Notes:

---

Range

Dashed line separates coastal and interior varieties.
**Pinus flexilis** James - Limber Pine (Pf)

Pf is a minor species in British Columbia and is found only in the southeastern corner of the province, at elevations of 1000-2000 m. It grows best on moist, nutrient-rich sites in the ESSF biogeoclimatic zone. It has high frost resistance and is shade intolerant.

### Cone and Seed Production Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reproductive cycle</td>
<td>3 years</td>
</tr>
<tr>
<td>Cone length (cm)</td>
<td>7-20</td>
</tr>
<tr>
<td>Cone bearing age (collectable quantities)</td>
<td>20-40 years</td>
</tr>
<tr>
<td>Cones/hectolitre</td>
<td>Unavailable</td>
</tr>
<tr>
<td>Periodicity</td>
<td>2-4 years</td>
</tr>
<tr>
<td>Viable seeds/hectolitre of cones</td>
<td>6,454</td>
</tr>
<tr>
<td>Position of cones in crown</td>
<td>Throughout</td>
</tr>
<tr>
<td>Ease of cone detachment</td>
<td>Moderate</td>
</tr>
<tr>
<td>Plantable trees/hectolitre of cones</td>
<td></td>
</tr>
<tr>
<td>Bareroot</td>
<td>4,000</td>
</tr>
<tr>
<td>Container</td>
<td>2,000</td>
</tr>
</tbody>
</table>

### Recommended Collection Standards

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filled seeds/half-cone</td>
<td>Unavailable</td>
</tr>
<tr>
<td>Cone colour</td>
<td>Lustrous yellowish to light brown</td>
</tr>
<tr>
<td>Storage tissue</td>
<td>Opaque and firm</td>
</tr>
<tr>
<td>Seedcoat</td>
<td>Light brown</td>
</tr>
<tr>
<td>Embryo</td>
<td>Should occupy 90% of the cavity</td>
</tr>
<tr>
<td>Seedwing</td>
<td>Wingless</td>
</tr>
<tr>
<td>Cleanliness</td>
<td>Less than 5% debris and unacceptable cones</td>
</tr>
</tbody>
</table>

### Pests Affecting Cone and Seed Production

Pf has no major cone or seed pests.

### Collection Notes

1. Old Pf cones, recognizable by their grey-brown “weathered” appearance and open scales, should not be collected.
2. Local collection productivity information is not available.
3. Recommended collection techniques: climbing, pruning shears.
**Pinus monticola** Doug. ex D.Don in Lamb. - Western White Pine (Pw)

Pw grows on a wide variety of soils and sites in the ESSF (lower elevations), IDF (wetter subzones), IWH, and CWH biogeoclimatic zones throughout southern British Columbia. On the coast, this species can be found from sea level to timberline. In the Interior, Pw generally occurs at elevations ranging from 300-1700 m. It is a fast-growing tree, generally outcompeting its competitors on most sites. It is severely affected by calcium shortages which cause root dieback and, in some cases, crown dieback through chlorosis and subsequent necrosis. This species is also highly susceptible to white pine blister rust, and infected trees often fail to reach merchantable size. Consequently, reforestation of Pw has been limited. Advances in tree breeding and the production of rust-resistant Pw should dramatically increase the future use of this species.

### Cone Production Characteristics

- Reproductive cycle: 3 years
- Cone length (cm): 10-25
- Cone bearing age (collectable quantities): 20 years
- Cones/hectolitre: 250-350
- Periodicity: 3-7 years
- Viable seeds/hectolitre of cones: 7,587
- Position of cones in crown: Top 1/4
- Ease of cone detachment: Moderate
- Plantable trees/hectolitre of cones
  - Bareroot: 5,000
  - Container: 4,000

### Recommended Collection Standards

- Filled seeds/half-cone: 10
- Cone colour: Beige, brown or purplish-brown
- Storage tissue: Opaque and firm
- Seedcoat: Light to dark brown and often darkly mottled
- Embryo: Should occupy 90% of the cavity; opaque and yellowish in colour, and easily separated from the storage tissue
- Seedwing: Tan and darker along the straight edge and tip
- Cleanliness: Less than 5% debris and unacceptable cones

### Pests Affecting Cone and Seed Production

**Insects**

- Pine cone beetle (*Conophthorus monticola*)

### Collection Productivity

<table>
<thead>
<tr>
<th>Collection technique</th>
<th>Hectolitres collected/man-day Average (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerial</td>
<td>3.3 (1.4 - 6.3)</td>
</tr>
<tr>
<td>Climbing</td>
<td>1.4 (0.6 - 2.3)</td>
</tr>
<tr>
<td>Felling</td>
<td>2.5 (1.2 - 4.5)</td>
</tr>
</tbody>
</table>

### Collection Notes

1) Cones should be collected from trees that are 25-55 years of age and that show no symptoms of rust on any branches or the stem (MOFL, White Pine Policy Statement - 1983), i.e., from the surviving trees in heavily infected stands. The surviving trees are likely to be more resistant to the disease and, therefore, their seeds are also more likely to have higher resistance than seeds collected from infected immature trees. Infected trees should be marked and excluded from the collection (Meagher, Hunt and Wallinger 1987).

2) Occasionally, greenish Pw cones may contain mature seeds, so repeated seed cutting tests are necessary to determine collection timing.

3) Once mature, Pw cones tend to open quickly. Constant monitoring and good pre-collection organization are essential to ensure that seeds can be collected promptly upon maturation.

4) Because Pw cones are very resinous, gloves are recommended for pickers.
Many Cones

Mature Cones

Notes:

Range
**Pinus ponderosa** Dougl. ex P. & C. Lawson - Ponderosa Pine (Py)

Py is found in the south-central and southeastern parts of the province, at elevations of 250-1200 m. It generally occurs in pure, open, park-like stands on nutrient-rich sites in the dry PPBG and IDF biogeoclimatic zones. It has very low shade tolerance, moderate frost resistance, and relatively high flood resistance.

### Cone and Seed Production Characteristics

- Reproductive cycle: 3 years
- Cone length (cm): 7-9
- Cone bearing age (collectable quantities): 12-16 years
- Cones/hectolitre: 700
- Periodicity: 4-6 years
- Viable seeds/hectolitre of cones: 31,522
- Position of cones in crown: Throughout
- Ease of cone detachment: Difficult
- Plantable trees/hectolitre of cones:
  - Bareroot: 2,000
  - Container: 7,000

### Recommended Collection Standards

- Filled seeds/half-cone: 7 (or 75 per whole cone)
- Cone colour: Lustrous yellow-brown
- Seedcoat: Pale brown to brown and usually mottled; very hard and difficult to cut
- Storage tissue: Opaque and firm
- Embryo: Should occupy 90% of the cavity; yellow
- Seedwing: Tan
- Cleanliness: Less than 5% debris and unacceptable cones

### Pests Affecting Cone and Seed Production

**Insects**
- Ponderosa pine cone moth (*Cydia piperana*)
- Pine coneworms (*Dioryctria abietivorella* & *D. auroanticella*)
- Cone scale midge (*Resseliella spp.*)

### Collection Productivity

<table>
<thead>
<tr>
<th>Collection technique</th>
<th>Hectolitres collected/man-day Average (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerial</td>
<td>0.8 (0.3 - 1.4)</td>
</tr>
<tr>
<td>Felling</td>
<td>1 (0.8 - 1.3)</td>
</tr>
</tbody>
</table>

### Collection Notes

1. Py seeds can be extracted for evaluation by heating sample cones in a microwave oven at full power for approximately 1-2 minutes. Care must be taken not to damage the seeds by leaving the cones in the oven for too long; damage is indicated by a fatty smell.

2. Py branches are brittle, so pickers must take extra care when climbing.

3. Cones should be bent toward the end of the branch to break the stalk. They can also be knocked or shaken off and gathered from the ground later.

4. Because cones have sharp barbs protruding from the scales, pickers must use gloves.
Many Cones

Mature Cones

Notes:

Range
Pseudotsuga menziesii (Mirb.) Franco - Douglas-fir (Fd)

Two forms of Fd, coast and interior, are generally recognized in British Columbia. The coastal form can be found at elevations ranging from sea level to 1200 m; the interior form occurs to 1500 m. Fd grows on a variety of sites in the southern CALP, IDF, IWH, CDF, and southern CWH biogeoclimatic zones. It also occurs to a lesser extent in the southern MH, lower ESSF, SBS, PPBG, and northern CALP. The interior form is more frost resistant than the coastal form, but does not grow as quickly. Fd is considered to have moderate shade tolerance and nutritional requirements. Calcium deficiencies result in dieback, and shortages of magnesium cause reductions in diameter growth. Nitrates are required for best growth. This species is also thought to have the lowest flood resistance of all trees growing in British Columbia.

Cone and Seed Production Characteristics

Reproductive cycle ........................................2 years
Cone length (cm) .........................................5-10
Cone bearing age (collectable quantities) ..........20-25 years
Cone/hectolitre ...........................................2 800
Periodicity ......................................................2-10 years
Viable seeds/hectolitre of cones
   Coast .......................................................39 577
   Interior ...................................................70 343
Position of cones in crown .................................Top 1/2
Ease of cone detachment ..................................Easy
Plantable trees/hectolitre of cones
   Coast ........................................................3 000
   Interior .....................................................9 000
   Bareroot ...................................................20 000
   Container ................................................14 000

Recommended Collection Standards

Filled seeds/half-cone .............5
Cone colour ..................Golden brown
Storage tissue ..................Opaque and firm
Embryo .................Should occupy 90% of the cavity; pale yellow
Seedcoat ..................Tan to golden and often variegated on one side; the other side may be glossy and darker
Seedwing ..................Golden brown and easily detached from the cone scale
Cleanliness ..................Less than 5% debris and unacceptable cones

Collection Productivity

<table>
<thead>
<tr>
<th>Collection technique</th>
<th>Hectolitres collected/man-day Average (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerial</td>
<td>1.6 (0.1 - 3.6)</td>
</tr>
<tr>
<td>Climbing</td>
<td>1.2 (0.4 - 2.0)</td>
</tr>
<tr>
<td>Felling</td>
<td>1.4 (0.5 - 3.3)</td>
</tr>
</tbody>
</table>

Pests Affecting Cone and Seed Production

Insects

- Cone scale midge (*Camptomyia pseudotsuga*)
- Douglas-fir cone moth (*Barbara spp.*)
- Douglas-fir cone gall midge (*Contarinia oregonensis*)
- Douglas-fir cone scale midge (*Contarinia washingtonensis*)
- Douglas-fir cone beetle (*Ernobius punctulatus*)
- Douglas-fir seed chalcid (*Megascolia spermatophus*)
- Douglas-fir twig mining beetle (*Pityophorini orarius*)
- Fir coneworm (*Dioryctria abietivorella*)
- Western spruce budworm (*Choristoneura occidentalis*)

Diseases

- Seed fungus or cold fungus (*Caloscypha fulgens*)

Collection Notes

1) Fd embryos may fill their cavities well before seeds are mature, so cones should not be collected until all maturity criteria have been met.

2) Cone bracts may still be green at maturity, but scales should be separating before collection. The cone scales of Fd reflex almost completely before seeds begin to fall, so the collection period is somewhat extended in comparison to other species.

3) Cones should not be collected from trees heavily infested with dwarf mistletoe.
Many Cones

Mature Cones

Notes:


Range
Thuja plicata Donn. ex D. Don in Lamb. - Western Redcedar (Cw)

Cw is confined almost entirely to regions with abundant precipitation and atmospheric humidity, preferring moist sites in the IWH, CDF, CWH and IDF biogeoclimatic zones. It generally occurs below 1500 m, and has low frost resistance, high shade tolerance, and high flood resistance. Cw grows best on nutrient-rich sites.

### Cone and Seed Production Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reproductive cycle</td>
<td>2 years</td>
</tr>
<tr>
<td>Cone length (cm)</td>
<td>1-2</td>
</tr>
<tr>
<td>Cone bearing age (collectable quantities)</td>
<td>20-30 years</td>
</tr>
<tr>
<td>Cones/hectolitre</td>
<td>110 000</td>
</tr>
<tr>
<td>Periodicity</td>
<td>2-4 years</td>
</tr>
<tr>
<td>Viable seeds/hectolitre of cones</td>
<td>897 837</td>
</tr>
<tr>
<td>Position of cones in crown</td>
<td>Through</td>
</tr>
<tr>
<td>Nursery factor</td>
<td>0.250</td>
</tr>
<tr>
<td>Ease of cone detachment</td>
<td>Easy</td>
</tr>
<tr>
<td>Plantable trees/hectolitre of cones</td>
<td></td>
</tr>
<tr>
<td>Bareroot</td>
<td>266 000</td>
</tr>
<tr>
<td>Container</td>
<td>258 000</td>
</tr>
</tbody>
</table>

### Recommended Collection Standards

- Filled seeds/half-cone*: 2
- Cone colour: Golden to cinnamon brown
- Storage tissue: Opaque and firm
- Seedcoat: Light to dark brown; soft
- Seedwing: Light brown
- Embryo: Should occupy 90% of its cavity in length; white
- Cleanliness: Less than 10% debris and unacceptable cones

*Cut transversely at 1/2 cone length.

### Pests Affecting Cone and Seed Production

**Insects**

- Redcedar cone midge (*Mayetiola thujae*)

### Collection Productivity

<table>
<thead>
<tr>
<th>Collection technique</th>
<th>Hectolitres collected/man-day Average (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerial</td>
<td>0.08 (0.04 - 0.25)</td>
</tr>
<tr>
<td>Felling</td>
<td>0.2 (0.04 - 1.6)</td>
</tr>
</tbody>
</table>

### Collection Notes

1. Current cones are borne very near branchlet tips. Old cones, distinguishable by their weathered, grey-brown colour and open scales, are found further along the branch and should be avoided.
2. When the cutting test is performed on Cw, the basal area of the cone must also be examined for potential midge damage.
3. Cw cones should be loosely sacked (20 litres/sack) to prevent overheating and pre-germination.
4. Cw has low seed dormancy and is subject to pre-germination. Cones should be forwarded to the processing facility immediately after collection to ensure that preconditioning can be carried out in a controlled environment.
Many Cones

Mature Cones

Notes:

Range
**Tsuga heterophylla** (Raf.) Sarg. - Western Hemlock (Hw)

Hw grows in areas of high mean annual precipitation in the IWH, CWH, and, to a lesser extent, CDF biogeoclimatic zones. It can be found at elevations up to 1200 m at the coast and to 1500 m in the Interior. It has little resistance to frost unless the ground is well covered with snow before freezing, but it has high shade tolerance and flood resistance. The nutritional requirements of Hw are low. While Hw hybridizes with Hm, such hybrids rarely produce cones.

### Cone and Seed Production Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reproductive cycle</td>
<td>2 years</td>
</tr>
<tr>
<td>Cone length (cm)</td>
<td>2-3</td>
</tr>
<tr>
<td>Cone bearing age (collectable quantities)</td>
<td>25-30 years</td>
</tr>
<tr>
<td>Cones/hectolitre</td>
<td>83 000</td>
</tr>
<tr>
<td>Periodicity</td>
<td>3-4 years</td>
</tr>
<tr>
<td>Viable seeds/hectolitre of cones</td>
<td>366 698</td>
</tr>
<tr>
<td>Cleaned seeds/gram</td>
<td>489</td>
</tr>
<tr>
<td>Position of cones in crown</td>
<td>Throughout</td>
</tr>
<tr>
<td>Ease of cone detachment</td>
<td>Easy</td>
</tr>
<tr>
<td>Plantable trees/hectolitre of cones</td>
<td></td>
</tr>
<tr>
<td>Bareroot</td>
<td>93 000</td>
</tr>
<tr>
<td>Container</td>
<td>98 000</td>
</tr>
</tbody>
</table>

### Recommended Collection Standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filled seeds/half-cone</td>
<td>3</td>
</tr>
<tr>
<td>Cone colour</td>
<td>Purplish or yellow-brown;</td>
</tr>
<tr>
<td>Storage tissue</td>
<td>Opaque and firm often with reddish brown tips</td>
</tr>
<tr>
<td>Embryo</td>
<td>Should occupy 90% of the cavity</td>
</tr>
<tr>
<td>Seedcoat</td>
<td>Brown to dark brown; soft</td>
</tr>
<tr>
<td>Seedwing</td>
<td>Light brown</td>
</tr>
<tr>
<td>Cleanliness</td>
<td>Less than 10% debris and unacceptable cones</td>
</tr>
</tbody>
</table>

### Collection Productivity

<table>
<thead>
<tr>
<th>Collection technique</th>
<th>Hectolitres collected/man-day Average (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerial</td>
<td>0.2 (0.04 - 0.52)</td>
</tr>
<tr>
<td>Felling</td>
<td>0.2 (0.05 - 0.75)</td>
</tr>
</tbody>
</table>

### Pests Affecting Cone and Seed Production

- **Insects**
  - Seed chalcid (*Megastigmus tsugae*)

### Collection Notes

1. Old Hw cones, recognizable by their dark greyish/brown colour and their “open” scales, should be avoided.
2. Cone scales should be separating at the time of collection.
3. Since Hw seeds germinate quickly in cool, moist conditions, cones should be sent to the processing facility immediately after collection to ensure that pre-conditioning can be carried out in a controlled environment.
4. Hw cones should be loosely sacked (20 litres/sack) to prevent overheating and pre-germination.
5. If cones are picked too early, problems with cone opening may be encountered at the extractory.
6. Cone rakes may be used when picking is done from felled trees.
7. Hw seeds generally mature later in the fall (October) than do seeds of other species.
Tsuga mertensiana (Bong.) Carr. - Mountain Hemlock (Hm)

Hm is found on moist sites in the MH and wetter ESSF biogeoclimatic zones, at elevations ranging from 1000 to timberline. It is not frost resistant or flood resistant, but it is shade tolerant and has low nutritional requirements. Hm is better adapted to snowy subalpine climates than is Hw. Hm and Hw hybridize where their ranges overlap, but cone production by these hybrids is rare.

Cone and Seed Production Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reproductive cycle</td>
<td>2 years</td>
</tr>
<tr>
<td>Cone length (cm)</td>
<td>2-8</td>
</tr>
<tr>
<td>Cone bearing age (collectable quantities)</td>
<td>30 years</td>
</tr>
<tr>
<td>Cones/hectolitre</td>
<td>Unavailable</td>
</tr>
<tr>
<td>Periodicity</td>
<td>3-6 years</td>
</tr>
<tr>
<td>Viable seeds/hectolitre of cones</td>
<td>356 428</td>
</tr>
<tr>
<td>Position of cones in crown</td>
<td>Top 1/3</td>
</tr>
<tr>
<td>Ease of cone detachment</td>
<td>Easy</td>
</tr>
<tr>
<td>Plantable trees/hectolitre of cones</td>
<td></td>
</tr>
<tr>
<td>Bareroot</td>
<td>87 000</td>
</tr>
<tr>
<td>Container</td>
<td>95 000</td>
</tr>
</tbody>
</table>

Recommended Collection Standards

- Filled seeds/half-cone: Unavailable
- Cone colour: Light purple to brownish-purple
- Storage tissue: Opaque and firm
- Seedcoat: Golden to reddish brown
- Embryo: Should occupy 90% of the cavity; pale yellow
- Seedwing: Tan
- Cleanliness: Less than 5% debris and unacceptable cones

Pests Affecting Cone and Seed Production

Hm has no major cone or seed pests.

Collection Productivity

<table>
<thead>
<tr>
<th>Collection technique</th>
<th>Hectolitres collected/man-day Average (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerial</td>
<td>0.8 (0.5 - 1)</td>
</tr>
</tbody>
</table>

Collection Notes

1) The cone scales of Hm reflex almost completely before seeds begin to fall, so the collection period is somewhat extended in comparison to that for other species.
Many Cones

Mature Cones

Notes:

Range
REFERENCES


———. 1984c. The reproductive cycles of western and mountain hemlock. B.C. Min. For., Victoria, B.C. 34p.


Workers’ Compensation Board of British Columbia. 1980. Industrial health and safety regulations. Richmond, B.C.


APPENDICES

An interim cone storage facility

Monitoring cone temperature

Squirrel with cone

Surveying the cone crop

Aerial clipping
**APPENDIX 1  Glossary**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apices</td>
<td>growing points, or zones of cell division, at the tips of stems and roots in vascular plants.</td>
</tr>
<tr>
<td>Bract</td>
<td>a modified leaf which extends underneath a scale in female cones.</td>
</tr>
<tr>
<td>Cone</td>
<td>the reproductive structure of conifers. (see also Pollen cone. Seed cone.)</td>
</tr>
<tr>
<td>Cotyledons</td>
<td>primary leaves of an embryo or seedling which degenerate soon after the plant produces the first true leaves.</td>
</tr>
<tr>
<td>Cascharden</td>
<td>inability of cone scales to reflex, caused by rapid drying of the outer layers while the inner layers remain moist, thereby preventing the further exit of moisture.</td>
</tr>
<tr>
<td>Diploid</td>
<td>an organism or cell having double the basic or haploid number of chromosomes (usually abbreviated as 2N), characteristic of almost all vascular plant cells except gametes.</td>
</tr>
<tr>
<td>Dormancy</td>
<td>a physiological state in which a seed that is capable of germination does not germinate, even in the presence of favourable environmental conditions.</td>
</tr>
<tr>
<td>Embryo</td>
<td>the product of fusion of a male gamete with an ovule during fertilization (2N). In conifers, the embryo is enclosed by storage tissue and the seedcoat, and under favourable conditions grows into a new plant.</td>
</tr>
<tr>
<td>Empty seed</td>
<td>a seed that does not contain all tissues essential for germination.</td>
</tr>
<tr>
<td>Endosperm</td>
<td>a commonly used, but incorrect, term applied to the nutrient storage tissue (1N) surrounding the embryo in gymnosperm seeds. This tissue, which is the megagametophyte, serves the same function as the endosperm of angiosperm seeds. However, fertilization is not required for this tissue to form in gymnosperm seeds.</td>
</tr>
<tr>
<td>Fertilization</td>
<td>penetration of a pollen tube into the ovule and union of the male and female nuclei.</td>
</tr>
<tr>
<td>Filled seed</td>
<td>a seed containing all tissues essential for germination. (Also used in cone evaluation (p. 22) to describe a seed containing storage tissue, but not necessarily an embryo, since the latter is not checked for.)</td>
</tr>
<tr>
<td>Gamete</td>
<td>sex cell (1N) capable of fusion with another gamete to produce a fertilized zygote (2N).</td>
</tr>
<tr>
<td>Gametophyte</td>
<td>haploid plant (1N) which produces gametes (1N) by mitosis.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Genotype</td>
<td>an individual organism’s hereditary constitution which may or may not be expressed phenotypically.</td>
</tr>
<tr>
<td>Germination</td>
<td>growth of an embryo resulting in its emergence from the seed.</td>
</tr>
<tr>
<td>Haploid</td>
<td>an organism or cell having only one complete set of chromosomes, ordinarily half the normal diploid number (usually abbreviated as 1N). It is characteristic of gametes of vascular plants.</td>
</tr>
<tr>
<td>Integument</td>
<td>the layer of tissue in conifers that encloses the nucleus of an ovule, and which develops into the seedcoat.</td>
</tr>
<tr>
<td>Internode</td>
<td>that part of a plant stem separating two distinct whorls of branches.</td>
</tr>
<tr>
<td>Megaspore</td>
<td>first cell of the female gametophyte which eventually becomes the embryo sac.</td>
</tr>
<tr>
<td>Megasporangia</td>
<td>ovules.</td>
</tr>
<tr>
<td>Megasporophyll</td>
<td>modified leaf, or cone scale, bearing megasporangia.</td>
</tr>
<tr>
<td>Megagametophyte</td>
<td>haploid (1N) nutrient storage tissue in coniferous seeds. This tissue is often mistakenly called the “endosperm” in conifers. In this guide, it is called “storage tissue.”</td>
</tr>
<tr>
<td>Meiosis</td>
<td>a series of complex nuclear changes within the original cell, resulting in the production of new cells with half the number (1N) of chromosomes characteristic of the original cell.</td>
</tr>
<tr>
<td>Microspore</td>
<td>first cell of the male gametophyte which eventually becomes a pollen grain.</td>
</tr>
<tr>
<td>Microsporangia</td>
<td>pollen sacs.</td>
</tr>
<tr>
<td>Microsporophyll</td>
<td>modified leaf, or scale, bearing microsporangia.</td>
</tr>
<tr>
<td>Mitosis</td>
<td>a process of precise duplication of genetic material in which the cell nucleus divides into two new nuclei, each of which has the same number (2N) of chromosomes as the original cell.</td>
</tr>
<tr>
<td>Nucleus</td>
<td>a dense, spherical, somewhat transparent, body in the protoplasm of plant and animal cells, which contains chromosomes.</td>
</tr>
<tr>
<td>Ovule</td>
<td>a female organ surrounded by integument, within which an egg cell (1N) is produced, and which matures into a seed (2N) following fertilization.</td>
</tr>
<tr>
<td>Periodicity</td>
<td>the interval (in years) between good cone crops. Some trees in a stand, or area, may bear cones every year, but heavy crops are periodic, usually occurring several years apart.</td>
</tr>
<tr>
<td>Phenotype</td>
<td>all characteristics – morphological, anatomical, and physiological – of a plant, determined by the interaction between genotype and environment.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Pollen cone</td>
<td>- the male reproductive structure of conifers, which produces pollen grains. It consists of an axis bearing spirally arranged scales, each of which supports two pollen sacs containing pollen.</td>
</tr>
<tr>
<td>Pollination</td>
<td>- the transfer of pollen from the pollen cone to the receptive part of the seed cone.</td>
</tr>
<tr>
<td>Primordia</td>
<td>- rudimentary structures, structures at their earliest stages of development.</td>
</tr>
<tr>
<td>Progeny</td>
<td>- offspring of plants.</td>
</tr>
<tr>
<td>Provenance</td>
<td>- the geographical area (latitude, longitude, and elevation) and environment to which the parent trees are native, and within which their genetic constitution has evolved through natural selection.</td>
</tr>
<tr>
<td>Seed</td>
<td>- a matured ovule containing an embryo and nutritive tissue enclosed by a protective seedcoat, which is capable of developing into a plant under suitable conditions.</td>
</tr>
<tr>
<td>Seedcoat</td>
<td>- the protective outer layer of a seed derived from the integument of the ovule.</td>
</tr>
<tr>
<td>Seed cone</td>
<td>- the female reproductive structure of conifers, which produces seeds. It consists of an axis that supports spirally-arranged bracts, with ovuliferous scales at the base of each bract. Two ovules, which become seeds after fertilization occurs, are attached to the upper surface of each ovuliferous scale.</td>
</tr>
<tr>
<td>Seedlot</td>
<td>- a quantity of seeds of the same species, provenance, date of collection and handling history, and which is identified by a single number.</td>
</tr>
<tr>
<td>Seed orchard</td>
<td>- specially selected collection of trees, planted in an orchard fashion, established to produce seeds, usually of improved genetic quality. Seed orchards may be clonal (i.e. propagated from scions and produced from grafts or rooted cuttings) or seedling (i.e. propagated from seeds). An orchard may be described as first generation (from untested [natural stand] parents) or as advanced generation (the offspring of superior parents selected from a genetic test plantation). Some orchards may be established to produce seeds of species that do not produce adequately in natural stands.</td>
</tr>
<tr>
<td>Seed production stand</td>
<td>- a forest stand reserved and managed as a source of seeds.</td>
</tr>
<tr>
<td>Seed planning zone</td>
<td>- in accordance with seed transfer rules, an area throughout which seeds of a given provenance may be transferred and in which the resulting seedlings can be expected to perform adequately.</td>
</tr>
<tr>
<td>Seed source</td>
<td>- the place (latitude, longitude, and elevation) at which seeds are collected. The source of a seed collection may not be identical with its provenance.</td>
</tr>
<tr>
<td>Serotinous</td>
<td>- a term applied to cones that remain on the parent tree, without opening, for a year or more after the seeds inside have matured.</td>
</tr>
<tr>
<td>Zygote</td>
<td>- diploid cell (2N) resulting from the fusion of two haploid gametes (1N), the product of fertilization.</td>
</tr>
</tbody>
</table>
APPENDIX 2 Pests

INSECTS

Barbara spp. (cone moths)

Larvae
- white with dark head
- pupate in mid-summer
- overwinter in cocoon constructed perpendicular to the cone axis

Damage
- attacks scales and seeds
- extensive, often destroying up to 50% of the cone crop
- cones are pitchy, brown and often distorted

Species affected
- Bg, Fd

Camptomyia pseudotsuga (cone scale midge)

Larvae
- similar to Contarinia oregonensis

Damage
- occurs only in cones infested by larvae of Contarinia oregonensis

Species affected
- Fd

Choristoneura occidentalis (western spruce budworm)

Larvae
- body colour varying longitudinal bands of darker and lighter shades
- shiny yellow to brownish black head capsule
- pupate by mid-summer

Damage
- male and female flowers completely consumed or holes bored into developing cones

Species affected
- Fd

Conophthorus monticolae (pine cone beetle)

Larvae
- white
- feed inside cone from mid-June to mid-July, after which they pupate for 1 week

Damage
- tunnels through conductive tissue at base of cone, killing it
- cones appear shrivelled and brown
- cones completely destroyed internally

Species affected
- Pw

Contarinia spp. (Douglas-fir cone gall and scale midges)

C. oregonensis

Larvae
- orange
- tunnel into scale tissue in early June
- form gall
- lie in U-shape
- drop to litter in fall

Damage
- seeds may become fused to scales or may be completely destroyed
- scales die and turn red in July or August

Species affected
- Fd
### C. washingtonensis

**Larvae**
- deep orange
- tunnel into scale
- do not form galls
- lie fully extended
- emerge after cones reach maturity

**Damage**
- no direct damage to seeds
- if infestation severe, cone scales die and turn red in July or August

**Species affected**
- Fd

### Cydia spp. (seedworms)

**Larvae**
- white with dark head
- after seeds mature, larvae tunnel into cone axis where they over-winter

**Damage**
- no external evidence
- feed almost entirely on seeds
- seed pairs on same scale may become fused by silk-lined tunnels
- destroyed seed filled with frass

**Species affected**
- Py, Sb, Ss

### Dasineura spp. (cone midge)

**Larvae**
- yellow-orange
- feed in single seed
- drop to ground in fall as cone disintegrates
- pupate in litter, overwinter

**Damage**
- no external evidence
- seeds may be destroyed or fused to cone scale
- generally light

**Species affected**
- Ba, Bg, Bl, Sb, Sx, Ss

### Dioryctria spp. (coneworms)

**Larvae**
- reddish with brown head
- mine cone, severing cone scales

**Damage**
- cone scales die and turn brown
- cones badly distorted
- cones usually do not open

**Species affected**
- D. abietivorella
  - Fd, Py, Pw, Sb
- D. auranticella
  - Py

### Earomyia spp. (cone maggots)

**Larvae**
- white with black mouth hooks
- move through cone axis
- feed on seeds until late summer
- pupate and overwinter in litter

**Damage**
- no external evidence
- internal destruction of cones and seeds

**Species affected**
- Ba, Bg, Bl
### Ernobius punctulatus (Douglas-fir cone beetle)

<table>
<thead>
<tr>
<th>Larvae</th>
<th>Damage</th>
<th>Species affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>- curved, white with yellowish brown head</td>
<td>- none to living cones</td>
<td>- Fd</td>
</tr>
<tr>
<td>- feed in mature or dead cones</td>
<td>- complete destruction of cone</td>
<td></td>
</tr>
</tbody>
</table>

### Eucosma recissoriana (lodgepole pine cone moth)

<table>
<thead>
<tr>
<th>Larvae</th>
<th>Damage</th>
<th>Species affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>- dirty white</td>
<td>- holes and frass on surface of cones</td>
<td>- Pl</td>
</tr>
<tr>
<td>- feeds on scales and seeds</td>
<td>- destruction of seeds and scales</td>
<td></td>
</tr>
<tr>
<td>- pupates and overwinters in cocoon in litter</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Lasiomma anthracina (spiral spruce cone borer)

<table>
<thead>
<tr>
<th>Larvae</th>
<th>Damage</th>
<th>Species affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>- white</td>
<td>- no external damage until larvae emerge</td>
<td>- Sb, Sx, Ss</td>
</tr>
<tr>
<td>- constructs spiral tunnel around cone axis</td>
<td>- spiral borings around cone axis</td>
<td></td>
</tr>
<tr>
<td>- leaves cone by mid-summer</td>
<td>- seeds and scales damaged</td>
<td></td>
</tr>
<tr>
<td>- pupates and overwinters in the litter</td>
<td>- single larva may destroy more than half of the seeds in one cone</td>
<td></td>
</tr>
<tr>
<td>- major pest of spruce cones</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Leptoglossus occidentalis (cone bug)

<table>
<thead>
<tr>
<th>Damage</th>
<th>Species affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>- adult bug sucks juices from developing seeds</td>
<td>- Fd, Pl, Py, Pw</td>
</tr>
</tbody>
</table>

### Mayetiola spp. (midges)

#### M. carpophaga

<table>
<thead>
<tr>
<th>Larvae</th>
<th>Damage</th>
<th>Species affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>- yellowish pink</td>
<td>- each larva destroys one seed</td>
<td>- Sx</td>
</tr>
<tr>
<td>- enters seed, feeds and forms cocoon by mid-summer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- not a serious pest</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### M. thujae

<table>
<thead>
<tr>
<th>Larvae</th>
<th>Damage</th>
<th>Species affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>- orange</td>
<td>- destruction of both scales and seeds</td>
<td>- Cw</td>
</tr>
<tr>
<td>- feed beneath cone scales</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- move about cone and so may damage more than one seed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- form cocoons in the cone during August and early September</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Megastigmus** spp. (seed chalcids)

<table>
<thead>
<tr>
<th>Larvae</th>
<th>Damage</th>
<th>Species affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>- white, curved</td>
<td>- no external evidence of damage</td>
<td>- Ba, Bg, Bl, Fd, Hw, Sx</td>
</tr>
<tr>
<td>- one larva develops per seed, devouring the seed’s contents in the process</td>
<td>- other than small borehole in seedcoat</td>
<td></td>
</tr>
<tr>
<td>- mature larva overwinters in the seed</td>
<td>- seed contents devoured</td>
<td></td>
</tr>
<tr>
<td>- adults emerge by boring a small round hole in the seedcoat</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Pityophthorus orarius** (Douglas-fir twig mining beetle)

<table>
<thead>
<tr>
<th>Damage</th>
<th>Species affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>- adults and larvae mine and kill young twigs, affecting next year’s cone crop</td>
<td>- Fd</td>
</tr>
</tbody>
</table>

**Resseliella** spp. (cone scale midge)

<table>
<thead>
<tr>
<th>Larvae</th>
<th>Damage</th>
<th>Species affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>- yellowish-orange</td>
<td>- scales darken prematurely, or if the attack is severe scales may die, killing the seeds indirectly</td>
<td>- Bg, Py</td>
</tr>
<tr>
<td>- feed singly or in groups on the surface of cone scales</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- do not feed on seeds directly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- larvae overwinter in the litter</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DISEASES

Caloscypha fulgens (seed fungus or cold fungus)

This seed-borne fungus is spread from diseased to healthy seeds during stratification and when seeds are sown in cold soils. Cones that have been in contact with an infected forest floor, or that have been collected from squirrel caches, often contain infected seeds. During stratification, a whitish-grey mycelium forms on the seedcoat and eventually penetrates the seedcoat, mummifying the contents. This fungus may survive inside killed seeds for several years.

<table>
<thead>
<tr>
<th>Damage</th>
<th>Species affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>- seeds appear to be sound, but are mummified and will not germinate</td>
<td>- Bg, Fd, Sx, Ss</td>
</tr>
</tbody>
</table>

Chrysomyxa spp. (cone rusts)

*Pyroila* spp. and *Moneses uniflora* are the alternative hosts for this rust fungus. Spores are wind disseminated in spring or early summer and infect young spruce cones. As the cones dry out in mid- to late-summer, yellow-orange spores are released.

<table>
<thead>
<tr>
<th>Damage</th>
<th>Species affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>- in mid- to late-summer, cones become light brown, dry and open prematurely in the area of infection</td>
<td>- Sx, Ss</td>
</tr>
<tr>
<td>- cones may be either completely or partly infected</td>
<td></td>
</tr>
<tr>
<td>- seed yields are substantially reduced</td>
<td></td>
</tr>
<tr>
<td>- if seeds do develop, cone malformation often prevents their extraction</td>
<td></td>
</tr>
<tr>
<td>- if extracted, seeds from infected cones have reduced or abnormal germination</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 3  Basic Cone Collection Equipment Checklist

☐ Altimeter
☐ Axe and/or chainsaw plus fuel and file
☐ Binoculars
☐ Cone sacks
☐ Cone cleaning and inspection table
☐ Cone volume measure
☐ Cone collectors’ report forms (FS 721)
☐ Cone cutter (or strong knife)
☐ Flagging tape
☐ First aid kit
☐ Hand cleaner and rags
☐ Hand lens (10X)
☐ Hard hat
☐ Map
☐ Plastic pails
☐ Razor blades or scalpel
☐ Strong twine
☐ Spray paint
☐ Shipping tags
☐ Signalling device (whistle, horn, etc.)
☐ Tarpaulins or polythene sheets
☐ Tally/note book
☐ Water

* Readers contemplating specialized cone collection techniques, such as climbing or aerial chipping, should refer to the appropriate manuals for specific equipment requirements.
APPENDIX 4  Regulations Pertinent to the Collection of Cones of B.C. Conifers
Forest Act

TREE CONE AND TREE SEED REGULATION
[includes amendments up to B.C. Reg. 147/88]
[Consolidated June 30, 1988]

Interpretation

1. (1) In this regulation
   "dealer" means a person, other than an employee of the Ministry of Forests,
   engaged in the buying and selling of cones or seeds as a business enterprise, and
   includes a processor;
   "licence" means an agreement in the form of a forest licence, timber sale
   licence, timber licence, tree farm licence, woodlot licence or timber sale
   harvesting licence entered into under the Forest Act or the former Act;
   "process" and "processing" means every form of treatment of cones and
   seeds and includes drying, kilning and tumbling of cones and dewinging and
   cleaning of seeds;
   "processor" means a person engaged in processing, but does not include an
   employee of the Ministry of Forests;
   "provenance" means the geographic source or place of origin, including
   elevation of cones and seeds;
   "seedlot" means a quantity of cones or seeds having uniformity of species,
   provenance, quality and year of collection.
   (2) A reference in this regulation to cones or seeds is a reference to the cones,
   seeds or fruits of any species of commercial forest trees growing in the Province.

Collection

2. (1) Subject to subsection (2), no person shall collect cones or seeds from
       Crown land unless he holds a cone collection permit issued by a regional manager
       or other person authorized by him to issue it.

       (2) Subsection (1) does not apply to employees or agents of
           (a) the Crown.
           (b) Repealed. [B.C. Reg. 147/88.]

       (3) A permit issued under subsection (1) may be in Form 1 and
            (a) must contain a description of the area of land to which it relates,
            (b) may confer rights and be granted subject to obligations referred to in
                the permit, and
            (c) may require, as a condition of issuance, that the holder submit a cone
                collector's report or a seed orchard cone collection and cost report in a
                form approved by the chief forester.

       (4) A permit to collect cones and seeds from Crown land held under licence or
           lease shall not be issued unless the licensee or lessee consents in writing to the
           collection.

       [am. B.C. Reg. 147/88.]

June 30/88
FOREST ACT

TREE CONE AND TREE SEED

Registration

3. (1) It is the duty of the Ministry of Forests to
(a) maintain a register of seedlots,
(b) enter in that register particulars of every seedlot accepted for
registration, and
(c) issue a notice of registration for each seedlot so accepted.
(2) A person seeking to have a seedlot registered shall submit an application
for registration to the seed centre of the Ministry of Forests and the application
must be accompanied by
(a) a sample of the seedlot, or
(b) a completed cone collector's report or seed orchard cone collection and
   cost report, or sufficient information to complete either of those
   reports.

Processing

4. (1) A processor shall not process cones or seeds collected from Crown land
unless there is deposited with the processor at the time of delivery of the cones or
seeds
(a) a cone collector's report or a seed orchard cone collection and cost
   report, or
(b) evidence of registration of the seedlot.
(2) Except with the consent of the Chief Forester, no person shall remove from
the Province for processing cones or seeds collected from
(a) Crown land, or
(b) seed orchards on private lands which are subject to a management
   agreement with the Crown.

Disposition

5. (1) No dealer shall buy, sell or trade in cones or seeds unless he is the
holder of a seed dealer's licence issued by a regional manager or person authorized
by him.
(2) Every dealer shall maintain within the Province a ledger containing, in
respect of each transaction in cones or seeds,
(a) the name and address of the vendor and purchaser,
(b) the date of the transaction,
(c) the species of cone or seed,
(d) the volume of cones or mass of seeds, and
(e) the seedlot registration number, cone collection permit number or any
   other identifying number, or, when the cones or seeds have been
   collected from land other than Crown land, the name and address of
   the owner of that land.
(3) The Chief Forester or his agent has power to inspect and make copies of
the ledger at any reasonable time.
(4) A seed dealer's licence may be in Form 2.

June 30/88
FOREST ACT

TREE CONE AND TREE SEED

Offences

6. Any person who
(a) contravenes section 2 (1), 4 or 5 (1) or (2),
(b) fails to comply with a condition of a permit or licence issued under this regulation, or
(c) obstructs or impedes the chief forester or his agent in carrying out his duties under section 5 (3),
commits an offence.

Ministry of Forests

FORM 1

CONE COLLECTION PERMIT

PERMIT NO

is hereby authorized under B.C. Regulation _________ to collect cones and seeds from:
Crown lands described as follows:

<table>
<thead>
<tr>
<th>Licence/Lease No.</th>
<th>Cutting Permit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block or Unit No.</td>
<td>Location</td>
</tr>
</tbody>
</table>

and subject to the following conditions:

1. Cones or seeds shall be collected only from the Crown lands described above.

2. In the case of Crown land held under licence or lease, the written permission of the licensee or lessee or their agent must be obtained.

3. Cones or seeds may be collected only from the following species of trees

4. This permit is valid from the date of issue until midnight _________ 19___.

5. Cones or seeds shall be collected only by means of, or from:
   Climbing trees
   Felling trees of the above species
   Other (specify) ________________________________

May 31/87
6. Branches or foliage may not be cut from standing trees for the purpose of collecting cones or seeds therefrom under this permit.

7. Slash and debris resulting from the felling of trees or cutting of branches or foliage shall be disposed of at the permittee's expense by

8. Merchandable logs resulting from the felling of trees for the purpose of collecting cones or seeds therefrom under this permit shall be disposed of by

9. The permittee shall, not later than 7 days after the expiry date of the permit, report to the person issuing the permit, the volume (in hectolitres) of cones or the mass (in kilograms) of seeds of each species collected under this permit.

10. Cones or seeds collected under this permit will be delivered to

11. The permit may be suspended during any forest travel restriction covering the permit area.

12. The permit is subject to immediate cancellation for contravention of any of the above conditions, or for unwarranted damage to the forest.

Forest region ____________________________ Forest Officer ____________________________
District ____________________________ date of issuance: 19

I have read and understand the terms and conditions of this permit and the regulations governing the collection of cones and seeds.

PERMIT ISSUED FREE OF CHARGE

Permittee ____________________________

[en. B.C. Reg. 364/82.]

May 31/87
Ministry of Forests

FORM 2

SEED DEALER’S LICENCE

Licence No.

_________________________,

(Home)

of______________________

(Address)

is hereby licensed to purchase, sell or otherwise trade in tree cones and tree seeds subject to the provisions of the Tree Cone and Tree Seed Regulation, and the following conditions:

1. This licence may not be sold or transferred.

2. This licence is valid from the date of issue below.

3. This licence is subject to cancellation where the dealer
   (a) fails to comply with the conditions of this licence,
   (b) fails to comply with sections 4 and 5 of the Tree Cone and Tree Seed Regulation, or
   (c) obstructs or impedes the chief forester or his agent in carrying out their duties in section 5 (3) of the Tree Cone and Tree Seed Regulation.

_________________________ 19 ________________

Date Chief Forester

THIS LICENCE IS ISSUED FREE OF CHARGE

[Provisions of the Forest Act relevant to the enactment of this regulation: section 158(2) (k)]

Queen’s Printer for British Columbia/C
Victoria, 1985

May 31/87

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SECTION 33

AIRCRAFT OPERATIONS

Scope
33.00. This section covers the use of aircraft in support of industry and includes the use of aircraft as a means of lifting, transporting, and landing loads and workers.*
*The crewing, maintenance, and operation of aircraft are governed by Department of Transport (Canada) regulations.

Pre-job planning
33.02. Operational procedures, including the selection of aircraft and equipment, shall be planned comprehensively and in detail by qualified persons. Where special circumstances exist, or when directed to do so by the Board, written plans or procedures shall be available to all persons directly concerned.

Aircrew
33.04. Crews of aircraft engaged in airlifting operations shall be qualified in the type of work involved.

Pre-job instruction and training
33.06. All persons involved shall be given adequate pre-job instruction and, where necessary, trial operational training before actual operations commence.

Job supervision
33.08. All operations shall be conducted under the direction of qualified persons.

Emplaning and deplaning
33.10. Emplaning and deplaning from aircraft in flight shall be undertaken only with the prior approval of the Department of Transport (Canada).

Work prohibition
33.12. No worker shall be on any load supported or suspended from an aircraft in flight.
HELI COPTER OPERATIONS

General requirements
33.14 (1) Pilots of helicopters utilized for aerial construction, demolition, erection, dismantling, and the associated transport of workers or materials, shall have:
(a) a commercial, senior commercial, or airline transport helicopter pilot's licence endorsed for the type of aircraft being used, and
(b) a minimum of 500 hours flying time as pilot-in-command of helicopters.
(2) Whenever approaching or leaving a helicopter with blades rotating, all workers shall remain in full view of the pilot and keep in a crouched position. Workers shall avoid the area from the cockpit or cabin rearward unless authorized by the pilot and should not approach from uphill nor depart in an uphill direction.

Communications
33.16. (1) No airlift operation shall be initiated without effective clear channel radio communication between pilots and supervisors of all workers involved in the operation. Alternative land signals shall be rehearsed in advance but shall be used only to complete an operation in the event of radio failure when the aircraft has been committed to a point which precludes termination of the operation.
(2) Workers who are in two-way radio contact with pilots, shall be identified by wearing fluorescent red vests or jackets.
(3) In structural erection or dismantling, where existing conditions adversely affect communications between the supervisor and the crew handling the airlifted load, designated crew members shall wear receivers on which they can hear radio communications to and from the pilot.

Personal protective equipment
33.18. Appropriate personal protective equipment, including head, hearing and eye protective devices as required by Section 14, shall be worn by workers employed in proximity to operating helicopters.

Grounding
33.20. Workers shall not touch an airlifted load or any part of its rigging until accumulated static electricity has first been discharged to ground.

Assembly yards, landings and work sites
33.22. (1) Material assembly yards, landing areas and work sites shall be located at a safe distance from trees, poles, power lines and other obstructions, and shall be kept clear of:
(a) slipping and tripping hazards, and
(b) excavated materials or other obstructions, which could endanger workers during placement of airlifted loads.

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(2) In all work areas exposed to rotor downdrafts:
(a) equipment and materials shall be secured against dislodgement, and
(b) effective measures shall be taken to control dust and prevent loose materials from becoming airborne.

Load release devices
33.24. Helicopters shall be equipped with both electrically and mechanically operated load release mechanisms to permit instant release of the load in an emergency. Automatic load release mechanisms shall not be armed while handling loads over workers.

Rigging
33.26. (1) All rigging shall be in conformity with the requirements of Section 54.
(2) Tag lines shall be of a length that will not permit their being drawn up into rotors.

Work procedures
33.28. Workers shall keep clear of airlifted loads except for those workers directly involved in handling and securing the loads.

Design factors for landing or touching down helicopters on structures
33.30. Where it is intended that helicopters will emplane or deplane workers or material onto or from a structure, there shall be provided, by January 1, 1980, a suitable touch-down or landing surface that ensures stability for the helicopter and safe footing for workers. The extent of the surface to be used for touch-down or landing shall be defined and the permissible loading certified by a registered professional engineer. The area and the permissible loading shall be marked upon the structure so as to be clearly visible to the pilot or the pilot shall be provided with the information in writing.

Operational procedures for landing or touching down helicopters on structures
33.32. At the discretion of the pilot-in-command, workers or material may be emпланed or deplaned onto or from a structure subject to the following minimum conditions:
(a) Where the surface prescribed by regulation 33.30 is installed the employer of the workers involved shall obtain permission in writing from the owner of the structure. The pilot shall be provided with this information in writing.
(b) Landing or touching down on a structure where the provisions of regulation 33.30 do not ordinarily apply, and to other structures before January 1, 1980, is permitted providing that the employer of the workers involved is in possession of permission in writing from the owner of the structure, and of certification signed by a registered professional engineer as to the permissible safe loading, with definition of the portion of the structure covered by the certificate. The pilot shall be in possession of this information in writing.
(c) The helicopter shall place sufficient weight on the structure to provide aircraft stability.

(d) The skids shall be, whenever possible, of the lowest configuration. They shall extend sufficiently beyond the supports upon which they are to rest to preclude entanglement.

(e) "Bear paws" shall be removed.

(f) Hinged doors for access or egress shall be removed, sliding doors locked back, and adequate handholds shall be provided when workers are emplaning or deplaning onto or from elevated structures.

(g) Safe access and egress routes shall be available and used by the workers.

(h) Workers shall be safely positioned before the helicopter touches down, lands, or lifts off.
1. This regulation may be cited as the "British Columbia Balsam Woolly Aphid Regulation, 1976".

2. (1) Anyone wishing to grow Abies spp. in British Columbia must obtain an annual permit from the B.C. Ministry of Agriculture and Food.
   (2) Anyone who is granted a permit under subsection (1) to grow Abies spp. must treat such trees for balsam woolly aphid control in a manner specified by the Minister of Agriculture and Food.
   (3) All trees of Abies spp. offered for sale or moved from the nursery must bear a B.C. Ministry of Agriculture and Food tag showing that they have been grown under permit.

3. Abies spp. originating within the infested zone are prohibited movement to areas in British Columbia outside the infested zone.

4. The infested zone is described by B.C. Forest Service Ranger District boundaries and includes the following portions of the Vancouver Forest District:
   RD 1 - Cultus Lake,
   RD 3 - Harrison Lake,
   RD 4 - Mission,
   RD 5 - Port Moody,
   RD 6 - Squamish,
   RD 7 - Sechelt,
   RD 8 - Pender Harbour,
   RD 9 - Powell River,
   RD 19 - Parksville, that portion south of a line between Parksville and Port Alberni,
   RD 21 - Duncan,
   RD 23 - Langford,
   RD 24 - Lake Cowichan,
   RD 25 - Port Alberni, that portion southeast of Alberni Inlet.

5. Sale and movement of cut trees or foliage of Abies spp. is prohibited between January 31 and November 1 anywhere in British Columbia.

6. The sale and movement of cones and seeds of Abies spp. is permitted anywhere in British Columbia.

7. Retail outlets offering Abies spp. for sale which are found by an inspector to have infested trees shall immediately treat the trees in a manner specified by an inspector or the inspector may order the destruction of the infested trees.

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8. Inspectors appointed under the Provincial Plant Protection Act and the Federal Plant Quarantine Act are empowered to enforce the provisions of this regulation.

9. Where an inspector is of the opinion that this regulation or the intent of this regulation is being contravened,
   (a) he may serve upon that person who is responsible for such contravention a written notice of the contravention ordering that person to do such things as the inspector may order for the purpose of preventing any similar or further such contravention,
   (b) every person who neglects or refuses to comply with the order of an inspector contained in a notice under paragraph (a) is guilty of an offence, and
   (c) where an inspector takes any action under paragraph (a) he shall, forthwith after the action is taken, give to the Head, Entomology Branch, a report of his actions.

10. Every person who contravenes any of the provisions of this regulation is guilty of an offence and is liable, on summary conviction, to a fine not exceeding $100 or to imprisonment for a term not exceeding 6 months, or to both fine and imprisonment and, in addition, the stock may be destroyed.

[Provisions of the Plant Protection Act relevant to the enactment of this regulation: section 3]