SPECIES FACT SHEET

Common Name: Methuselah's beard, beard lichen
Scientific Name: *Usnea longissima* Ach.
Kingdom: Fungi
Division: Ascomycota
Class: Ascomycetes
Order: Lecanorales
Family: Parmeliaceae
Genus: *Usnea* Dill. ex Adans.

Technical Description:
Usnea longissima is pale greenish or silvery-yellowish-green, fruticose and pendulous; main branches are cylindric, up to 3 meters or more in length and very rarely dividing, with numerous dense, short perpendicular side branches and fibrils of about equal length (3-40 mm). The cortex is smooth but disintegrating on the main stems, leaving rough patches of white medulla over the pinkish-to-brownish central cord. The unexposed central cord beneath the cortex is white (when exposed with a razor blade), but frequently turns pinkish or reddish brown in decorticate main branches. Papillae are lacking. Soredia or isidia occasionally form on the side branches (Brodo et al. 2001; McCune 2005, McCune & Geiser 1997). Apothecia are extremely rare; when present, they are disk-shaped, 1-3 (5) mm across, terminal on the ends of side branches, with numerous fibrils extending from the thalline margin (Keon 2002).

Chemistry
Central cord I+B. Cortex and medulla K-, C-, KC- PD- (with various combinations of evernic, diffractaic, barbatic, and 4-O-demethylbarbatic acids; sometimes with usnic acid only), rarely K+Y-O, PD+O (salacinic acid)(McCune 2005).

Identification Tips
Usnea longissima is one of the most easily recognizable lichens. All *Usnea* species have a characteristic central axis, appearing like an elastic cord or cylindric rubber band in the center of the lichen thallus, which is surrounded by medulla and outer cortex. Other similar fruticose pendant genera, such as *Alectoria* and *Ramalina*, lack the diagnostic central cord of *Usnea* species.

Usnea longissima is distinguished from other *Usnea* species by the extremely long, mostly unbranched main strands, which have perpendicular side branches and fibrils, and a patchy surface due to the eroded cortex. Small specimens may be confused with other pendant *Usnea* species, but only *U. longissima* has a I+ violet or dark bluish central cord and eroding cortex (Brodo et al. 2001; McCune & Geiser 1997).

Similar Species
"Spanish moss" may be confused with *U. longissima* because both can festoon trees and shrubs with long billowing strands. However, Spanish moss is a epiphytic vascular plant common in the southeastern U.S., not a lichen. It lacks the characteristic central cord of *Usnea*.

"Alectoria sarmentosa contains usnic acid, giving it the same color as *U. longissim*a. Typically their growth forms are very different, with *A. sarmentosa* being considerably shorter (to 40 cm long), more branched, and with fewer perpendicular side branches. It lacks the central cord which is diagnostic for all *Usneas*." (Derr et al. 2003)

"Ramalina menziesii is sometimes mistaken for *U. longissim*a, particularly thin coastal specimens that lack the characteristic netted morphology typical of the species." (Derr et al. 2003). *Usnea longissima* is usually considerably longer, with strands growing over three meters long, where *R. menziesii* grows to one meter. *Ramalina* also lacks the central cord of Usnea, and typically has flattened portions of the thallus while *Usnea* is round in cross-section.

Keys to Identification of the Species
Useful dichotomous keys are available in Brodo et al. (2001), Goward (1999), and McCune & Geiser (1997). The most recent key by Bruce McCune key is presented in part in Appendix 1, and available in its entirety online (McCune 2005).

Life History:
This lichen has a large thallus that is identifiable year-round. It typically festoons trees with many long, draping strands, making it one of the most noticeable lichens, unless visibility is impeded by snow cover or inclement weather. Small, isolated specimens may be less readily observed. Reproductive structures are not necessary for accurate identification.

It is not typically fertile, since apothecia are extremely rare (Keon 2002). Soredia are infrequent in western North American specimens (Brodo et al. 2001, Keon & Muir 2002). This species primarily reproduces asexually by fragmentation of the main thallus, side branches and fibrils (Keon 2002). The relatively large size of the propagules indicates an inherent dispersal limitation, with the majority of vegetative propagules dispersing only short distances, (i.e. typically less than 5 meters) from their source locations (Esseen 1985, Esseen et al. 1981; Keon & Muir 2002).

Range, Distribution, and Abundance:
Historically, this taxon was fairly common and nearly circumboreal in distribution, occurring in eastern and western North America, Scandinavia, Europe, Asia (including China, Indonesia, India, and Bhutan) and Africa (Keon 2002). However, it has declined significantly throughout its global range. It is now endangered or extirpated from many areas of Europe and Scandinavia, due to a combination of human influences such as habitat alteration and air quality degradation (Derr et al. 2003). It was recently placed on the Red List of California Lichens, where it is considered rare (Doell & Wright 2000).

In western North America, *U. longissima* occurs from northern California north to Alaska (Brodo et al. 2001). In Washington, it is found in the Western Lowlands, Western Cascades, and the Olympic Peninsula Physiographic Provinces, only in and west of the Cascade Range. In Oregon, it occurs in the Willamette Valley, Western Cascades, Klamath, and Coast Range Physiographic Provinces, also west of the Cascade Range.

Within its range, it has a limited and patchy distribution on both the forest stand and landscape level (Keon & Muir 2002). It may be abundant on one to several trees in close proximity, but absent or infrequent through the surrounding stand. The reasons for this patchiness may be from dispersal limitations inherent to the species, difficulty with establishment, lack of suitable habitat, or a combination of factors. Current research suggests that the species is strongly dispersal-limited (Keon & Muir 2002, Sillet et al. 2000).

Habitat Associations:
Usnea longissima occurs in old-growth and late-successional conifer stands, hardwood stands, and riparian areas, particularly in coastal climates or on fog-swept mountains where humidity is high. It is usually infrequent but can be locally abundant.

In the Oregon Coast Range, where extensive growth and habitat studies of *U. longissima* have been conducted (Keon & Muir 2002; Keon 2002; Keon 2001), it reachs its greatest biomass in old-growth/late-successional stands on upper slopes or ridges. Based on presence/absence habitat studies, stand ages greater than 120 years with north to northeast-facing slopes were predicted to be the most suitable habitat (Keon 2001).

In a study which took place on seven Pacific Northwest forests (Umpqua, Willamette, Mt. Hood, Deshutes, Gifford-Pinchot, Siuslaw, and Winema,), *U. longissima* was found three times as often in stands greater than or equal to 80 years old than those less than 80 years (Edwards et al. 2004). However, this association with older stand ages was not statistically significant, possibly due to the small number of observations (Edwards et al. 2004).

Experiments using *U. longissima* revealed that thalli transplanted into habitat predicted to be least suitable (i.e. very young clear cut stands) actually increased in biomass more than transplants into old-growth (Keon & Muir 2002). This suggests that the presence of a nearby propagule source may be more important to dispersal and survival at both the local and landscape level than habitat characteristics (Keon & Muir 2002). However, most naturally occurring *U. longissima* populations occur in older, moist forests rather than very young stands.

> "In California, *U. longissima* is distributed for the most part in old growth forests in the same ecological zone as the redwoods, although it does not necessarily grow on that substrate (Doell & Wright 2000). *U. longissima* is found in the coastal mountains north of San Francisco, less than forty kilometers inland, at lower elevations (up to at least 2700 feet) where the climate is cool and moist (Doell & Wright 2000). It may reach as far inland as 48 km in river canyons like the Van Duzen that receive a lot of coastal fog (D. Wright pers. comm.). Substrates include conifers, hardwoods and shrubs." (Derr et al. 2003)

Additional site-specific habitat information can be found in the National Air Quality Database (U.S. Department of Agriculture 2006a).

Threats:

Usnea longissima is a pollution-sensitive lichen (McCune & Geiser 1997); it is considered "most sensitive" by the National Air Quality Database (U.S. Department of Agriculture 2006b). It was abundant throughout the Northwest and Europe prior to industrialization; it has been extirpated from most of its former range in Europe, with rare populations remaining in Italy and Norway.

Historic and current illegal harvesting for floral shops, other decorative uses, and medicinals may also contribute to the declining abundance of this species.

Forest management practices may threaten existing populations directly by harvest of host trees. Additional loss of populations, loss of suitable habitat, and forest fragmentation would increase the already large distances between existing populations. Since this species is notoriously slow to disperse and establish in new locations, forest management practices may slow recovery time.

Conservation Considerations:

Current research indicates that the retention of *U. longissima* host trees during tree harvest will benefit the species. Remnant trees (both conifers and hardwoods) function as sources of inoculum from which lichen propagules can disperse, and can serve as important "hotspots" of lichen diversity and

abundance (Keon & Muir 2002, Peck & McCune 1997, Peterson & McCune 2003).

> "This species is dispersal-limited at both stand and landscape levels across the Pacific Northwest (McCune & Geiser 1997, Sillett et al. 2000). Studies suggest that the presence of populations in old-growth (i.e. tall) stands increases the possibility of dispersal and establishment of *U. longissima* onto adjacent substrates in suitable habitat, especially adjacent tree crowns where the species is most effective at continuing to disperse to other suitable habitats (Keon & Muir 2002, Keon 2001). The finding that *U. longissima* transplants thrive in habitat that was predicted to be the least suitable (i.e. clear cuts) also suggests that dispersal limitations play a more significant role than the availability of suitable habitat in determining this species' distribution, and highlights the important role of colonized green-tree retention in timber harvest areas (Keon & Muir 2002, Keon 2001)." (Derr et al. 2003)

Other Information:

Survey Protocols

U. S. Department of the Interior; U. S. Department of Agriculture Forest Service; U. S. Fish and Wildlife Service. 2003. Survey Protocols for Survey and Manage Category A & C Lichens in the Pacific Northwest Forest Plan Area (Version 2.1). Portland, OR: USDA Forest Service Region 6. Available in hardcopy and online: http://www.blm.gov/or/plans/surveyandmanage/SP/Lichens/20030609/Lichens%20Version%202.1.pdf. [Accessed July 28, 2006].

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ATTACHMENTS:

(1) Key to Identification of the Species
(2) List of References
(3) Map of Range and Distribution in Oregon and Washington
(4) Photos

Attachment 1 - Key to Identification of the Species

Usnea in the Pacific Northwest (McCune 2005)

By Bruce McCune, March 22, 2005

The species concepts in the key below were revised based primarily on Halonen et al. (1998), Halonen (2000), and Tavares (1997); also see other references.

Introductory Key

1a Cortex or central cord distinctly reddish, brown, yellow, or blackening

Group 1, Lead 7

1b Cortex yellow green to green and central cord white

2a Thallus pendulous, often long, typically > 12 cm

Group 2, Lead 12

2b Thallus tufted, ± erect or drooping, typically < 12 cm

3a Thallus with sparse to abundant apothecia; soredia and isidia lacking

Group 3, Lead 24

3b Thallus with few or no apothecia; soredia and/or isidia usually present

4a Branches pinched at the nodes and slightly to distinctly expanded in the internodes, so that individual branch segments are cigar shaped

Group 4, Lead 30

4b Branches cylindrical

Group 5, Lead 40

Group 2
Pendulous

12a Base blackened; cortex with abundant annular cracks, especially at the base; cortex thick (10-20% of radius); medulla compact, thin (7-15% of radius); soralia typically larger than ½ of the branch diameter, isidiate at least when young. Thallus pendent to subpendent, rarely shrubby, to 25 cm long; fibrils and papillae variable, but papillae usually indistinct; branching mainly isotomic dichotomous but becoming anisotomic near the tips; soralia often numerous, distinctly raised, closely spaced to confluent, occasionally absent or sparse; medulla K+Y or R, P+Y or O, with salacinic acid and accessory protocetraric and constictic acids, rarely with accessory barbatic acid; on conifers, hardwoods, and shrubs; common in oceanic areas from Calif to BC, usually found near the coast, sometimes in the Coast Ranges, sporadic in the Willamette-Puget trough

U. silesiaca Motyka
U. madeirensis Motyka

[Halonen et al. (1997) and Halonen (2000) use the name *U. madeirensis.* Tavares (1997) asserted that *U. silesiaca* is the correct name; an attempt to conserve *U. madeirensis* against *U. silesiaca* failed (Clerc 2004).]

12b Base blackened or not, but if blackened, then with fewer annular cracks; cross section and propagules various

13a Papillae lacking

14a Main branches very long, rarely dividing, with dense short perpendicular fibrils; central strand of main branches > 0.5X thickness of branches; central axis I+B. Thallus commonly very long (to >> 1 m), cortex eroded on the main branches; soredia occasionally present; central axis white but occasionally turning pinkish or reddish brown in decorticate branches; apothecia

rare; cortex and medulla K-, C-, P- (with various combinations of evernic, diffractaic, barbatic, and 4-*O*-demethylbarbatic acids; sometimes with usnic acid only), rarely K+Y-O, P+O (salacinic acid); on both conifers and hardwoods, frequently in riparian areas but also on fog-swept ridges; locally common in moist low-elevation coastal forests; Alaska to Calif in the coastal states and provinces

U. longissima Ach.

[This species shows rich chemical variation in the Pacific Northwest. In BC (Halonen et al. 1998) evernic acid was most frequent, followed by barbatic acid); the various chemotypes were recognized as species by Asahina, but these have largely been ignored because the specimens are otherwise indistinguishable morphologically]

14b Main branches often rebranching, fibrils absent to moderate; central strand of main branches < 0.5X thickness of the branch; central axis I-

15a Main branches becoming strongly pitted (foveolate) and ridged, bluntly angular in crosssection. Thallus sometimes long (to 30 cm), soft, sparsely branched; soredia and isidia lacking; central strand and terminal branches ± sinuous; fibrils lacking or very sparse; apothecia rare; medulla I-, usually K+Y to O and P+O (with salazinic acid), rarely with only usnic acid (K-, P-); usually on conifers; widespread, boreal south in mountains to Ariz, Calif, and Mex; uncommon and scattered in PNW

U. cavernosa Tuck.

15b Main branches not or only weakly pitted

16a Main branches ridged or wrinkled; isidia usually abundant; papillae often present but weakly developed; annular cracks few ***U. scabrata*** (see below)

16b Main branches smooth, cylindrical; isidia and soralia sparse to almost lacking; annular cracks common.

17a Base slightly to distinctly blackened; papillae usually present, though often sparse and low; medulla usually containing salacinic acid (K+Y to R, P+O), rarely with usnic acid only (K-, P-);cortex moderately thick (___% of radius); medulla ___?___ and compact (____% of radius); axis ____ (_____% of diameter). Thallus often 30 cm or more long; sometimes resembling *Alectoria*; usually with abundant slender branches but never with abundant fibrils; soralia absent to scattered, usually minute, borne on small tubercles; isidia usually absent but occasionally present. Usually on conifers; uncommon to locally common in the Coast Ranges and Cascades at low to middle elevations; BC (and probably Alaska) to Oregon

U. chaetophora Stirton

17b Base not blackened; papillae absent; cortex relatively thick (8-14% of radius); medulla thin and compact (6-16% of radius); axis thick (43-64% of diameter); medulla K+Y or K-, P+R (protocetraric acid with accessory compounds in the stictic acid group). Thallus to 50 cm long or more, sometimes resembling *Alectoria*; fibrils absent to abundant; cortex matte; soralia absent to abundant, minute; isidia absent to sparse, soon abraded; usually on conifers near the coast

U. schadenbergiana Göpp. & Stein
U. hesperina Motyka
U. subgracilis Vainio

[See Clerc's (2004) nomenclatural conclusion regarding loss of the familiar name *U. hesperina*.]

13b Papillae present

18a Branches with abundant annular cracks (typically 6-15 cracks per cm) that sometimes expose the medulla; papillae usually sparse and low, mainly on the thickest branches; soralia absent to scattered, usually minute.

U. chaetophora (see above)

18b Branches with few annular cracks (0-8 per cm), those present mainly near the base

19a Main branches with raised wrinkles which may be widely scattered or dense and

reticulating with intervening flat or depressed spots; branches uneven in thickness, ± swollen, often sinuose; cortex thin (2-8% of radius). Thallus to 50 cm long; main branches often with few fibrils (but sometimes heavily fibrillose); branches with raised warts that become isidiate; papillae usually weakly developed; medulla usually lax, K+Y to O (salacinic acid) or K- (usnic acid only); widespread, boreal and montane; mesic montane forests, with more old-growth affinity than *U. filipendula*

U. scabrata Nyl. sens. lat.

(including *U. alpina* Motyka, *U. barbata* (L.) F. H. Wigg., *U. catenulata* Motyka, ? *U. graciosa* Motyka, ? *U. intermedia* (Mass.) Jatta, *U. prostrata* Räsänen, *U. scabiosa* Motyka, *U. sylvatica* Motyka)

["a highly polymorphic species in which many intergrading morphotypes occur. These polymorphic characters, which are seemingly controlled mostly by environmental parameters, include the morphology of the papillae, the occurrence of foveoles, the density of branching and fibrils, and the thickness of the branches" (Halonen et al. 1998). Furthermore, they relegated *U. scabiosa* Motyka to a synonym of *U. scabrata*: "described from New Mexico, has a rugose, abundantly foveolate thallus and it probably represents *U. scabrata* sens. str." Tavares (1997), however, stated "these species are very distinct and do not seem to be closely related." Tavares separated *U. scabiosa* as having "papillae short, think, cylindrical or slightly tapered" vs. "papillae usually tall and cylindrical" for *U. scabrata* and *U. filipendula*. The usnic-only chemotype is more common inland (this has been called *U. scabrata* ssp. *nylanderiana* Motyka) while west of the Cascades the salacinic chemotype is most common. Tavares (1997) also separates the *U. pendulina* - *U. graciosa* group as having distinctly inflated branch segments and sinuose fibrils, with small, thin, low papillae and cross-sectional proportions about the same as *U. scabrata*. She stated "California specimens allied to *U. pendulina* Motyka, described from Italy, and *U. graciosa* Motyka, described from Sweden, include some individuals with strongly fusiform segments that may belong to a distinct taxon."]

19b Main branches cylindrical throughout, not ridged; cortex moderately thick (8-14% of radius)

20a Fibrils usually abundant; papillae usually tall, cylindrical, and abundant; isidio-soralia tuberculate, often arising from scars of detached fibrils; medulla K+Y-O, P+O (salacinic acid). Thallus to 60 cm long; base blackened or not; main branches with abundant papillae and tubercles, the latter producing isidia; isidia usually abundant; central axis rather thick (30-45% of diameter); medulla with salacinic acid (UV-, K+R, P+O) or usnic acid only (K-, P-). On both hardwoods and conifers in low to mid elevation forests, mainly in mesic to dryish sites west of the Cascades, mesic sites east of the Cascades; BC to California inland to w Montana

U. filipendula Stirton

[Other names that have been commonly applied in this group are *U. plicata* and *U. dasypoga* (Ach.) Shirley]

20b Fibrils absent to sparse; papillae short warty bumps; soralia plane to tuberculate, arising from small tubercles; medulla UV+ white, K-, P+Y (squamatic and baeomycesic acids)

U. pacificana (pendulous morphotype; see below)

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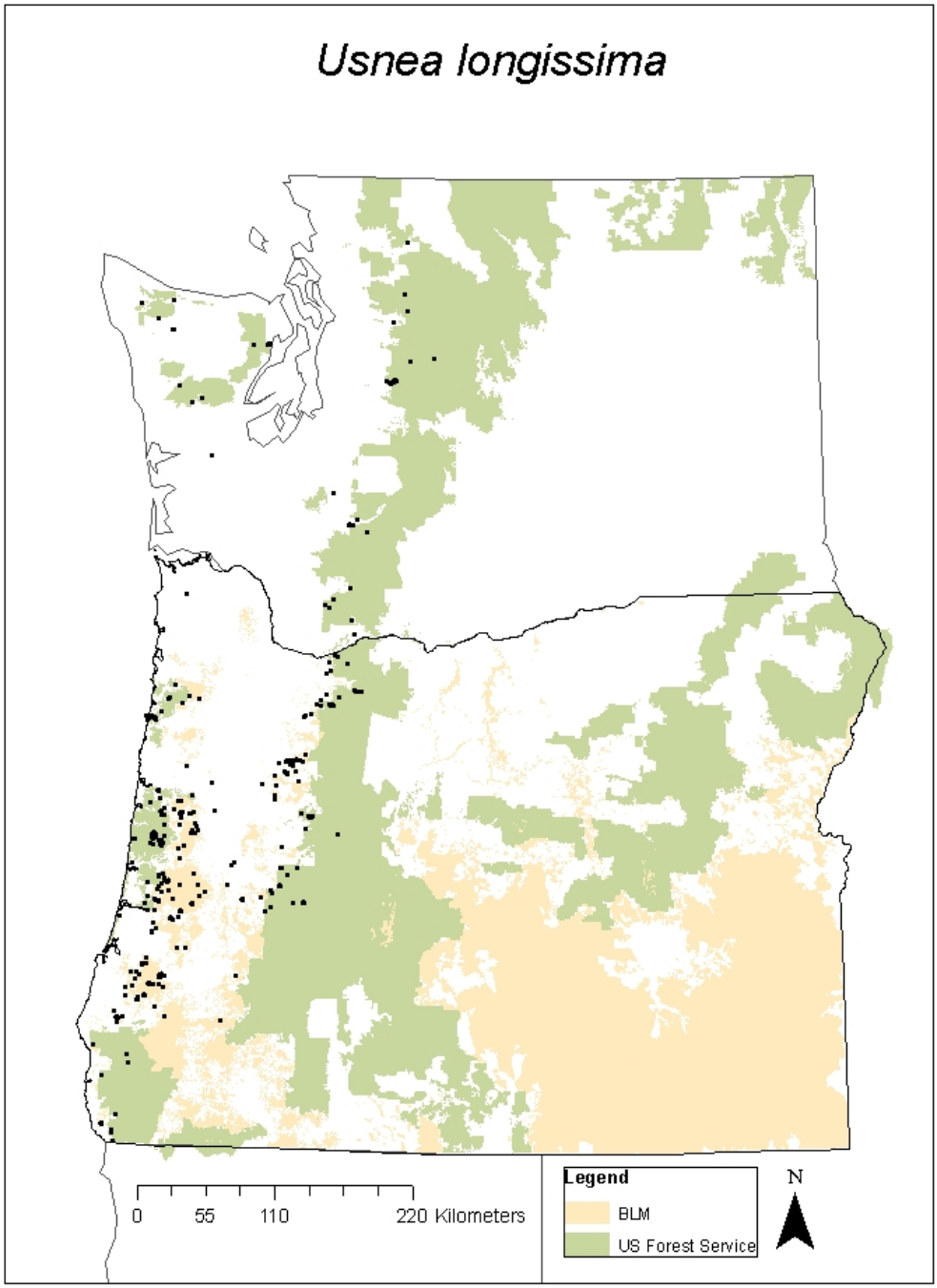
Attachment 3 - Map of Usnea longissima locations in Oregon and Washington from GeoBob database (Oct. 2006)



Attachment 4 - Photos

Photo © Stephen and Sylvia Sharnoff; used with permission.

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