# Plant Propagation Protocol for *[Abies lasiocarpa]*

ESRM 412 – Native Plant Production

| TAXONOMY | |
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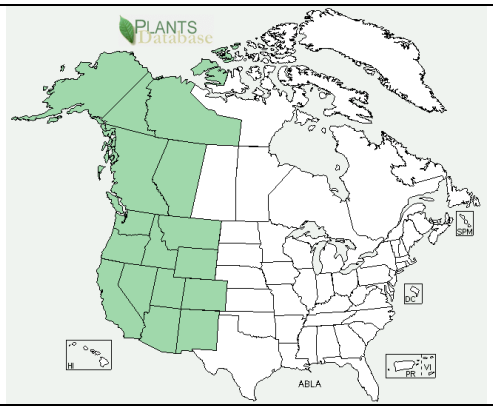
| Family Names | |
| Family Scientific Name: | Pinaceae |
| Family Common Name: | Pine Family |
| Scientific Names | |
| Genus: | *Abies* |
| Species: | *lasiocarpa* |
| Species Authority: | |
| Variety: | |
| Sub-species: | |
| Cultivar: | |
| Authority for Variety/Sub-species: | |
| Common Synonym(s) | *Abies bifolia* |
| Common Name(s): | Subalpine fir, alpine fir, balsam fir, white fir, mountain balsam fir, white balsam, western balsam fir, Rocky Mountain fir; pino real blanco de las sierras [Spanish] (Gymnosperm Database) |
| Species Code (as per USDA Plants database): | ABLA |
| **GENERAL INFORMATION** | |
| Geographical range |  |

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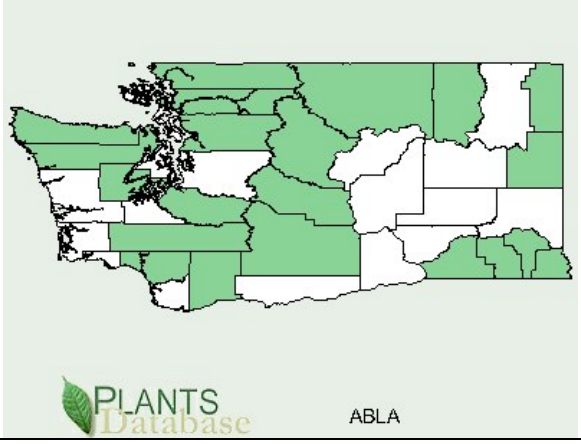
| |  |
| Ecological distribution | *A. lasiocarpa* is the mostly widely distributed fir in North America, spanning more than 32 degrees of latitude. It occurs chiefly in mountainous areas from the Yukon interior near tree line and along the coast of southeastern Alaska south through western Alberta and British<br>Columbia to southern Colorado and scattered mountain ranges of Arizona and New Mexico. In the western portion of its range, subalpine fir does not occur along the western slope of the Coast Range in southern British Columbia or along the Coast Ranges of Washington and<br>Oregon but does occur on Vancouver Island and in the Olympic Mountains of Washington. It occurs on both slopes of the Cascade Mountains as far south as southern Oregon (US Forest Service). |
| Climate and elevation range | *A. lasiocarpa* is restricted to cold, humid habitats because of low tolerance to high temperatures. Cool summers, cold winters, and deep winter snow packs are more important than total precipitation in differentiating where subalpine fir grows in relation to other species. Subalpine fir grows in subalpine coniferous forests, 600-3600 meters, up to timberline, often associated with Douglas fir, Engelmann spruce, and blue spruce (USDA Plant Database). Beginning at about 3500ft until you reach tree line, where soon before tree line, its growth will be stunted (Pojar). |
| Local habitat and abundance; may include commonly associated species | *A. lasiocarpa* generally occupies cold, high elevation mountain forests and is commonly associated with Douglas Fir, Western White Pine, Spruce, Hemlock, Larch and Lodgepole pine and others (US Forest Service). |
| Plant strategy type / successional stage | *A. lasiocarpa* occurs as either a climax co-dominant or as a persistent, long-lived species in most subalpine fir habitat types (US Forest Service). |
| Plant characteristics | *A. lasiocarpa* is a tree that can reach 20 meters in height; trunk to 0.8 meters in diameter. It has gray bark that is thin, smooth and furrows in age. Branches are stiff and straight. Bark splitting as early as 2 years to reveal red-brown layer (Flora of North America). |
| **PROPAGATION DETAILS** | |
| Ecotype | |
| Propagation Goal | Plants |
| Propagation Method | Seed |
| Product Type | Container (plug) |

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| Stock Type: | 172 ml containers |
| Time to Grow | 2 years. *A. lasiocarpa* grows very slowly and can take up to 40 years to reach a height of 5 feet. |
| Target Specifications | Height: 3.5 cm.<br>Caliper: 5 mm.<br>Root System: Firm plug in container. |
| Propagule Collection | *A. lasiocarpa* may begin to produce cones when 20 years old and 4 to 5 feet tall. Maximum seed production is by dominant trees between 150 and 200 years old. Yearly seed production erratic. Good seed crops are produced every 3 to 5 years with light crops or failures in between. (US Forest Service).<br>Cones are hand collected in early to mid September using cone-picking poles when cones turn purple and begin to dehisce. Seed fill rates are usually low with this genus. Thus, large quantities of cones must be collected and carefully screened to obtain adequate amount of filled seeds (Luna). |
| Propagule Processing/Propagule Characteristics | *A. lasiocarpa* averages 34,800 seeds per pound. (Forest service species information).<br>Seeds exhibit physiological dormancy (Baskin)<br>Fir seeds undergo 2 stages of ripening. The first involves movement of materials from the cone scale to the seed. The second involves after-ripening of the seeds. For this reason, seeds must not be extracted from the cones immediately after collection. Cones are kept in burlap bags for several weeks in a well-ventilated drying shed prior to cleaning. During storage, burlap sacks of cones must be inspected and turned once per week to facilitate evening curing and drying.<br>Once cones have cured, disintegrated cones can be tumbled or passed over screens to separate seeds from cone scales. Abies seeds are fragile and can be easily damaged during de-winging. Small lots can be gently de-winged by hand. Seed longevity is up to 5 years at 0C in sealed containers (Luna). |
| Pre-Planting Propagule Treatments | Moist stratification is required for germination (US Forest Service). Seeds are placed in cold moist stratification for 28 days, more if seed sources are collected near tree line. Germination occurs at 30D/20N C alternating temperature cycle.<br>Germination was greater in dark than light (Baskin). |
| Growing Area Preparation / Annual Practices for Perennial Crops | Greenhouse for the first year then moved to an outdoor nursery growing facility (Luna). Seedlings establish best on mineral soil seedbeds but will also establish on other surfaces including litter, duff, and decaying wood (US Forest Service). |
| Establishment Phase | Germination is very non-uniform and continues over a 30-day period. Germination to true leaf stage is 3 weeks. Seedlings are thinned and transplanted at this stage (Luna). |
| Length of Establishment Phase: | 4 weeks |
| Active Growth Phase | Plants are fertilized with Conifer Starter 7-40-17 liquid NPK at half the recommended rate for 2 months. Seedlings are very non-uniform in rate of |

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| | development before bud set. The average seedling height of 3 seed lots collected at the upper limits of tree line was 1.5 cm at the end of the first growing season (Luna). |
| Length of Active Growth Phase: | 20 weeks |
| Hardening Phase | Plants are fertilized with 10-20-20 liquid NPK at 200 ppm in early fall; pots are leached with water; irrigation is gradually reduced through September and October (Luna). |
| Length of Hardening Phase: | 4 Weeks |
| Harvesting, Storage and Shipping | Total Time To Harvest: 2 years<br>Harvest Date: Fall of the 2nd year.<br>Storage Conditions: Overwinter in outdoor nursery under insulating foam cover and snow (Luna). |
| Length of Storage | 5 months |
| Guidelines for Outplanting / Performance on Typical Sites | In the Cascades, the European balsam woolly adelgid has caused significant mortality to *A. lasiocarpa*, virtually eliminating it from some stands in Oregon and southern Washington. Windthrow is a common problem in subalpine fir, presumably because of its relatively shallow root system. Pruning should be kept to a minimum, for when older branches are removed, new growth seldom develops and, consequently, the trees become ragged and unkempt (USDA Plant Database). |
| Other Comments | |
| **INFORMATION SOURCES** | |
| References | "Abies Lasiocarpa (Hooker) Nuttall, N. Amer. Sylv. 3: 138. 1849." *EFloras.org*. Flora of North America. Web. 20 Apr. 2011. <http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=233500008>.<br><br>"Abies Lasiocarpa (subalpine Fir) Description." *The Gymnosperm Database: Home Page*. Web. 20 Apr. 2011. <http://www.conifers.org/pi/Abies_lasiocarpa.php>.<br><br>"Abies Lasiocarpa." *US Forest Service - Caring for the Land and Serving People.* Web. 20 Apr. 2011. <http://www.fs.fed.us/database/feis/plants/tree/abilas/all.html>.<br><br>"Abies Lasiocarpa." *USDA Plants Database*. United States Department of Agriculture Natural Resource Conservation Service. Web. 20 Apr. 2011. <http://plants.usda.gov/java/profile?symbol=ABLA>.<br><br>Baskin, Carol C.; Baskin, Jerry M. 2002. Propagation protocol for production of container *Abies lasiocarpa* (Hooker) Nuttall plants; University of Kentucky, Lexington, Kentucky. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 20 April 2011). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery. |

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| | Luna, Tara; Hosokawa, Joy.; Evans, Jeff.; Wick, Dale. 2008. Propagation protocol for production of container *Abies bifolia* A. Murray plants (172 ml containers); USDI NPS - Glacier National Park, West Glacier, Montana. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 20 April 2011). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.<br><br>Pojar, Jim, A. MacKinnon, and Paul B. Alaback. *Plants of the Pacific Northwest Coast: Washington, Oregon, British Columbia & Alaska*. Redmond, WA: Lone Pine Pub., 1994. Print.<br><br>"Subalpine Fir." *Northeastern Area State & Private Forestry - USDA Forest Service*. Web. 20 Apr. 2011. <http://www.na.fs.fed.us/spfo/pubs/silvics_manual/Volume_1/abies/lasiocarpa.htm>. |
| Other Sources Consulted | "Abies Lasiocarpa - Subalpine Fir Interactive Native Range Distribution Map with USDA Hardiness Zones." *Plant Maps - Plant,Tree,Gardening, Climate and Hardiness Zone Maps*. Web. 18 Apr. 2011. <http://www.plantmaps.com/nrm/abies-lasiocarpa-subalpine-fir-native-range-map.php>.<br><br>"Abies Lasiocarpa." *Wikipedia, the Free Encyclopedia*. Web. 18 Apr. 2011. <http://en.wikipedia.org/wiki/Abies_lasiocarpa>.<br><br>Evans, Erv. "Trees: Abies Lasiocarpa." *NC State Urban Horticulture*. NC State University. Web. 19 Apr. 2011. <http://www.ces.ncsu.edu/depts/hort/consumer/factsheets/trees-new/abies_lasiocarpa.html>. |
| Protocol Author | Austin Dickson |
| Date Protocol Updated | 04/20/11 |

Note: This template was modified by J.D. Bakker from that available at:
http://www.nativeplantnetwork.org/network/SampleBlankForm.asp

Original Protocol:

## Range

Coast ranges of SE Alaska, the Cascades of Oregon and Washington, and California (6). In Canada, mostly in the South Yukon and the coast Range of British Columbia (2). Found towards the "east to central Idaho, Montana, and south to New Mexico and Arizona" (5)

Range photo courtesy of Michael Kuo at MushroomExpert.com:
http://www.bluewillowpages.com/mushroomexpert/trees/abies_lasiocarpa.html

## Climate, Elevation

Beginning at about 3500 ft until you reach treeline, where soon before treeline, its growth will be stunted. Will tolerate moist or dry sites. Shade tolerant, but grows in full sun (6).

Local occurrence (where, how common)
"Associated with glacial refugia on dry sites, especially limestone" north of the Olympics on the outer coast. Some small, isolated populations occur in dry sites in the eastern Olympics (6). Found on both slopes of the Cascades as far as southern Oregon (8).

Habitat preferences

Prefers cool, moist sites (7). Needs sun and well drained soil (4), but is known to be shade tolerant (9). Not exacting in its soil preferences (3). Found in floodplain valley-bottom forests and at higher elevations in such cold air drainages (6).

Plant strategy type/successional stage (stress-tolerator, competitor, weedy/colonizer, seral, late successional)

Stress tolerator, and in southeast Alaska, early post-glacial colonizer (6). Long-lived seral species in most habitat types (8).

Associated species

Engelmann spruce; lodgepole, whitebark, limber, or bristlecone pines; alpine larch; cork fir; aspen (7). White spruce; white spruce – paper birch; mountain hemlock; interior douglas fir; western larch; grand fir; western white pine; blue spruce; sitka spruce; western hemlock; coastal true fir-hemlock; alaska cedar; pacific silver fir; western red-cedar (3).

May be collected as: (seed, layered, divisions, etc.)

Seeds (cones) (5). Though the tree propagates itself through layering (6), it is not recommended to obtain cuttings (9).

Collection restrictions or guidelines

Collect early through mid September. Seed is fragile and can be easily damaged during de-winging (5).

Seed germination (needs dormancy breaking?)

30 to 60 day naked cold moist stratification (physiological dormancy) (5). Germination often poor (1). Collect lots of seeds.

Seed life (can be stored, short shelf-life, long shelf-life)

Seed longevity is up to 5 years in sealed containers (5).

Recommended seed storage conditions

Overwinter in outdoor nursery under insulating foam cover and snow (5).

Propagation recommendations (plant seeds, vegetative parts, cuttings, etc.)

Bare root, container, seed (9)
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Soil or medium requirements (inoculum necessary?)

No inoculum necessary, but may benefit growth(5). 70% 6:1:1 sphagnum peat, perlite, and vermiculite, and 30% sand (5). Grows well in clay soil (1). Minimum pH =4, maximum pH = 6.50 (9).

Installation form (form, potential for successful outcomes, cost)

Container plants grown from seeds, bare-root, seeds (9). If you don't have sufficient seeds, grow at least first winter in pots. "Plant in permanent positions in late spring or early summer, after last expected frosts" (1).

Recommended planting density

Minimum planting density: 300/acre; Maximum planting density: 1200/acre (9). (Equivalent to 1 tree per 37-146 $ft^2$). "One report says that it is best to grow the seedlings on in the shade at a density of about 550 trees per square metre, [Equivalent to 51 plants per $ft^2$] whilst another report says that they are best grown on in a sunny position" (1).

Care requirements after installed (water weekly, water once etc.)

Soil must be well-drained, do not over water (1). Medium moisture use (9).

Normal rate of growth or spread; lifespan

At timberline, reduced to shrub. Annual height growth for first 10-15 years at high elevations is commonly 2.5 cm. At lower elevations, 8.1-11.4 cm (3). Normal for trees to reach over 250 years old. Due to heartrot, however, many trees die early (3).

Sources cited

(1) "Abies lasiocarpa." GardenBed.com. Plants for a Future. 30 March 2005 <http://gardenbed.com/1/15_pro.asp>.

(2) “Abies lasiocarpa”. The Gymnosperm database home page. Ed. Earle, Christopher J. 25 March, 2004. 29 March, 2005. <http://www.conifers.org/pi/ab/lasiocarpa.htm>

(3) Burns, Russell M., and Barbara H. Honkala, tech. coords. 1990. Silvics of North America: Vol 1. Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC. 30 March, 2005. <http://www.na.fs.fed.us/spfo/pubs/silvics_manual/Volume_1/abies/lasiocarpa.htm>

(4) Evans, Erv. 2003. Abies lasiocarpa. Tree Index at NC

State University. 30 March, 2005. <http://www.ces.ncsu.edu/depts/hort/consumer/factsheets/trees-new/abies_lasiocarpa.html>.

(5) Luna, Tara; Hosokawa, Joy; Evans, Jeff; Wick, Dale. 2001. Propagation protocol for production of container Abies bifolia A. Murray plants (172 ml containers); Glacier National Park, West Glacier, Montana. Native Plant Network. 31 March, 2005. <http://www.nativeplantnetwork.org>. Moscow, ID: University of Idaho, College of Natural Resources, Forest Research Nursery.

(6) Pojar, J., & MacKinnon, A. (1994). Plants of the Pacific Northwest. Vancouver, BC: Lone Pine Publishing.

(7) Preston, Jr., R. (1989). North American Trees. 4th ed. Ames, IA: Iowa State University Press.

(8) Uchytil, Ronald J. 1991. Abies lasiocarpa. Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service. Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). 31 March, 2005. <http://www.fs.fed.us/database/feis/plants/tree/abilas>

(9) USDA, Natural Resource Conservation Service. 2004. Abies Lasiocarpa. The PLANTS Database, Version 3.5. 30 March, 2005. <http://plants.usda.gov/cgi_bin/plant_attribute.cgi?symbol=ABLA>

Data compiled by (student name and date)

Ivona Kaczynski, April 2005