Forest / Forêt **Association CNVC00122**

Pinus contorta / Viburnum edule – Rosa acicularis / Hylocomium splendens

Lodgepole Pine / Squashberry – Prickly Rose / Stairstep Moss
Pin tordu / Viorne comestible – Rosier aciculaire / Hylocomie brillante

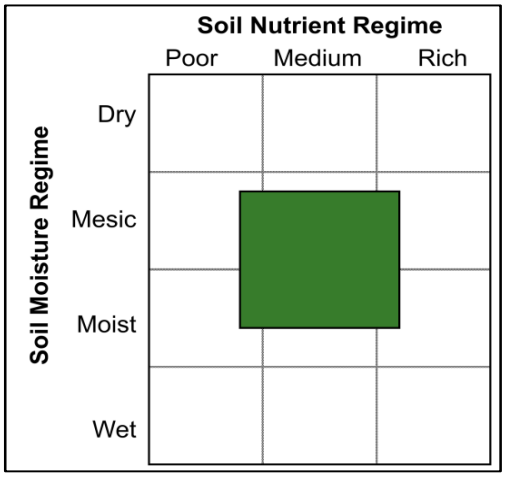
Subassociations: *122a typic, 122b Alnus viridis*
CNVC Alliance: CA00035 *Picea glauca – Pinus contorta / Hylocomium splendens*
CNVC Group: CG0014 Cordilleran Boreal Mesic Trembling Aspen – White Spruce Forest

Type Description

Concept: CNVC00122 is a boreal coniferous forest Association that occurs in Alberta. It has a moderately closed canopy dominated by lodgepole pine (*Pinus contorta*) and a relatively species rich understory. The shrub layer varies from moderately to well developed and typically includes squashberry (*Viburnum edule*) and prickly rose (*Rosa acicularis*), although green alder (*Alnus viridis*) can be abundant when present. The well-developed herb and dwarf shrub layer typically includes twinflower (*Linnaea borealis*), bunchberry (*Cornus canadensis*), fireweed (*Chamerion angustifolium*), dwarf raspberry (*Rubus pubescens*) and downy lymegrass (*Leymus innovatus*). The moss layer is well developed and dominated by stairstep moss (*Hylocomium splendens*), knight's plume moss (*Ptilium crista-castrensis*) and red-stemmed feathermoss (*Pleurozium schreberi*). CNVC00122 occurs on mesic to moist, nutrient-medium sites in a region with a subhumid continental climate. It typically establishes as the first cohort after fire. Two subassociations are distinguished, *typic* and *Alnus viridis*.

Vegetation: CNVC00122 is a coniferous forest Association with a moderately closed canopy that is dominated by *Pinus contorta* (see Comments). The understory is relatively species rich with a moderately to well-developed shrub layer that includes *Viburnum edule* and *Rosa acicularis* in both the *typic* and *Alnus viridis* subassociations. *A. viridis* is abundant in the latter subassociation. The well-developed herb and dwarf shrub layer usually includes *Linnaea borealis, Cornus canadensis, Chamerion angustifolium, Rubus pubescens* and *Leymus innovatus. Hylocomium splendens*, *Ptilium crista-castrensis* and *Pleurozium schreberi* dominate the well-developed moss layer.

Environment: CNVC00122 occurs in a subhumid continental climate where regional fire cycles are short (<100 years) or intermediate (100-270 years). It is typically found on mesic to moist, nutrient-medium sites, although nutrient status can vary from rich to poor. Stands are usually on level to gentle slopes on middle to upper-slope or crest topopositions. Soils are primarily fine textured (e.g., loams, silts, clays) and derived from morainal, eolian or glaciofluvial parent materials. Mor humus forms are typical. Compared to the *typic,* the *Alnus viridis* subassociation is more commonly found on cooler, north or east-facing aspects.



Pinus contorta / Viburnum edule – Rosa acicularis / Hylocomium splendens CNVC00122

Type Description (cont'd)

Dynamics: CNVC00122 is an early to mid-successional Association that is naturally perpetuated by stand-replacing fire. *Pinus contorta* has medium thick bark, with only moderate tolerance to fire, but reaches reproductive maturity at a young age and produces abundant seeds in serotinous cones. Moderate and high severity fires melt the resin of cones to release their seeds. These fires also remove competing vegetation and improve seedbed quality by reducing organic matter and exposing mineral soil. Maximum seed release can therefore coincide with optimal conditions for seedling establishment, survival and growth.

Succession typically proceeds with ingress of *Picea glauca* into the stand by seed dissemination from nearby sources. If seeds are available following disturbance, *P. glauca* sometimes re-colonizes at approximately the same time as *P. contorta,* but since it grows more slowly it usually requires several decades to attain canopy height. *P. glauca* is shade-tolerant and able to self-replace once established in a stand. Succession is often re-initiated by fire before a stand reaches the mid-successional stage, but in the prolonged absence of disturbance *P. glauca* can gradually dominate the overstory. A late successional *P. glauca*-dominated condition (e.g., CNVC00102 [*Picea glauca / Rosa acicularis / Hylocomium splendens*] could develop after approximately 100 to 125 years.

In recent years, mountain pine beetle (*Dendroctonus ponderosae*) has caused significant economic and ecological impacts to *P. contorta* forests in sub-boreal British Columbia (BC). Within its historic range in interior BC, beetle cycles occur every 20-40 years. At low population densities, the insect preferentially attacks and kills older, less vigorous trees, opening canopy gaps. At epidemic levels however, mass attacks can extend over large areas and overwhelm the defenses of vigorously growing immature pines. Recently the beetle has spread northward and eastward into boreal *P. contorta* forests, affecting even hybrid *Pinus x murraybanksiana* and *P. banksiana* stands in northern Alberta. Climate change and forest management practices, including fire suppression, have likely contributed to these unprecedented beetle densities as well as to the expansion of its range and host species. Because the mountain pine beetle is novel to boreal ecosystems, long-term effects on these forests are uncertain.

Range: CNVC00122 occurs primarily in the Rocky Mountain foothills of Alberta. It also occurs occasionally in the boreal highlands of northwestern and northern Alberta (Cameron Hills, Clear Hills, Buffalo Head Hills, Naylor Hills and Caribou Mountains) and its range likely extends into British Columbia.

Conservation Status (NatureServe)

Global Conservation Rank: no applicable rank
National Conservation Rank: not yet determined
Subnational Conservation Rank: not yet determined

Forest / Forêt **Association CNVC00122**

Pinus contorta / Viburnum edule – Rosa acicularis / Hylocomium splendens

Lodgepole Pine / Squashberry – Prickly Rose / Stairstep Moss

Pin tordu / Viorne comestible – Rosier aciculaire / Hylocomie brillante

Distribution

Countries: Canada

Provinces / Territories / States: Alberta, British Columbia

Terrestrial Ecozones and Ecoregions of Canada: Boreal Plains: Clear Hills Upland, Western Alberta Upland

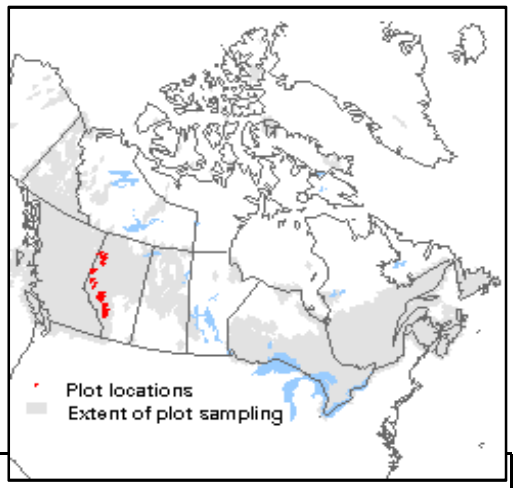
Rowe's Forest Regions and Sections of Canada: Boreal: Lower Foothills, Upper Foothills

NAAEC CEC Ecoregions of North America (Levels I & II): Northern Forests: Boreal Plains

Nature Conservancy of Canada Ecoregions: Boreal Plains

Biogeoclimatic Ecosystem Classification of British Columbia (zones and subzones): BWBS

Natural Regions and Subregions of Alberta: Boreal Forest: Lower Boreal Highlands, Upper Boreal Highlands; Foothills: Lower Foothills, Upper Foothills



Corresponding Types and Associations

122a typic	Alberta	SW/LF/D/01/01	Pl / prickly rose - low-bush cranberry / wild sarsaparilla
		SW/LF/D/01/03	Pl / Canada buffalo-berry
		SW/LF/E/01/02	Pl / bracted honeysuckle / fern
		SW/UF/C/01/06	Pl / low-bush cranberry / feather moss
		WC/LF/E/01/02	Pl / low-bush cranberry
		WC/LF/E/01/03	Pl / feather moss
122b Alnus viridis	Alberta	SW/LF/D/01/02	Pl / green alder
		SW/LF/E/01/01	Pl / green alder / fern
		WC/LF/E/01/01	Pl / green alder

Forest / Forêt **Association CNVC00122**

Pinus contorta / Viburnum edule – Rosa acicularis / Hylocomium splendens

Lodgepole Pine / Squashberry – Prickly Rose / Stairstep Moss

Pin tordu / Viorne comestible – Rosier aciculaire / Hylocomie brillante

Vegetation Summary*

	Association CNVC00122 60 plots		Subassociation 122a *typic* 21 plots		Subassociation 122b *Alnus viridis* 39 plots	
Species Name[T]	% Cover[±]	% Presence[^]	% Cover[±]	% Presence[^]	% Cover[±]	% Presence[^]
Overstory Trees						
Pinus contorta	41	100	42	100	40	100
Picea glauca	9	40	9	52	8	33
Populus tremuloides	6	28	8	29	5	28
Picea mariana	5	20	6	14	4	23
Populus balsamifera	2	12	2	29	1	3
Tree Stratum Cover (P_{10} P_{25} Mean P_{75} P_{90})[‡]	**(28 34 47 60 73)**		**(31 35 51 65 75)**		**(27 34 45 53 66)**	
Understory Woody Shrubs and Regenerating Trees						
Viburnum edule	**6**	**83**	**8**	**76**	**5**	**87**
Rosa acicularis	**5**	**78**	**5**	**76**	**5**	**79**
Alnus viridis	30	70	2	14	**32**	**100**
Picea glauca	2	50	3	52	2	49
Spiraea lucida	2	48	2	48	2	49
Lonicera involucrata	3	47	3	43	3	49
Rhododendron groenlandicum	4	43	8	24	2	54
Rubus idaeus	4	42	2	24	4	51
Ribes lacustre	1	27	2	29	1	26
Vaccinium myrtilloides	3	25	4	10	2	33
Populus tremuloides	3	22	4	29	2	18
Sorbus scopulina	2	17	2	24	2	13
Pinus contorta	**2**	**12**	**3**	**14**	**1**	**10**
Shrub Stratum Cover (P_{10} P_{25} Mean P_{75} P_{90})[‡]	**(14 26 41 52 70)**		**(11 15 27 39 47)**		**(26 32 49 66 78)**	
Understory Herbs and Dwarf Shrubs						
Linnaea borealis	4	98	7	100	3	97
Cornus canadensis	9	97	9	100	9	95
Chamerion angustifolium	4	90	4	95	4	87
Rubus pubescens	4	77	5	71	4	79
Leymus innovatus	4	72	7	71	2	72
Pyrola asarifolia	2	63	1	52	2	69
Calamagrostis canadensis	4	58	7	43	3	67
Lycopodium annotinum	3	57	3	57	3	56
Maianthemum canadense	2	57	3	48	1	62
Mertensia paniculata	2	55	3	67	1	49
Petasites frigidus	2	55	2	57	2	54
Arnica cordifolia	1	55	2	67	1	49
Mitella nuda	2	53	2	57	2	51
Vaccinium vitis-idaea	4	45	5	38	3	49
Vaccinium caespitosum	3	42	5	38	2	44

Pinus contorta / Viburnum edule – Rosa acicularis / Hylocomium splendens CNVC00122

Vegetation Summary (cont'd)*

Species Name[†]	Association CNVC00122 % Cover[±]	Association CNVC00122 % Presence[^]	Subassociation 122a *typic* % Cover[±]	Subassociation 122a *typic* % Presence[^]	Subassociation 122b *Alnus viridis* % Cover[±]	Subassociation 122b *Alnus viridis* % Presence[^]
Equisetum sylvaticum	1	40	1	38	1	41
Fragaria virginiana	2	37	3	33	2	38
Viola renifolia	1	37	1	33	1	38
Aralia nudicaulis	9	35	11	24	8	41
Symphyotrichum ciliolatum	1	35	2	38	1	33
Orthilia secunda	1	33	2	24	1	38
Lathyrus ochroleucus	2	27	3	43	1	18
Eurybia conspicua	2	25	2	24	2	26
Streptopus amplexifolius	2	25	3	19	1	28
Pyrola chlorantha	1	23	1	29	1	21
Galium trifidum	2	22	-	-	2	33
Actaea rubra	1	22	2	24	1	21
Galium boreale	1	20	2	29	1	15
Herb Stratum Cover (P_{10} P_{25} Mean P_{75} P_{90})[‡]	**(25 28 46 54 77)**		**(27 28 54 77 97)**		**(24 30 41 48 57)**	
Bryophytes and Lichens						
Hylocomium splendens	**18**	**95**	**19**	**95**	**18**	**95**
Ptilium crista-castrensis	12	93	13	86	12	97
Pleurozium schreberi	23	92	33	90	17	92
Cladonia sp.	4	47	5	43	3	49
Peltigera aphthosa	1	45	2	62	1	36
Ptilidium pulcherrimum	1	35	1	33	1	36
Polytrichum juniperinum	2	33	2	29	1	36
Dicranum polysetum	1	30	1	33	1	28
Vulpicida pinastri	1	28	2	19	1	33
Pohlia nutans	1	23	1	24	1	23
Brachythecium salebrosum	2	22	1	10	2	28
Tuckermannopsis americana	1	20	1	14	1	23
Dicranum fuscescens	1	17	1	29	2	10
Cladina mitis	2	13	2	29	1	5
Bryo-Lichen Stratum Cover (P_{10} P_{25} Mean P_{75} P_{90})[‡]	**(17 37 57 87 95)**		**(32 39 66 90 100)**		**(15 35 52 73 92)**	

* species present in > 20% of sample plots are listed

[†] see **Botanical Nomenclature** link at http://cnvc-cnvc.ca for botanical sources, synonyms and common names

[±] average percent cover of a species within the plots in which it occurs (i.e., characteristic cover)

[^] percent frequency occurrence for a species within the total plots

[‡] $P_x = X^{th}$ percentile (e.g., $P_{10} = 10^{th}$ percentile)

ISSN 1916-3266

Forest / Forêt **Association CNVC00122**

Pinus contorta / Viburnum edule – Rosa acicularis / Hylocomium splendens

Lodgepole Pine / Squashberry – Prickly Rose / Stairstep Moss
Pin tordu / Viorne comestible – Rosier aciculaire / Hylocomie brillante

Site / Soil Characteristics

	Association CNVC00122 **60 plots**	Subassociation 122a *typic* **21 plots**	Subassociation 122b *Alnus viridis* **39 plots**
Elevation Range (min–mean–max meters)			
	755–1164–1580	755–1129–1470	770–1181–1580
	missing data (5)	missing data (10)	missing data (3)
Slope Gradient (% frequency)			
	moderately steep (5)	moderately steep (0)	moderately steep (8)
	moderate (8)	moderate (5)	moderate (10)
	gentle (35)	gentle (43)	gentle (31)
	level (50)	**level (52)**	**level (49)**
	missing data (2)	missing data (0)	missing data (3)
Aspect (% frequency)			
	north (28)	north (24)	**north (31)**
	east (20)	east (10)	east (26)
	south (17)	south (24)	south (13)
	west (25)	**west (33)**	west (21)
	level (8)	level (10)	level (8)
	missing data (2)	missing data (0)	missing data (3)
Meso Topoposition (% frequency)			
	crest / upper (22)	crest / upper (29)	crest / upper (18)
	mid (37)	**mid (33)**	**mid (38)**
	lower / toe (3)	lower / toe (5)	lower / toe (3)
	level (12)	level (5)	level (15)
	missing data (27)	missing data (29)	missing data (26)
Moisture Regime (% frequency)			
	mesic (68)	**mesic (76)**	**mesic (64)**
	moist (32)	moist (24)	moist (36)
Nutrient Regime (% frequency)			
	poor (17)	poor (29)	poor (10)
	medium (62)	**medium (57)**	**medium (64)**
	rich (22)	rich (14)	rich (26)

Pinus contorta / *Viburnum edule – Rosa acicularis* / *Hylocomium splendens* CNVC00122

Site / Soil Characteristics (cont'd)

	Association CNVC00122	Subassociation 122a *typic*	Subassociation 122b *Alnus viridis*
Soil Parent Material (% frequency)			
	bedrock (2)	bedrock (0)	bedrock (3)
	eolian (17)	eolian (14)	eolian (18)
	moraine / till (45)	**moraine / till (43)**	**moraine / till (46)**
	fluvial (8)	fluvial (10)	fluvial (8)
	glaciofluvial (13)	glaciofluvial (14)	glaciofluvial (13)
	lacustrine (2)	lacustrine (5)	lacustrine (0)
	glaciolacustrine (10)	glaciolacustrine (10)	glaciolacustrine (10)
	missing data (3)	missing data (5)	missing data (3)
Soil Rooting Zone Substrate (% frequency)			
	non-soil (2)	non-soil (0)	non-soil (3)
	sandy (5)	sandy (5)	sandy (5)
	coarse loamy (15)	coarse loamy (14)	coarse loamy (15)
	fine loamy (35)	**fine loamy (38)**	**fine loamy (33)**
	silty (25)	silty (19)	silty (28)
	clayey (13)	clayey (14)	clayey (13)
	missing data (5)	missing data (10)	missing data (3)
Root Restricting Depth (% frequency)			
	missing data (100)	missing data (100)	missing data (100)
Humus Form (% frequency)			
	mor (40)	mor (33)	mor (44)
	moder (7)	moder (5)	moder (8)
	peatymor (3)	peatymor (0)	peatymor (5)
	missing data (50)	missing data (62)	missing data (44)

Forest / Forêt **Association CNVC00122**

Pinus contorta / Viburnum edule – Rosa acicularis / Hylocomium splendens

Lodgepole Pine / Squashberry – Prickly Rose / Stairstep Moss
Pin tordu / Viorne comestible – Rosier aciculaire / Hylocomie brillante

Additional Characteristics

Species of High Conservation Concern:

Non-native Species:

Management Issues:

Type Statistics

Internal Similarity: **Confidence:**
Strength:

Related Concepts

Similar CNVC Associations:

CNVC00092 [*Populus tremuloides – Pinus contorta / Vaccinium vitis-idaea / Hylocomium splendens*] is a similar mixedwood Association that occurs on comparable or slightly drier boreal sites in the same range. It has *Populus tremuloides* codominant or dominant in the overstory and more *Rhododendron groenlandicum* in the shrub layer.

CNVC00107 [*Pinus contorta / Alnus viridis / Arnica cordifolia / Pleurozium schreberi*] occurs on similar boreal sites in the same range. It has more *Rhododendron groenlandicum, Vaccinium membranaceum* and *V. vitis-idaea* and less *Viburnum edule* and *Rosa acicularis* in the understory.

CNVC00118 [*Pinus contorta / Vaccinium vitis-idaea – Arctostaphylos uva-ursi / Cladina* spp.] occurs on drier, poorer boreal sites in the same range and has *Vaccinium vitis-idaea* and *Arctostaphylos uva-ursi* dominant in the understory.

CNVC00119 [*Pinus contorta / Shepherdia canadensis / Geocaulon lividum*] occurs on comparable boreal sites in British Columbia and has more *Shepherdia canadensis* and *Geocaulon lividum* in the understory.

CNVC00120 [*Pinus contorta – Picea mariana / Vaccinium vitis-idaea / Pleurozium schreberi*] occurs on comparable boreal sites in the same range and has more *Picea mariana* in the overstory. It also has more *Rhododendron groenlandicum* and less *Viburnum edule* in the shrub layer.

CNVC00121 [*Pinus contorta / Shepherdia canadensis / Leymus innovatus*] occurs on comparable boreal sites in the same range. It has less *Viburnum edule* and more *Shepherdia canadensis* and *Leymus innovatus* in the understory.

CNVC00123 [*Pinus contorta / Gymnocarpium dryopteris*] occurs on richer boreal sites in the same range. It has greater species diversity and an understory with higher constancy and cover of species such as *Ribes lacustre, Gymnocarpium dryopteris, Streptopus amplexifolius* and *Rubus pedatus*.

CNVC00124 [*Pinus contorta / Oplopanax horridus*] occurs on moister, richer boreal sites in the same range. It has greater species diversity and an understory with higher constancy and cover of species such as *Oplopanax horridus, Sorbus scopulina, Gymnocarpium dryopteris, Aralia nudicaulis, Streptopus amplexifolius, Rubus pedatus* and *Tiarella trifoliata*.

CNVC00322 [*Pinus contorta – Picea mariana / Vaccinium membranaceum / Pleurozium schreberi*] occurs on comparable boreal sites in the same range and has more *Picea mariana* in the overstory and an understory dominated by *Rhododendron groenlandicum* and *Vaccinium membranaceum.*

Related United States National Vegetation Classification Associations:

Relationships with Other Classifications:

Pinus contorta / *Viburnum edule – Rosa acicularis* / *Hylocomium splendens* CNVC00122

Comments

Where CNVC00122 occurs at higher elevations (i.e., above 650 mASL) in the boreal highlands of northwestern and northern Alberta (see Range), *Pinus contorta* may form fertile hybrids with *P. banksiana* that are recognized by intermediate cone characters; ecologically, the hybrid pine (*P. x murraybanksiana*) occupies comparable sites. Stands containing hybrid pine with similar understories on comparable sites are classified as CNVC00122.

Similar *P. contorta* dominated forests occur in the montane and subalpine zones of the Rocky Mountains, in the sub-boreal zone of British Columbia, and in Yukon and Northwest Territories. These forests are described elsewhere in the CNVC.

Pinus contorta here refers to var. *latifolia* (lodgepole pine).

Source Information

Number of source plots for CNVC00122: 60
Number of source plots for 122a typic: 21
Number of source plots for 122b Alnus viridis: 39
Information Sources:
Alberta Environment and Parks. 2014. Ecological Site Information System (ESIS). Govt. AB, Edmonton, AB.
Concept Authors: L. Allen, J. Archibald, K. Baldwin, K. Chapman
Description Authors: D. Downing, K. Baldwin and K. Chapman
Date of Concept: January, 2013
Date of Description: July, 2016

Classification References:

Archibald, J.H.; Klappstein, G.D.; Corns, I.G.W. 1996. Field guide to ecosites of southwestern Alberta. Nat. Resour. Can., Can. For. Ser., North. For. Cent., Edmonton, AB. Spec. Rep. 8.

Beckingham, J.D.; Corns, I.G.W.; Archibald, J.H. 1996. Field guide to ecosites of west-central Alberta. Nat. Resour. Can., Can. For. Serv., North. For. Cent., Edmonton, AB. Spec. Rep. 9.

Characterization References:

Abrahamson, I. 2015. Picea glauca. In: Fire Effects Information System. U.S. Dept. Agric., For. Serv., Rocky Mt. Res. Stn., Fire Sci. Lab., Missoula, MT, US. Available: http://www.fs.fed.us/database/feis/plants/tree/picgla/all.html (accessed: October 2, 2015).

Anderson, M.D. 2003. Pinus contorta var. latifolia. In: Fire Effects Information System. U.S. Dept. Agric., For. Serv., Rocky Mt. Res. Stn., Fire Sci. Lab., Missoula, MT, US. Available: http://www.fs.fed.us/database/feis/plants/tree/pinconl/all.html (accessed: August 13, 2015).

Andison, D.W. 1998. Temporal patterns of age-class distributions on foothills landscapes in Alberta. Ecography 21(5):543-550.

Bergeron, Y.; Chen, H.Y.H.; Kenkel, N.C.; Leduc, A.; Macdonald, S.E. 2014. Boreal mixedwood stand dynamics: ecological processes underlying multiple pathways. For. Chron. 90(2):202-213.

Boulanger, Y.; Gauthier, S.; Burton, P.J. 2014. A refinement of models projecting future Canadian fire regimes using homogeneous fire regime zones. Can. J. For. Res. 44(4):365-376.

Greene, D.F.; Zasada, J.C.; Sirois, L.; Kneeshaw, D.; Morin, H.; Charron, I.; Simard, M.J. 1999. A review of the regeneration dynamics of North American boreal forest tree species. Can. J. For. Res. 29:824-839.

Kenkel, N.C.; Walker, D.J.; Watson, P.R.; Caners, R.T; Lastra, R.A. 1997. Vegetation dynamics in boreal forest ecosystems. Coenoses 12(2-3):97-108.

Nealis, V.G.; Cooke, B. J. 2014. Risk assessment of the threat of mountain pine beetle to Canada's boreal and eastern pine forests. Nat. Resour. Can., Can. Counc. For. Min., Forest Pest Working Group, CA.

Pinus contorta / Viburnum edule – Rosa acicularis / Hylocomium splendens CNVC00122

Characterization References (cont'd):

Peters, V.S.; Macdonald, E.; Dale, M.R.T. 2006. Patterns of initial versus delayed regeneration of white spruce in boreal mixedwood succession. Can. J. For. Res. 36:1597-1609.

Safranyik, L.; Wilson, B. (eds.). 2006. The mountain pine beetle: a synthesis of biology, management and impacts on lodgepole pine. Pac. For. Centre, Can. For. Serv., Nat. Resour. Can., Victoria, BC.

Stockdale, C. 2014. Fire regimes of western boreal Canada and the foothills of Alberta. A discussion document and literature review for the LANDWEB Project.

The information contained in this factsheet is based on data and expert knowledge that is current to the date of description. As new information becomes available, the factsheet will be updated.

For more information about the contents of this factsheet and definitions of attribute names and data classes, see the **Understanding the Factsheet** link at http//cnvc-cnvc.ca.

Suggested Citation: D. Downing, K. Baldwin and K. Chapman. *Pinus contorta / Viburnum edule – Rosa acicularis / Hylocomium splendens* [online]. Sault Ste. Marie, Ontario, Canada: Canadian National Vegetation Classification. July, 2016; generated Sep/09/2016; cited ENTER DATE ACCESSED. 10 p. Canadian National Vegetation Classification Association: CNVC00122. Available from http://cnvc-cnvc/ca. System Requirements: Adobe Acrobat Reader v. 7.0 or higher. ISSN 1916-3266.