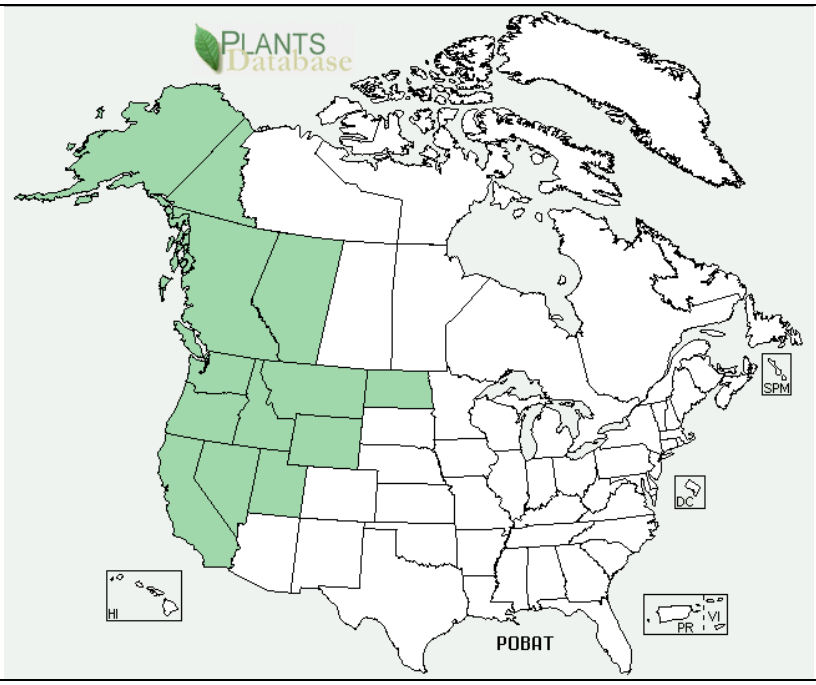
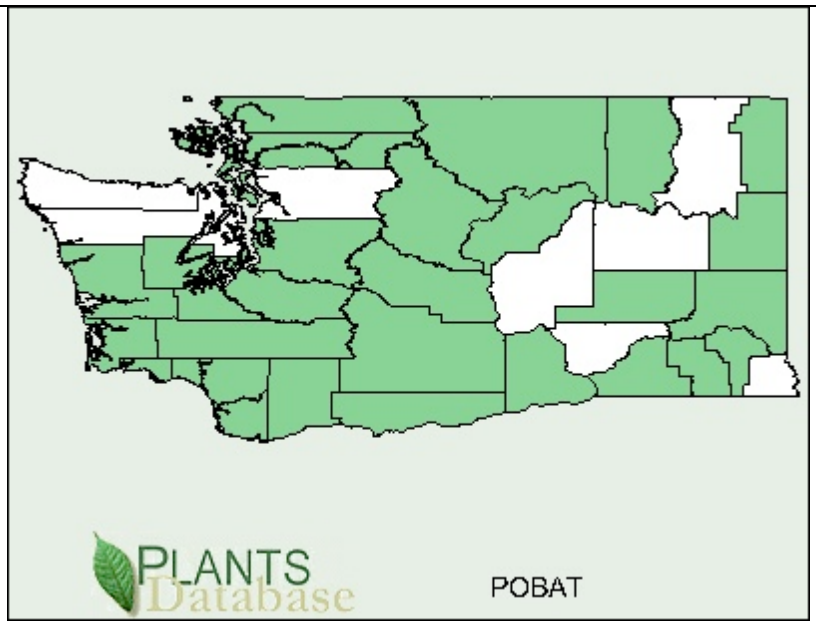
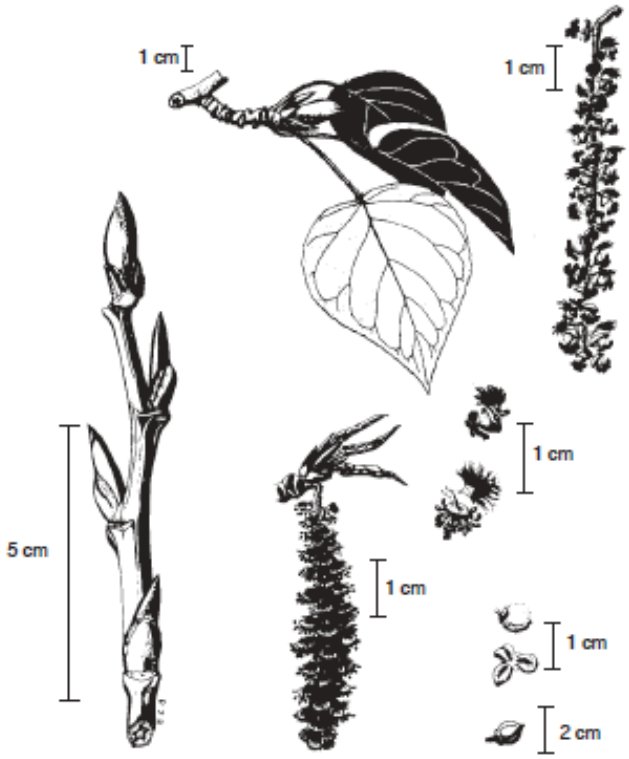
Plant Propagation Protocol for *Populus balsamifera* spp. *Trichocarpa* (Black Cottonwood)
ESRM 412 – Native Plant Production

Photo from source 2

TAXONOMY		
Family Names		
Family Scientific Name:	*Salicaceae* (1)	
Family Common Name:	Willow family (1, 2)	
Scientific Names		
Genus:	*Populus* (1)	
Species:	*balsamifera* (1)	
Species Authority:	L. (3)	
Variety:		
Sub-species:	*trichocarpa* (1)	
Cultivar:		
Authority for Variety/Sub-species:	Torr. and Gray (1)	
Common Synonym(s) (include full scientific names	POBAC3 POHA15 POTR15 POTRH	*Populus balsamifera* L. var. *californica* S. Watson *Populus hastata* Dode p.p. *Populus trichocarpa* Torr. & A. Gray ex Hook. *Populus trichocarpa* Torr. & A. Gray ex Hook. ssp. *hastata* (Dode)

(e.g., *Elymus glaucus* Buckley), including variety or subspecies information)	Dode p.p. POTRC *Populus trichocarpa* Torr. & A. Gray ex Hook. var. *cupulata* S. Watson POTRH2 *Populus trichocarpa* Torr. & A. Gray ex Hook. var. *hastata* (Dode) A. Henry p.p. POTRI *Populus trichocarpa* Torr. & A. Gray ex Hook. var. *ingrata* (Jeps.) Jeps. (1)
Common Name(s):	Black cottonwood, balsam cottonwood, western balsam cottonwood California poplar (1, 4, 5)
Species Code (as per USDA Plants database):	POBAT (1)
GENERAL INFORMATION	
Geographical range (distribution maps for North America and Washington state)	

	 Black cottonwood is found in the United States (AK, CA, ID, MT, ND, NV, OR, UT, WA, WY) and Canada (AB, BC, YT) (1).
Ecological distribution (ecosystems it occurs in, etc):	Black cottonwood grows where there are moist silts, sands, and gravels (4). Black cottonwood prefers habitats that are in the humid coastal forests in the Pacific Northwest (5, 6).
Climate and elevation range	The information below comes from source 5. Black cottonwood can grow in relatively humid to very humid climates in areas that have rainfall that ranges between 10 and 120 in annually. The maximum temperature at which black cottonwood grows is 117 degrees F, while the minimum temperature it grows at is -53 degrees F. Both of these temperatures are extremes, however, and the more likely range in temperatures is 32 to 60 degrees F. Black cottonwood grows from sea level to 7,000 feet in elevation (5, 6).
Local habitat and abundance; may include commonly associated species	In British Columbia, black cottonwood is known to grow in soils that are abundant in moisture, nutrients, oxygen, and neutral in pH (5). Black cottonwood grows best on deep, moist alluvial soils in areas that are high in rainfall (5, 7). In both central and eastern Washington, which is relatively dry, black cottonwood can only grow in valleys and canyon bottoms, along stream backs, along edges of ponds, and on moist slopes (5).
Plant strategy type / successional stage (stress-tolerator, competitor, weedy/colonizer, seral, late successional)	Black cottonwood is a part of early successional forests and can be grow in pure stands on alluvial soils; it is very shared intolerant (5, 10).
Plant characteristics (life form (shrub, grass, forb),	Black cottonwood is a tree. It matures at 60 years, but lives up to 200 years (5). The national record for the largest black cottonwood tree was found in Haines, Alaska; the tree was 101 ft (31 m) tall and 32.5 ft (9.9 m) in circumference (8).

longevity, key characteristics, etc)	But, black cottonwood is usually 30 to 60 m tall (1). The tree is straight, has not branches for half its lifespan, and has gray or brown-gray furrowed bark (1). The tree reaches flowering age at 10 years, and flowers appear in March to May after about 10 years of growth (5). After 20 years of growth, black cottonwood is usually 40 feet tall and has a diameter at breast height of 7 to 8 inches (1, 5). When mature, the tree is usually about 100 feet (1). Black cottonwood is shade intolerant (5). Black cottonwood also has good self-pruning (10). The morphology of black cottonwood's leaves, twigs, catkins, and capsules are shown below (10). 
PROPAGATION DETAILS	
Ecotype (this is meant primarily for experimentally derived protocols, and is a description of where the seed that was tested came from):	Possible ecotypes include the aforementioned regions, elevations, and climates where black cottonwood is known to propagate and grow.
Propagation Goal (Options: Plants, Cuttings, Seeds, Bulbs, Somatic Embryos, and/or Other Propagules):	Black cottonwood grows from a seed or cutting; it grows into a tree (1).
Propagation Method	Black cottonwood propagates both by seed and through vegetative means (1, 5,

(Options: Seed or Vegetative):	10). Seeds require moist mineral seedbeds, while black cottonwood reproduced vegetatively by sprouting from its stumps, from buried branch fragments, and sometimes from root suckers (10).
Product Type (options: Container (plug), Bareroot (field grown), Plug + (container-field grown hybrids, and/or Propagules (seeds, cuttings, poles, etc.))	Black cottonwood may be propagated from a container, bare root, cutting, or seed (1).
Stock Type:	According to the British Columbia Ministry of Forest and Range, "[Black cottonwood] stock type selection is influenced by the combined consideration of management regime and limiting factors. Unrooted cuttings are a common stock type for intensive poplar farming. Cuttings are typically 40 to 50 cm in length, planted up to 30 cm deep. Genetically superior hybrids play an important role in poplar farming" (9). Additionally, black cottonwood may successfully grow from a seed or cutting stock grown in styroblock containers (9).
Time to Grow (from seeding until plants are ready to be outplanted):	Seeds should be sown after ripened, and placed into permanent positions the next growing season; in essence, this takes about one year for the plants to be ready to be outplanted (11).
Target Specifications (size or characteristics of target plants to be produced):	Seedlings should be 20 to 45 cm long and one to three cm in diameter (11).
Propagule Collection (how, when, etc):	Seeds can be collected late May to early July after a plant is 10 years of age (10).
Propagule Processing/Propagule Characteristics (including seed density (# per pound), seed longevity, etc):	Seeds remain viable for one to three years if placed in -10 degree C in an airtight container (10). Seed density was not reported by the USDA or found in other sources (1).
Pre-Planting Propagule Treatments (cleaning, dormancy treatments, etc):	Seeds should be collected as capsules begin to open; if they are not open, place the seeds in a paper bag and allow them to open in a warm area (2, 11).
Growing Area Preparation /	Put live stakes 3.5 cm in diameter and 1.2 m in length into the ground where each seedling is growing (2). Containers should be in containers that are either

Annual Practices for Perennial Crops (growing media, type and size of containers, etc):	styroblock or otherwise sturdy and that are at least 6 in in depth, 23 inches in length, and 14 inches in width (9). Plants grow best in mineral rich, moist soils in moderate/temperate temperatures (5).
Establishment Phase (from seeding to germination):	The USDA recommends the following: "They need to be sown within a few days of ripening; otherwise they may be kept viable for up to a year by drying and storing cold in an air-tight container. In a cold frame, sow on the surface or lightly cover the seeds. Plant into permanent positions either in late summer or the following spring, depending on growth of the young plants" (1).
Length of Establishment Phase:	Black cottonwood seeds germinate in 8 to 24 hours (12).
Active Growth Phase (from germination until plants are no longer actively growing):	The active growth period of black cottonwood takes place in the spring and summer of each year (1).
Length of Active Growth Phase:	The length of the active growth phase occurs within about 6 months (spring and summer) of each year (1).
Hardening Phase (from end of active growth phase to end of growing season; primarily related to the development of cold-hardiness and preparation for winter):	The hardening phase of black cottonwood occurs in the fall and winter when the temperatures drop and the active growth phase ends (5).
Length of Hardening Phase:	The hardening phase lasts the duration of fall and winter (5).
Harvesting, Storage and Shipping (of seedlings):	Plants may be harvested and placed into permanent positions in the late summer or the following spring after germination (three to 12 months) (1). They should be stored in the nursery in an area with full sunlight and a temperature of about 60 to 70 degrees F (5). Accordingly, seedlings should be shipped in an environment that complies with these requirements.
Length of Storage (of seedlings, between nursery and outplanting):	Seedlings should be stored for at least three months before planting (1).
Guidelines for Outplanting / Performance on Typical Sites (eg, percent survival,	Black cottonwood should be planted in the late summer or following spring after germination (1). It grows to 40 ft by 20 years, and eventually reaches 100 ft at maturation (at about 60 years) (1, 5, 10). Its diameter ranges from 11 to 18 inches (5). It takes 10 years before the black cottonwood flowers (1, 5).

height or diameter growth, elapsed time before flowering):	
Other Comments (including collection restrictions or guidelines, if available):	
INFORMATION SOURCES	
References (full citations):	1. "Plant Profile: Sitka Spruce." USDA: Natural Resources Conservation Services on-line. http://plants.usda.gov/java/nameSearch. April 12, 2009. 2. Pojar, Jim and Andy MacKinnon. *Plants of the Pacific Northwest Coast: Washington, Oregon, British Columbia & Alaska*. Vancouver: Lone Line, 1994. 3. "General Element Report: *Populus balsamifera*." Ministry of Natural Resources [Canada] on-line. April 27, 2009. http://nhic.mnr.gov.on.ca/MNR/nhic/elements/el_report.cfm?elid=41002. 4. "*Populus trichocarpa*: black cottonwood." About Forestry on-line. April 27, 2009. http://forestry.about.com/library/tree/blbcot.htm. 5. DeBell, Dean S. "Black Cottonwood." USDA Forest Service on-line. April 27, 2009. http://www.na.fs.fed.us/spfo/pubs/silvics_manual/volume_2/populus/trichocarpa.htm. 6. Roe, Arthur L. 1958. Silvics of black cottonwood. USDA Forest Service, Miscellaneous Publication 17. Intermountain Forest and Range Experiment Station, Ogden, UT. 18 p. 7. Smith, J. H. G. 1957. Some factors indicative of site quality for black cottonwood (Populus *trichocarpa* Torn and Gray). Journal of Forestry 55 (8):578-580. 8. Ewing, Susan. The Great Alaska Nature Factbook. Portland: Alaska Northwest Books, 1996. 9. "Black Cottonwood." Ministry of Forests and Range [Canada] on-line. April 27, 2009. http://www.for.gov.bc.ca/hfp/publications/00078/hardwood.htm. 10. E.B. Peterson, N.M. Peterson, and D.S. McLennan. Black Cottonwood and Balsam Poplar Managers' Handbook for British Columbia. B.C. Ministry

	of Forests Research Branch: Victoria, 1996. (Available in hard copy or at http://www.for.gov.bc.ca/hfd/pubs/docs/Frr/Frr250.pdf). 11. "Black Cottonwood Plant Tree Guide." Garden Guide on-line. April 27, 2009. http://www.gardenguides.com/plants/plantguides/trees/plantguide.asp?symbol=POBAT. 12. "Improving Crop Protection Technology for Horticulture Crops. United States Department of Agriculture on-line. April 27, 2009. http://www.ars.usda.gov/research/publications/publications.htm?seq_no_115=216612
Other Sources Consulted (but that contained no pertinent information) (full citations):	1. Tuskan GA, et al. The Genome of Black Cottonwood, Populus trichocarpa. *Science* 15 September 2006: Vol. 313. no. 5793, pp. 1596 – 1604. 2. Howe GT, Hackett WP, Furnier GR, Klevorn RE. Photoperiodic responses of a northern and southern ecotype of black cottonwood. *Physiologia Plantarum*. 28 April 2006. Volume 93 Issue 4, pp. 695 – 708.
Protocol Author (First and last name):	Andrew Lurker
Date Protocol Created or Updated (MM/DD/YY):	April 27, 2009

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

Appendix: Previous ESRM 412 Plant Protocol for Black Cottonwood (Zhang 2003)

Black cottonwood, *Populus trichocarpa*

Range

Figure: native range of black cottonwood Figure From: (1)
The range of black cottonwood extends northeast from Kodiak Island along Cook Inlet to latitude 62° 30° N., then southeast in southeast Alaska and British Columbia to the forested areas of Washington and Oregon, to the mountains in southern California and northern Baja California

(lat. 31° N.). It is also found inland, generally on the west side of the Rocky Mountains, in British Columbia, western Alberta, western Montana, and northern Idaho. Scattered small populations have been noted in southeastern Alberta, eastern Montana, western North Dakota, western Wyoming, Utah, and Nevada.(1)

Climate, Elevation
Populations of black cottonwood grow in climates varying from relatively and to humid, but best growth is attained in the humid coastal forests of the Pacific Northwest (23). Annual precipitation ranges from 250 min (10 in) to more than 3050 min (120 in). Only about one-third of the annual precipitation occurs during the growing season, and in mountainous and inland areas much of the dormant-season precipitation falls as snow. The frost-free period ranges from about 70 days in the interior areas to more than 260 days in southern California. Maximum temperatures range from 16° to 47° C (60° to 117° F); minimum temperatures, from 0° to –47° C (32° to –53° F). (1) Elevation ranges from Sea level to 2,700m. (2)

Local occurrence (where, how common)
Black cottonwood often forms extensive stands on alluvial sites at low elevations along the Pacific coast. (1)

Habitat preferences
The growth of black cottonwood is best at low elevations on deep, moist alluvial soils. (1)

Plant strategy type/successional stage (stress-tolerator, competitor, weedy/colonizer, seral, late successional)
Very intolerant to shade.

Associated species
Overstory: red alder *(Alnus rubra),* Douglas-fir *(Pseudotsuga menziesii),* western hemlock *(Tsuga heterophylla),* western redcedar *(Thuja plicata),* Sitka spruce *(Picea sitchensis),* grand fir *(Abies grandis),* bigleaf maple *(Acer macrophyllum),* Oregon ash *(Fraxinus latifolia),* black hawthorn *(Crataegus douglasii),* and several birch *(Betula* spp.) and cherry *(Prunus* spp.), western white pine *(Pinus monticola),* ponderosa pine *(P. ponderosa),* white fir *(Abies concolor),* western larch *(Larix occidentalis),* subalpine fir *(A. lasiocarpa),* white spruce *(Picea glauca),* Engelmann spruce *(P. engelmannii),* and quaking aspen *(Populus tremuloides).*
Shrub: Vine maple *(Acer circinatum),* red-osier dogwood *(Cornus stolonifera)* and other *Cornus* spp., beaked hazel *(Corylus cornuta),* Nootka rose *(Rosa nutkana),* thimbleberry *(Rubus parviflorus),* salmonberry *(R. spectabilis),* elder *(Sambucus* spp.), bearberry honeysuckle *(Lonicera involucrata),* spirea *(Spiraea* spp.), and common snowberry *(Symphoricarpos albus).*
Herbaceous: swordfern *(Polystichum munitum),* lady fern *(Athyrium filix-femina),* horsetail *(Equisetum* spp.), stinging nettle *(Urtica dioica),* hedge nettle *(Stachys* spp.), false solomons-seal *(Smilacina stellata),* Canada violet *(Viola canadensis),* jewelweed *(Impatiens* spp.), enchanters nightshade *(Circaea alpina),* golden-saxifrage *(Chrysosplenium* spp.), buttercup *(Ranunculus spp.),* bittercress *(Cardamine* spp.), angelica *(Angelica* spp.), loosestrife *(Lysimachia spp.),* bedstraw *(Galium* spp.), and iris *(Iris spp.).* (1)

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

Seed. Or stem cutting.

Collection restrictions or guidelines
Seed mature from late May to mid-July. A good time to collect is when a small number of the capsules are beginning to open.(2)

Seed germination (needs dormancy breaking?)
Seed germination may happen very rapidly after ripen.

Seed life (can be stored, short shelf-life, long shelf-life)
Longevity of black cottonwood seed under natural conditions may be as short as 2 weeks to a month. But with proper drying and cold storage, viability and capacity to germinate can be maintained for at least 1 year.(1)

Recommended seed storage conditions
Air dry for four days at a 5-8% moisture content and then store at 5 °C (Schreiner 1974).

Propagation recommendations (plant seeds, vegetative parts, cuttings, etc.)
Can reproduce sexually or asexually. By seeds or stem cuttings.

Soil or medium requirements (inoculum necessary?)
Moist seedbeds are essential for high germination , and seedling survival depends on continuously favorable conditions during the first month .

Installation form (form, potential for successful outcomes, cost)
Seeds, stem cuttings.

Recommended planting density
1.8 by 1.8 in (6 by 6 ft).

Care requirements after installed (water weekly, water once, never water, etc.)
Require moist soil bed.

Normal rate of growth or spread; lifespan
17 cm (6.7 in) in d.b.h. and 14.8 m (48.5 ft) in height at 9 years, normally with 35-75 years growth remaining. Typical lifespan is about 80-120 years. (3) Max. 200 years. (1)

Sources cited

(1) Burns, R.M. and B.H. Honkala. 1990. Silvics of North America, Vol. 2, Hardwood. Washington DC: U.S.D.A. Forest Service Agriculture Handbook 654. http://www.na.fs.fed.us/spfo/pubs/silvics_manual/table_of_contents.htm)

(2) Rose, R., C. Chachulski and D. Haase. 1996. Propagation of Pacific Northwest Native Plants: A Manual, Volume Two, First Edition. Nursery Technology Cooperative, Oregon State

University, Corvallis, Oregon. 211p.

(3) http://southcove.net/cottonwoods/nwwoodlandsreport.htm

Data compiled by: Yongjiang Zhang, 21 April 2003