparation

FIRE

- Burning is generally not prescribed because the burn must be very severe to destroy rhizomes already present on site and prevent resprouting. Low- to moderate-impact burning may stimulate germination of buried seed, create a favourable seedbed, and promote increased cover.

MECHANICAL SITE PREPARATION

- Scalping must be deep enough to remove rhizomes, in which case soil disturbance may be severe, and the depressed microsite would be poorly drained. Scalps may be reinvaded quickly. Mixing may stimulate sprouting and should be avoided. Large inverted mounds can reduce competition from bluejoint, and provide more favourable seedling microsites.

Management considerations (continued)

Site preparation (continued)

- In one experiment, mounds with mineral soil caps of 10 cm or less had six times more rhizomes growing up through the mound than mounds with mineral caps greater than 15 cm. Once the seedlings have established, further entries may not be necessary. If grass is allowed to develop before stand establishment, then soil temperature as well as light and nutrient availability become critical.

CHEMICAL

- Site preparation with the herbicides hexazinone (Velpar®) or glyphosate (Roundup®) in accordance with pertinent regulations can provide effective control; however, broadcast herbicide treatment may reduce wildlife habitat value and forage availability, and reduce evapotranpiration, a consideration on subhygric to hydric sites.

REPLACEMENT VEGETATION

- Seeding with other grass and legume species may reduce cover of bluejoint; however, consider the effect of the replacement species on crop tree performance. Apply seed in conjunction with site preparation, which creates a suitable seedbed.

Planting

- Plant as soon as possible after disturbance (first growing season after harvest). Planting stock should be good quality, large-caliper seedlings (2+0 415Bs) that are properly shipped, appropriately stored in the field, and correctly planted. Stocking density should be 15–25% higher than normal. Complete a seedling survival assessment after 1 year and 3 years.

Plantation maintenance

BIOLOGICAL

- Although no biological controls have been registered for use in British Columbia, studies show that several fungal agents and some deleterious rhizosphere bacteria suppress bluejoint to some degree.

CHEMICAL

- Application of hexazinone or glyphosate is effective for crop release. A spot treatment of a 2 m radius around planted white spruce, which leaves untreated ground between spots, can provide good control and retain adjacent herbaceous and woody vegetation.

SHEEP GRAZING

- Good annual control of bluejoint is possible with two grazing passes, the first early in the growing season, right after planting. Appropriate sites are those with less than 50% slope, little heavy slash, few very wet areas, and a crop tree species not susceptible to browsing. Proper grazing management is essential for success.

MANUAL TREATMENT

- Cutting and clipping are not effective, since only above-ground vegetation is removed and plants will resprout rapidly. In one experiment, clipping four times in one summer did not suppress growth the following year; however, studies show that two or more cuts per year for several years, or intensive grazing, can keep the grass under control.

Impacts on productivity

- Bluejoint inhibits growth of crop trees by competing for light and shading out young seedlings.
- A dense bluejoint bed can result in a growing season frost hazard for conifer seedlings by creating a re-radiation surface. This occurs under clear night sky conditions where temperatures are low enough to damage newly flushed buds that are level with the top of the grass canopy.
- Heavy litter from plant dieback each year can also cause seedling deformities, snowpress, and mortality.
- A heavy litter layer can also prevent seeds of crop and non-crop species from reaching the soil surface and germinating.
- Thick root and litter layers can contribute to delayed emergence and reduced numbers and growth of trembling aspen suckers.
- The litter layer can insulate the soil, delay spring thaw, and keep soil temperatures cool throughout the growing season, thus negatively affecting crop tree growth. In one study, soil temperatures 10 cm beneath a bed of bluejoint were 4.0°C cooler than at sites with no above-ground cover. Soil warming above 0°C was delayed by 1 month under beds of bluejoint compared with open sites.
- Bluejoint competes for nutrients. When nitrogen is limited, bluejoint reduces N uptake and growth of white spruce. The insulating effect of the litter layer can further reduce N availability.
- Even when tree seedlings overtop bluejoint, a competitive effect still exists. In a trial with a 13-year-old, free-growing stand in Alberta, removal of the bluejoint understorey improved white spruce growth.
- Bluejoint cover may, however, reduce frost heaving of seedlings and its presence may limit invasion of other competitive species.
- Bluejoint appears to contribute to recovery of soil properties (bulk density, porosity, and organic matter content via inputs of fine root material and litter) after disturbance.

Other values

Wildlife

- Bluejoint can supply forage for bison, moose, elk, and other ungulates, especially when it is young and most palatable. It has been rated fair for energy value and poor for protein value.

Other values (continued)

Wildlife (continued)

- In one study, the ability of bluejoint to provide cover for ungulates in some U.S. states was rated poor to fair, except for white-tailed deer where it was rated good. Bluejoint provides a valuable source of seed for birds as well as cover for ground-nesting birds such as grouse, sparrows, and warblers. It also provides cover for small mammals like voles and shrews.

Livestock

- This grass can provide palatable forage and has its greatest utilization by livestock early in the growing season. However, it often grows in wet habitats, which limits its use until late in the season when the grass is tough and unpalatable. It can also occupy extensive areas to the exclusion of other more valuable grasses.

Water and soil

- Studies suggest that bluejoint may be a useful (although not preferred) species for lowering the water table on subhygric to hygric sites, but benefits of reduced water table level must be weighed against competitive effect.
- Bluejoint can provide stream bank stability, reduce soil surface erosion, maintain water quality by filtering runoff, and reduce flooding through increased evapotranspiraton. Bluejoint has been used to rehabilitate wetlands and to revegetate oil-spill sites. For revegetation uses, "Sourdough" is a cultivar developed near Sitka, Alaska, by the Alaska Agricultural and Forestry Experiment Station (University of Alaska, Fairbanks).

Monitoring

- Bluejoint is recommended as a vegetation indicator for operational monitoring of biodiversity and ecological integrity of plant communities on BWBSmw1/01 and /06 ecosystems in the Peace River region. Because cumulative land management activities at the landscape level have allowed this species to expand, it currently poses a greater threat to biodiversity than invasive alien plants.

Resource and reference list

B.C. Ministry of Forests. 1995. Mechanical site preparation for vegetation management in north-eastern British Columbia. Silviculture Practices Branch, Victoria, B.C. Regeneration Note No. 6. *http://www.for.gov.bc.ca/hfp/publications/00107/SN06.pdf* (Accessed December 2010).

_____. 2000. Boreal plant community diversity 10 years after glyphosate treatment: A report summary. Forest Practices Branch, Victoria, B.C. Silviculture Note No. 25. *http://www.for.gov.bc.ca/hfp/publications/00126/SN25.pdf* (Accessed December 2010).

_____. 2000. Operational summary for vegetation management, reedgrass complex. Forest Practices Branch, Victoria, B.C. *http://www.for.gov.bc.ca/hfp/publications/00051/reedgrass.pdf* (Accessed December 2010).

Chang, S.X. and M. Matsushima. 2006. Vector analysis of understory competition, N fertilization, and litter layer removal effects on white spruce growth and nutrition in a 13-year-old plantation. Forest Ecology and Management 236:332–341.

_____. 2007. Nitrogen and water availabilities and competitiveness of bluejoint: Spruce growth and foliar carbon-13 and nitrogen-15 abundance. Soil Science Society of America Journal 71:1547–1553.

Haeussler, S. and D. Coates. 1986. Autecological characteristics of selected species that compete with conifers in British Columbia: A literature review. B.C. Ministry of Forests, Victoria, B.C. Land Management Report No. 33. *http://www.for.gov.bc.ca/hfd/pubs/Docs/Mr/Lmr033.htm* (Accessed December 2010).

Haeussler, S., R. Kabzems, and J. Boateng. 2007. Local level vegetation indicators for boreal mixedwood forests. Bulkley Valley Centre for Natural Resources Research and Management, Smithers, B.C. Extension Note No. 5. *http://bvcentre.ca/files/research_reports/06-07VegetationIndicatorsBVRC-EN5.pdf* (Accessed December 2010).

Hamilton, E.H. and L. Peterson. 2006. Succession after slashburning in an Engelmann Spruce–Subalpine Fir subzone variant: West Twin Site. B.C. Ministry of Forests and Range, Forest Science Program, Victoria, B.C. Technical Report No. 28. *http://www.for.gov.bc.ca/hfd/pubs/Docs/Tr/Tr028.pdf* (Accessed December 2010).

Kabzems, R. and S. Haeussler. 2005. Soil properties, aspen, and white spruce responses 5 years after organic matter removal and compaction treatments. Canadian Journal of Forest Research 35:2045–2055.

Krzic, M., H. Page, R.F. Newman, and K. Broersma. 2005. Aspen regeneration, forage production, and soil compaction on harvested and grazed boreal aspen stands. BC Journal of Ecosystems and Management 5(2):30–38. *http://www.forrex.org/publications/jem/ISS26/vol5_no2_art4.pdf* (Accessed December 2010).

Landhäusser, S.M. and V.J. Lieffers. 1997. Growth of *Populus tremuloides* in association with *Calamagrostis canadensis*. Canadian Journal of Forest Research 28:396–401.

_____. 1999. Rhizome growth of *Calamagrostis canadensis* into mounds created for tree seedling establishment. New Forest 18:245–262.

Landhäusser, S.M., V.J. Lieffers, and U. Silins. 2003. Utilizing pioneer species as a hydrological nurse crop to lower water table for reforestation of poorly drained boreal sites. Annals of Forest Science 60(2003):741–748. *http://www.afs-journal.org/index.php?option=article&access=standard&Itemid=129&url=/articles/forest/pdf/2003/07/F3720.pdf* (Accessed December 2010).

Lieffers, V.J., S.E. Macdonald, and E.H. Hogg. 1993. Ecology of and control strategies for *Calamagrostis canadensis* in boreal forest sites. Canadian Journal of Forest Research 23:2070–2077.

Lieffers, V.J., and K.J. Stadt. 1994. Growth of understory *Picea glauca*, *Calamagrostis canadensis*, and *Epilobium angustifolium* in relation to overstory light. Canadian Journal of Forest Research 24: 1193–1198. Cited in Lieffers, V.J., C. Messier, K.J. Stadt, F. Gendron, and P.G. Comeau. 1999. Predicting and managing light in the understory of boreal forest. Canadian Journal of Forest Research 29:796–811.

Macey, D.E. and R.S. Winder. 2001. Biological control and the management of *Calamagrostis canadensis* (bluejoint grass). Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, B.C. Technology Transfer Note No. 25. *http://warehouse.pfc.forestry.ca/pfc/18422.pdf* (Accessed December 2010).

Man, C.D., P.G. Comeau, and D.G. Pitt. 2008. Competitive effects of woody and herbaceous vegetation in a young boreal mixedwood stand. Canadian Journal of Forest Research 38:1817–1828.

Negrave, R. 1996. Sheep grazing controls *Calamagrostis canadensis*-dominated vegetation in the boreal forest. In: Integrated forest vegetation management: Options and applications, Proceedings of the 5th B.C. vegetation management workshop. P.G. Comeau, G.J. Harper, M.E. Blache, J.O. Boateng, and L.A. Gilkeson (editors). Canadian Forest Service and B.C. Ministry of Forests, Victoria, B.C. FRDA Report No. 251, pp. 125–126.

Pojar J., K. Klinka, and D.V. Meidinger. 1987. Biogeoclimatic ecosystem classification in British Columbia. Forest Ecology and Management 22:119–154.

Quinlan, S.E. and S. Cuccarese. 2004. Native Alaskan and exotic plants used by wildlife. Alaska Department of Fish and Game, Anchorage, Alaska. *http://www.wildlife.alaska.gov/index.cfm?adfg=birds.plants* (Accessed December 2010).

Swift, K. and J. Turner. 2002. Cariboo Forest Region: Part 1 of 3 Vegetation Complex Stand Establishment Decision Aids. BC Journal of Ecosystems and Management 2(1):18–26. *http://www.forrex.org/JEM/ISS2/vol2_no1_art2.pdf* (Accessed December 2010).

Tesky, J.L. 1992. *Calamagrostis canadensis*. In: Fire Effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, Missoula, Mont. *http://www.fs.fed.us/database/feis/plants/graminoid/calcan/introductory.html* (Accessed December 2010).

Wurtz, T.L. and J.C Zasada. 2001. An alternative to clearcutting in the boreal forest of Alaska: A 27-year study of regeneration after shelterwood harvesting. Canadian Journal of Forest Research 31:999–1011.

Wynia, R.L. 2006. Plant guide: Bluejoint reedgrass. U.S. Department of Agriculture, Natural Resources Conservation Service, Plant Materials Center, Manhattan, Kans. *http://plants.usda.gov/plantguide/pdf/pg_caca4.pdf* (Accessed December 2010).

ARTICLE RECEIVED: **May 4, 2009**

ARTICLE ACCEPTED: **December 10, 2010**

FIA Forest Investment Account Forest Science Program

Production of this article was funded, in part, by the British Columbia Ministry of Forests, Mines and Lands through the Forest Investment Account–Forest Science Program.

Test Your Knowledge . . .

British Columbia's Nouthern Interior Forests: Bluejoint Stand Establishment Decision Aid

How well can you recall some of the main messages in the preceding Extension Note? Test your knowledge by answering the following questions. Answers are at the bottom of the page.

1. Bluejoint rhizomes can expand rapidly on sites following disturbance.
   How many centimetres per year can they grow?

2. Effective control of a bluejoint infestation can be achieved with which of the following.
   A) Light burning
   B) Manual cutting
   C) Treatment with glyphosate
   D) Mechanical mixing

3. The thick litter layer produced by bluejoint can insulate the soil beneath it, delaying spring thaw by what length of time?

4. Bluejoint dominant communities can persist for years under a dense coniferous canopy.
   A) True
   B) False

5. Which of the following are beneficial effects of bluejoint cover?
   A) Forage for livestock
   B) Stream bank stabilization
   C) Improvement of soil organic matter content
   D) Protection of seedlings from mechanical damage

ANSWERS

1. Up to 50 cm 2. C 3. Up to 1 month 4. A 5. A, B, and C