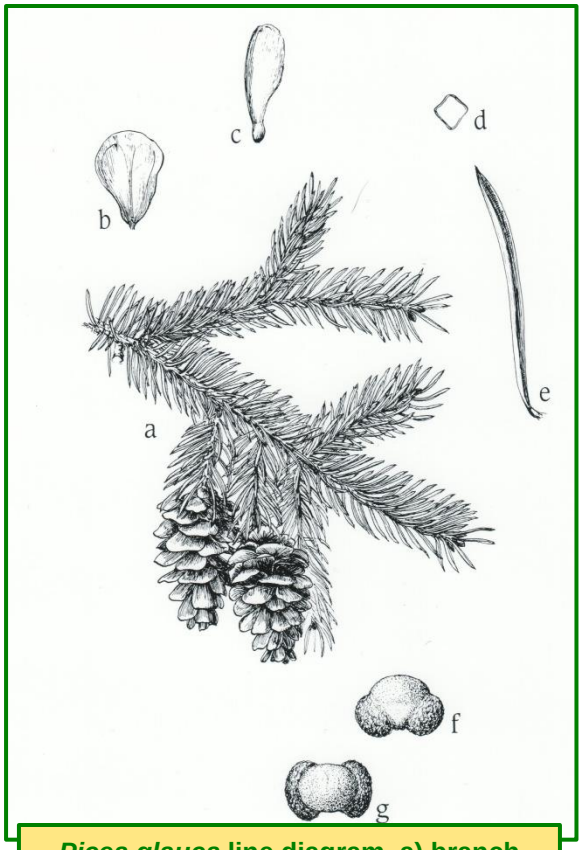
Scientific Name: *Picea glauca* (Moench)Voss **Family:** *Pinaceae*

Common Name: white spruce, Canadian spruce, cat spruce



***Picea glauca* line diagram a) branch with female cones b) ovuliferous scale c) seed d) leaf (x-section) e) leaf f-g) pollen**

Plant Description

Common tree in boreal forests, up to 40 m tall; bark ashy brown, sometimes reddish; narrow crown consisting of spirally arranged branches with twigs extending from all sides; leaves are 4-sided, pointed but not sharp, green to bluish-green, lines of white dots on all sides, borne singly; slender, cylindrical seed cone, 3 to 6 cm long, blunt-tipped, stalkless; scales light brown, outer margins of the scales are smooth (Farrar 1995, Moss 1983). Plants live for 200 years (Government of the Northwest Territories n.d.).

Seed: 2 to 4 mm wide and 4 to 8 mm long (Farrar 1995).

Habitat and Distribution

Common tree in northern forests and widespread throughout Alberta.

Seral Stage: Climax (Rook, 2002, Uchytil 1991). High shade tolerance (Hardy BBT Limited 1989).

Soil: Fine to coarse textured soil, high drought tolerance, pH 4.0 to 8.2 (USDA NRCS n.d.).

Best growth on well drained silty soils with adequate moisture (Hardy BBT Limited 1989). Can withstand flooding during growing season (Hardy BBT Limited 1989).

High acid tolerance; intolerant of salinity (Hardy BBT Limited 1989).

Distribution: Alaska to northern Montana east to Labrador, Newfoundland south to Great Lakes (Moss 1983).

***Picea glauca* enlarged seed with cross-section**

Phenology

Cones open in late summer (Government of the Northwest Territories n.d.); seeds are released from late summer to spring (Farrar 1995). Trees begin

producing seed at the age of four but they produce their best quality seed around 30 years of age (Rook 2002, Uchytil 1991). Trees can live up to 1,000 years old in some areas (Uchytil 1991).

Pollination
Wind.

Seed Dispersal
Wind with some caching by squirrels (Rook 2002, Uchytil 1991).

Genetics
2n=24 (Moss 1983).

Symbiosis
Forms mycorrhizal associations with ectomycorrhizal basidiomycetes *Thelephora americana* and *Amphinema byssoides* in container seedlings. Seedlings also associate with VAM and *Helotiales*, close to ericoid mycorrhizae (Kernahgan et al. 2003). Hydraulic conductance is improved by association with ectomycorrhizae (Landhausser et al. 2002).

***Picea glauca* new growth**

Seed Processing
Collection: Collect August 15 to September 15 (Formaniuk 2013).
Collected by climbing ladders or cutting down the tree as the cones develop at the top (crown) of the tree. Harvesters pick cones with lard or vegetable oil on their hands to prevent them from sticking.
Seed Weight: 0.16 g/1,000 seeds (Gerling et al. 1996).
0.12 g/1,000 seeds (Burton and Burton 2003).
Harvest Dates: August.
Cleaning: Cones open when they are dried, often using heat; seeds can be separated from the cone by winnowing.
Storage Behaviour: Orthodox, dry seeds to low relative humidity prior to cold storage (Royal Botanic Gardens Kew 2008).
Storage: 40% germination following 15 years hermetic storage at -4°C; viability maintained for 5 to 17 years in hermetic storage at 2 to 4°C with 4% to 8% moisture content; 0% to 14% viability lost after 17 to 20 years hermetic storage at 2 to 4°C with 3.6% to 5.5% moisture content; 47% to 81% viability lost after 21 to 34 years with 8.5% to 9% moisture content (Royal Botanic Gardens Kew 2008). Remains viable for up to 10 years (Uchytil 1991).
Longevity: 34 years (Royal Botanic Gardens Kew 2008).

Propagation
Natural Regeneration: Naturally regenerates from seeds, however it is possible for *Picea glauca* to reproduce vegetatively by layering (Uchytil 1991) though not as well as *P. mariana* (CYSIP: Botany n.d.).
Germination: 8 to 10 days germination (Wood pers. comm.).
Pre-treatment: 21 day cold stratification (Formaniuk 2013, Wood pers. comm.).
Direct Seeding: Field germination of seed rarely exceeds 30% of laboratory germination. Canadian average 123,552 seeds/ha. Manitoba 98,842 to 395,368 seeds/ha and Alberta uses 49,421 to 74,132 seeds/ha (Barth 1986).

Planting Density: Recommended planting densities for a variety of oil sands ecosites is provided in Alberta Environment (2010).
740 to 1,729 plants/ha (USDA NRCS n.d.).
Vegetative Propagation: Can be propagated by layering (Uchytil 1991) and cuttings though not done regularly (USDA NRCS n.d.).
Greenhouse Timeline: 24 to 28 weeks in the greenhouse until out-planting. Can be over wintered for a spring or fall planting the following season (Wood pers. comm.). Grow for 170 days before harvest (Formaniuk 2013).

***Picea glauca* understory in a *Populus tremuloides* stand**

Aboriginal/Food Uses

Food: Inner bark can be dried and ground to be added to flour in times of shortage; young shoots can be stripped of their needles and boiled as an emergency food high in vitamin C (CYSIP: Botany n.d., Gray 2011), branches can be made into tea (Mackinnon et al. 2009). Spruce tip jelly is used as a topping for toast and goes well with meats and poultry (Gray 2011).
Medicinal: The sticky sap or inner bark was used as poultices on slivers, sores and inflammations, was also mixed with fat to make salves for treating skin infections, insect bites, chapped hands, cuts, scrapes, eczema, burns, rashes, blood poisoning, heart trouble, syphilis and arthritic joints, was also placed on the eye for snow blindness. Spruce gum was chewed to treat sore throats and coughs, melted sap was used as a plaster when setting broken bones, it was also taken to help with digestion and gonorrhea. Medicinal tea was made from the bark to treat rheumatism, kidney stones and stomach problems and needle teas where to stimulate sweating and treat scurvy. The cone was used for toothaches, venereal disease, pain, urinary troubles and to assist women after childbirth. The roots are used to treat trembling and fits, stomach pain and diarrhea (Gray 2011, Mackinnon et al. 2009).
Other: Was used to make canoes, baskets, baby carriers, utensils and to thatch the roof of lodges; trunks sometimes used as teepee poles, to waterproof hide, make headgear and masks for ceremonies; roots used as lacing (Gray 2011, Mackinnon et al. 2009, Wilkinson 1990).

Wildlife/Forage Usage

Wildlife: Poor forage for deer, moose and elk. Seed is readily eaten by mice, voles, shrews, and red squirrels (Rook 2002, Uchytil 1991). Snowshoe hares sometimes feed heavily on saplings and seedlings (Hardy BBT Limited 1989, Rook 2002). Spruce grouse feed entirely on spruce needles during winter (Rook 2002).
Trees provide valuable nesting sites for birds (Lady Bird Johnson Wildflower Center 2013).
Livestock: Poor forage (Uchytil 1991).
Grazing Response: Seedlings are intolerant of grazing although older trees can tolerate small amounts of browsing.

Reclamation Potential

Are used for coal mine overburden revegetation (Uchytil 1991), oil and gas, and other reclamation projects. As a climax species in desired communities, *Picea* is often included in reclamation plans, however, ideal conditions are rarely present and growth is stunted.

Performance in several tests after 4 to 7 years on amended oil sands tailings and overburden indicated moderately good to excellent survival, good growth, no dieback and a positive response to heavy ground cover (Hardy BBT Limited 1989).

Commercial Resources

Availability: Trees are commercially available across Alberta (ANPC 2010).

Uses: Used for lumber (Borealforest.org n.d.) as well as landscaping purposes. This is the foremost pulpwood, and is valued for piano sounding boards, violins, and other musical instruments; it is generally the most important commercial tree species of Canada (Lady Bird Johnson Wildflower Center 2013, Wilkinson 1990).

Spruce beer is made from the young growing tips in the spring (CYSIP: Botany n.d., Gray 2011).

Spruce tips can be used in the bath and as a facial steam for oily skin (Gray 2011).

Notes

Synonym *Picea canadensis* ((USDA NRCS n.d.).

P. glauca is listed as 92% intact (less occurrences than expected) in the Alberta oil sands region (Alberta Biodiversity Monitoring Institute 2014).

Trees are easily killed by fire due to thin bark (Rook 2002).

Trees are shallow-rooted and therefore not wind firm (Wilkinson 1990).

Trees are subject to attack by the spruce budworm (*Choristoneura fumiferana* Clemens)(Cerezke 1991).

Photo Credits

Photo 1 & 3: Wild Rose Consulting, Inc. 2013.

Photo 2: L. Robb. Alberta Provincial Seed Specialist. 2013.

Line Diagram: John Maywood, used by permission of Bruce Peel Special Collections, University of Alberta.

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