Plant Propagation Protocol for *Taxus brevifolia TABR2*
ESRM 412 – Native Plant Production

TAXONOMY	
Family Names	
Family Scientific Name:	Taxaceae
Family Common Name:	yew
Scientific Names	
Genus:	*Taxus*
Species:	*brevifolia*
Species Authority:	
Variety:	
Sub-species:	
Cultivar:	
Authority for Variety/Sub-species:	
Common Synonym(s) (include full scientific names (e.g., *Elymus glaucus* Buckley), including variety or subspecies information)	
Common Name(s):	Western yew, Pacific yew, Canadian yew
Species Code (as per USDA Plants database):	TABR2
GENERAL INFORMATION	
Geographical range (distribution maps for North America and Washington state)	northern Vancouver Island, within a few kilometers of shoreline in Alaska and northern British Columbia (B.C.) (1). Range from the southern tip of southeast Alaska- including Annette and Prince of Wales Island- south through the Pacific Coast region of British Columbia, Vancouver and the Queen Charlotte Islands, and the Olympic Peninsula of Washington. It is rare in the Coast Range south of the Olympic Peninsula in Washington and north of the Umpqua River in Oregon, but occurs with greater frequency in the Coast Range in southern Oregon and northern California. Isolated occurrences are found as far south as Marin and San Mateo Counties in California. Yew occurs in scattered localities in the valleys between the Coast Range and Cascade Ranges of Oregon and Washington. On some sites in southern Oregon it is abundant. Pacific yew extends south through the Klamath Mountains of California, then southeasterly to the western slopes of the Sierra Nevada. Its southern limit is in Calaveras County. Farther inland,

	it grows on the western slopes of the Rocky Mountains in British Columbia, south into northern Idaho and western Montana, the Lewis Range in Montana, and isolated areas in eastern Washington and northeastern Oregon. In the South Fork of the Clearwater River basin in Idaho, Pacific yew deviates from its role as a minor forest component and becomes a dominant on about 16 000 hectares (40,000 acres) (2).
Ecological distribution (ecosystems it occurs in, etc)	Moist mature forest at low to middle elevation in the southern part of Pacific Northwest (PNW) (1).
Climate and elevation range:	Found over a wide range of moisture and temperature conditions. In dry, subhumid areas with an average annual precipitation as low as 470 mm (19 in), it is confined to streamside areas and the lower third of north-facing slopes. Some large specimens can be found in such environments; On the Queen Charlotte Islands, Pacific yew is confined to the borders of inlets (3). Throughout much of its range within humid and superhumid forests (precipitation of 1400 to 4000 mm [55 to 157 in]), it can be found on all slopes, benches, and ridgetops. Pacific yew is found from sea level in coastal areas to 2440 m (8,000 ft) in the Sierra Nevada. Length of growing season ranges from 60 to 300 days, with annual minimum temperatures from -15° to -12° C (5° to 10° F) (2).
Local habitat and abundance; may include commonly associated species	Often associated with Douglas-fir and western hemlock in old growth forests (1). Tolerates shade. Grows best on deep, moist or rich, rocky or gravelly soils. In dry interior forests, the species develops best along mountain streams, in shady canyons, ravines, and coves. Within the moist maritime climate of the Pacific Northwest, it grows most abundantly in drier, warmer environments. A partial list of soils on which Pacific yew grows includes those in the orders Ultisols, Alfisols, and Inceptisols (2). Commonly occurs as an understory species in several forest cover types. It is a major component in some stands, but in most it is minor to rare. In some types, it tends to be found mostly on microsites. Some examples: In stands of ponderosa pine *(Pinus ponderosa),* grand fir *(Abies grandis),* and western larch *(Larix occidentalis)* in the drier interior forests, yew is found in moist areas near streams and springs (but on well drained soil); on wet, hummocky sites west of the Cascades, yew can be

	found in Oregon white oak *(Quercus garryana)*-Oregon ash *(Fraxinus latifolia)* stands (ash occupies the low, wet spots and yew grows with the oak on slightly raised hummocks); scattered large yew trees grow along the Clackamas River in northwest Oregon on berms and banks between first and second bottomlands in stands of black cottonwood *(Populus trichocarpa),* red alder *(Alnus rubra),* hawthorn *(Crataegus* spp.*),* crab apple *(Malus* spp.*),* and willow *(Salix* spp.*).* By far, Pacific yew is most common in dense conifer forests. Among the major Society of American Foresters cover types in which Pacific yew is found are: Engelmann Spruce-Subalpine Fir, Interior Douglas-Fir, White Fir, Grand Fir, Black Cottonwood-Willow, Western Hemlock, Western Redcedar-Western Hemlock, Western Redcedar, Pacific Douglas-Fir, Douglas-Fir-Western Hemlock, Port-Orford-Cedar, Redwood, Oregon White Oak, Douglas-Fir-Tanoak-Pacific Madrone, Sierra Nevada Mixed Conifer, and Pacific Ponderosa Pine-Douglas-Fir (2). In western Oregon, Douglas-fir was present on 89 percent of the forest inventory plots in which yew was tallied. A list of plants found most frequently with Pacific yew on these plots (table 1) indicates the broad range of conditions to which the species can adapt (2).
Plant strategy type / successional stage (stress-tolerator, competitor, weedy/colonizer, seral, late successional)	Usually found as an understory tree in undisturbed stands. Growth of such trees is slow, but where the overstory has been removed or thinned, diameter growth on undamaged yew trees may increase considerably (2).
Plant characteristics (life form (shrub, grass, forb), longevity, key characteristics, etc)	Evergreen shrub to small tree, 2-15 m high, up to 30 cm in diameter; branches droop; trunk often twisted and fluted; reddish bark can be papery, scaly to shreddy (1). Inconspicuous male and female cones on separate trees. Male strobili are stalked, bud-like, pale yellow, and composed of 6 to 12 filamentous stamens, each with 5 to 9 anthers. They are abundant on the underside of branch sprays and usually appear in May or June. Female strobili are less abundant, greenish, and composed of several scales. (2) Seed cone almost completely surrounded by a bright red, fleshy cup with a hole in the middle. Fruits ripen from August to October of the same year that flowering occurs. Fruits either drop to the ground or are taken from trees by birds or rodents. Birds devour the fleshy arils and void the seeds

	which remain viable. Chipmunks and squirrels often take only the seeds. Rodents and some birds-nuthatches, for example-cache yew seeds, thus creating the clusters of yew seedlings observed in some areas. The seed is about 6 mm (0.24 in) long with a depressed hilum, bony inner coat, and membranous outer seedcoat. Pacific yew is a prolific seeder (5,6). Seeds average about 33,100/kg (15,000/1b) after cleaning (7). The frequency of good seed crops is unknown. Pollen is dispersed by wind in the spring (4). Leaves: flat needles, 2-3 cm long, dull green above, striped with stomata below, ending abruptly in fine point, arranged in 2 rows in flat sprays. (1).
PROPAGATION DETAILS	
Propagation and Growth of Pacific Yew (*Taxus brevifolia* Nutt.) Cuttings by A.K. Mitchell 1997	
Ecotype (this is meant primarily for experimentally derived protocols, and is a description of where the seed that was tested came from):	Branches were collected from the mid to lower crown of mature (bearing pollen or seed) TABR2 found in natural stands on Vancouver Island.
Propagation Goal (Options: Plants, Cuttings, Seeds, Bulbs, Somatic Embryos, and/or Other Propagules):	Goal is to analyze components of vegetative propagation program: nursery culture, rooting success, and shoot growth and orientation of rooted cuttings.
Propagation Method (Options: Seed or Vegetative):	vegetative
Product Type (options: Container (plug), Bareroot (field grown), Plug + (container-field grown hybrids, and/or Propagules (seeds, cuttings, poles, etc.))	Cuttings from branches
Stock Type:	Cutting
Time to Grow (from seeding until plants are ready to be outplanted):	2 years
Target Specifications (size or characteristics of target plants to be produced):	None.
Propagule Collection (how, when, etc):	Branches were collected from the mid to lower crown of mature (bearing pollen or seed) TABR2 found in natural stands on Vancouver Island. Because of a scarcity of suitable material for cuttings, each used different parent trees. In any given experiment, parent trees were from the same geographic location. Equal numbers of cuttings were set in each treatment in each

	experiment. To assess variation in rooting between male and female trees, three sites were selected on which there were large trees of both sexes. Branches from one of the sites in the montane (800 m) on Vancouver lsland were collected in October 1993. Cuttings were set in early November and assessed for rooting 6 months later. Branches from the other two sites on southern Vancouver Island were collected in January 1994. Cuttings were set in early February 1994 and assessed for rooting 6 months later. Experimental design consisted of four replicates of 20 cuttings (80 cuttings total) from each of three male and three female trees from each location (6 trees). To assess geographic variation in rooting of Pacific yew, branches were collected from six natural stands on Vancouver Island chosen to represent wet and dry (west and east), cool and warm (north and south), and coastal and montane (low and high elevation) sites. Cuttings were set in late November and assessed 6 months later. Experimental design consisted of four replicates of l2 cuttings (48 cuttings total) from each parent tree at each location. To assess the shoot growth and orientation, rooted cuttings from 3 male (n= 101) and 3 female trees (n=80) from a single Vancouver Island location (Iron River) were transplanted in March of 1994 to styroblocks (PSB 615 A, 45 cc) in equal parts of peat, sand and vermiculite and placed in a shaded greenhouse. They were fed once weekly with 100 ppm 20-20-20 (Plant Products, Bramalea, Ontario) and watered as required.
Propagule Processing/Propagule Characteristics (including seed density (# per pound), seed longevity, etc):	Branch cuttings were bagged in plastic and returned to the laboratory where they were stored at 2 C. All cuttings were made within l0 days of collection.
Pre-Planting Propagule Treatments (cleaning, dormancy treatments, etc):	Cultural experiment: Three treatment of cuttings: treated with a basal application of Stimroot 3 (Plant Products, Bramalea, Ontario), 0.87% lBA (indolebutyric acid) and untreated cuttings (two parent trees, 48 cuttings from each tree in each treatment).
Growing Area Preparation / Annual Practices for Perennial Crops	NA

(growing media, type and size of containers, etc):	
Establishment Phase (from seeding to germination):	NA
Length of Establishment Phase:	NA
Active Growth Phase (from germination until plants are no longer actively growing):	NA
Length of Active Growth Phase:	NA
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):	NA
Length of Hardening Phase:	NA
Harvesting, Storage and Shipping (of seedlings):	NA
Length of Storage (of seedlings, between nursery and outplanting):	NA
Guidelines for Outplanting / Performance on Typical Sites (eg, percent survival, height or diameter growth, elapsed time before flowering):	- All clones had branch-like shoot growth could be problem for outplanting. - Rooting hormone (IBA) increased rooting success from 30.6% to 50% (see table 2). - Cuttings from juvenile trees rooted 70.8% while those from sexually mature trees rooted 48.6%. -Planned contrasts between wet and dry sites, cool and warm sites, and coastal and montane sites showed that there was no significant effect of geographic location or elevation on rooting despite potential climatic affects on shoot growth and vigor of parent trees. Individual pacific yew parent trees had rooting percentages from 6.4% to 87.5%. It could be due to different parental ages. Increased age decrease rooting success and increase clonal variability. (17, 18) -No significant differences in rooting percentages between male and female Pacific yew trees from the three sites selected to test for sex specific effects table. Also significant clonal variation and rooting percentages of individual parent trees ranged from a high of 49.1% to low of 1.3%. This suggests that a large number of cuttings from each tree would be needed for a viable vegetative propagation program.
Other Comments (including collection restrictions or guidelines, if available):	

General Propagation Guidelines

Cuttings (in Autumn)

Take 4-6 inches (10-15cm) cuttings from one to three-year-old shoots that are strongly upright and nearly ripe, but green at the base. Hormone rooting compound helps. Cuttings root by early summer outdoors, and earlier under mist with bottom heat of 68F (20C) (11).

Seeding (any time of the year)

The arils turn red as the seeds ripen in autumn. The hard seed coats are usually broken down in the gut of a bird or mammal and germinate after a period of cold. Speed germination by mixing the seeds with damp peat or sand and keeping them at about 68 F (20 C), for example in a warm closet, for 4-5 months, then chilling them for 3 months around 34 F (1C). However, seeds germinate in late summer will have too little time to put on growth before winter. Store seeds and sow in spring in pots and keep them outdoors for 1-2 years until they germinate (11).

Seeds of Pacific yew germinate slowly and require stratification. Germination tests indicate that 30° C (86° F) day and 20° C (68° F) night temperatures are desirable. Germination is epigeal, and usually in heavy organic matter. Yew seeds sown in nursery beds in late spring require mulching. Beds require shading during the summer and again in December. Some seeds do not germinate until the second spring after sowing (2).

Grafting (in Spring)

In spring, pot pencil-thick 3 year-old seedlings; grow on until late summer. Splice side-veneer graft onto these rootstocks. Extra heat is not needed but shading may be. The union should callus in 6 weeks. (11)

INFORMATION SOURCES	
References (full citations):	See below.
Other Sources Consulted (but that contained no pertinent information) (full citations):	See below.
Protocol Author (First and last name):	Zhu Zhu Xiao
Date Protocol Created or Updated (MM/DD/YY):	04/17/09

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

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Propagation Protocol for Taxus brevifolia TABR2 (2003)

Plant Data Sheet

Pacific Yew / *Taxus brevifolia*

Range

Southern tip of southeast Alaska south through the Pacific Coast region of British Columbia and the Olympic Peninsula of Washington, as far south in the coastal range as northern California, scattered in the Cascade range, inland the Yew grows on the western slopes of the Rocky Mountains in British Columbia south to western Montana. (1)

Climate

Cool temperate and cool mesothermal climates (2)

Elevation

Low to middle elevations in the PNW (3)

Local occurrence

Moist, mature forest, (3) it's occurrence increases with increasing precipitation and decreases with increasing latitude and elevation (2)

Habitat preferences

Shade tolerant, submontane to subalpine, (2)

Plant strategy type/successional stage

In productive old growth forests as an understorey tree, at low, open elevations, as a mid-canopy or understorey tree (3) tolerant of shade (1)

Associated species

Doug fir and western hemlock in old growth forests, red cedar and western hemlock (3), *Berberis nervosa, Polystichum munitum, Acer circinatum, Tsuga heterophylla, Gaultheria shallon* (1)

Collection restrictions or guidelines

Fruit ripens in late summer (August) to autumn (October), fruits should be picked from the branches by hand as they ripen to avoid loss to birds (4)

Seed germination

Natural germination does not take place until the second year, strong but variable dormancy, broken by warm plus cold stratification, recommended 90-210 days at 60° F and then 60-120 days at 36-41° F (4)

Vegetative regeneration

Layering and often sprouts from stumps or rootstocks (1)

Seed life

Fruits are frequently eaten by birds and rodents which void the seeds in viable condition (1) no information on life of seeds

Recommended seed storage conditions

Propagation recommendations

Yew seeds sown in nursery beds in late spring require mulching, shade during the summer and in December (1),

Soil or medium requirements

Fresh to moist, nitrogen rich soils, frequent on water receiving sites (2) heavy in organic matter (1)

Installation form

Young plants from seeds

Recommended planting density

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

Normal rate of growth or spread; lifespan

Grows slowly, taking the same amount of time to grow 30 cm d.b.h. as other conifers, height growth is also slow, annual growth in diameter at 15 cm above ground to range from 0.05cm to 0.25 cm (1)

Sources cited

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Data compiled by: *Lizbeth Seebacher* May 6, 2003

Tables

Table 1- Plants frequently found on plots with Pacific yew present, western Oregon.		
Species	**Percentage of plots**	**Indicator value[1]**
Pseudotsuga menziesii	89	Common
Berberis nervosa	75	Common
Polystichum munitum	75	Mesic, common
Acer circinatum	70	Common
Tsuga heterophylla	59	Cool, common
Gaultheria shallon	59	Warm, mesic to dry
Corylus cornuta var. californica	43	Warm, dry
Acer macrophyllum	39	Warm
Vaccinium parvifolium	39	Warm, common
Thuja plicata	36	Moist, common
Alnus rubra	36	Warm, moist
Rhododendron macrophyllum	34	Cool, mesic
Cornus nuttallii	32	Warm, dry
Holodiscus discolor	27	Hot, dry
Linnaea borealis	27	Mesic
Arbutus menziesii	25	Warm, dry
Abies grandis	23	Warm, dry
Xerophyllum tenax	23	Cool, dry
Rhus diversiloba	20	Hot, dry
Oxalis oregana	20	Warm, moist

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Table 2. Summary of rooting percentages in cultural studies. Hormone treatment was 0.8% IBA. Juvenile trees were less than 1 m tall and did not have reproductive structures. Mature trees were more than 5 cm in diameter and bearing pollen or seed.

Experiment	Treatment	% Rooted
Hormone	+ IBA	50
	- IBA	30.6
Size	3-5 cm	55.7
	25-40 cm	50.6
Age	Juvenile	70.8
	Mature	48.6
Species	Pacific yew	45.8
	English yew	95.4

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