

BIOGEOGRAPHY OF RARE LICHENS FROM THE COAST OF OREGON

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Abstract: Along the Oregon coast there are pockets of exceptionally high diversity of rare lichen species. These include a number of extreme disjunct populations, with affinities to the flora of the southern hemisphere, tropical and subtropical areas, California, northeast Asia, maritime Arctic, eastern North America, and Europe. Only two of these rare species are endemic to the Pacific Northwest. Concentrations of rare lichens tend to occur on peninsulas, headlands, bald mountaintops near the coast, and the extensive dune sheet between Heceta Head and Cape Arago. Many of these species are known in North America only from the immediate coast. The geographic distribution of these populations of rare species and their biogeographic affinities are described. Fourteen species are new records for Oregon. *Acarospora subrufula* is newly reported for North America. *Hypogymnia pulverata* is a new record for western North America.

Keywords: Biogeography, coastal ecosystems, lichens, Oregon, rare species

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INTRODUCTION

Many species of lichens are known in the Pacific Northwest from just a few locations scattered along the coast. The number seems disproportionately high compared to the number from areas inland of the Coast Range. The purpose of this paper is to document recent lichenological finds along the Oregon coast and to examine these records for commonalities in topographic position, physiognomy of the vascular vegetation, and substrate. Furthermore, we describe the affinities of these species with floras in other parts of the world. We also discuss factors affecting the accumulation of rare species, including immigration and extirpation rates and propagule sizes.

NOTES ON SELECTED SPECIES

Notes on the distribution and ecology of selected species thought to be rare in Oregon are listed below. Other species are represented by only a few collections each from Oregon, but may not be rare (Table 1).

In addition to these infrequent or rare species, many species are characteristic and frequent on the coast but rare or absent inland (Table 1). Epiphytic species in this category include *Caloplaca vicaria*, *Cetraria californica*, *Coccoloma pycnanthum*, *Hypogymnia heterophylla*, *Parmotrema arnoldii*, *P. chinense*, *P. crinitum*, *Pyrrhospora querneae*, and *Usnea cornuta*. Many species are restricted to rock in the supralittoral zone (Table 1).

Unless otherwise noted, collections cited below are by the authors and are deposited in the herbarium of Oregon State University (OSC) or the research collections of the authors. Nomenclature of lichens follows Egan (1987) unless otherwise given.

Acarospora subrufula (Nyl.) H. Oliv. This species of siliceous coastal rocks is known mainly from southern Europe, sporadically north to the English Channel (Purvis *et al.*, 1992). In Oregon it was found on sandstone outcrops above Simpson Beach in Coos County. Based on its European distribution it should be found south into California as well.

Anaptychia setifera Räs. This boreal species is most common in eastern North America. A few isolated locations are, however, known for western North America (Alaska and northern British Columbia). A single extremely narrow-lobed specimen was found on a stunted *Picea sitchensis* near the Eel Creek Campground on the dunes (Coos County). It was more abundant on Cape Blanco and Cape Sebastian, both windswept headlands in Curry County. Few other examples of boreal species with scattered occurrences southward along the coast are known. *Bryoria furcellata* is one of these; *Ramalina thrausta* is similar but it also occurs in the Cascades and northern Rocky Mountains (McCune and Goward, 1995).

Anema cf. *dodgei* Herre. On soft welded tuff in shaded roadcut in mature *Abies* forest, Grass Mountain Research Natural Area, McCune 21514.

RARE LICHENS OF THE OREGON COAST

TABLE 1. Characteristic and rare lichens of the Oregon Coast, all rare or absent inland in Oregon.

Characteristic and common coastal species	<i>Diplotomma chlorophaeum</i>	<i>Bryoria pseudocapillaris</i>
<i>Caloplaca vicaria</i>	<i>Lecanora campestris</i>	<i>Bryoria subcana</i>
<i>Cetraria californica</i>	<i>Lecidella elaeochromoides</i>	<i>Bryoria tenuis</i>
<i>Cladina portentosa</i>	<i>Leprocaulon microscopicum</i>	<i>Buellia oidalea</i>
<i>Coccotrema pocillarium</i>	<i>Opegrapha saxicola</i>	<i>Caloplaca ludificans</i>
<i>Hypogymnia heterophylla</i>	<i>Pannaria maritima</i>	<i>Caloplaca stantonii</i>
<i>Parmelia squarrosa</i>	<i>Pyrenocollema halodytes</i>	<i>Cladidium bolanderi</i>
<i>Parmotrema arnoldii</i>	<i>Rinodina sp. undescribed</i>	<i>Collema furfuraceum</i> var. <i>luzonense</i>
<i>Parmotrema chinense</i>	<i>Toninia ruginosa</i> ssp. <i>pacifica</i>	<i>Erioderma solediatum</i>
<i>Parmotrema crinitum</i>	<i>Verrucaria maura</i>	<i>Flavoparmelia caperata</i>
<i>Pyrrhospora querneae</i>		<i>Heterodermia</i> sp.
<i>Ramalina roesleri</i>	Rarely collected; status uncertain	<i>Hypogymnia duplicata</i>
<i>Usnea cornuta</i>	<i>Bryoria furcellata</i>	<i>Hypogymnia pulverata</i>
	<i>Buellia stellulata</i>	<i>Lecanora caesiurubella</i> ssp. <i>merrillii</i>
Largely restricted to Rocky Supralittoral	<i>Caloplaca brattiae</i>	<i>Leioderma solediatum</i>
<i>Acarospora subrufula</i>	<i>Catillaria chalybeia</i>	<i>Leptogium brebissonii</i>
<i>Buellia stellulata</i>	<i>Cladonia artuata</i>	<i>Niebla cephalota</i>
<i>Caloplaca bolacina</i>	<i>Dimerella lutea</i>	<i>Ochrolechia subplicans</i>
<i>Caloplaca brattiae</i>	<i>Diplotomma chlorophaeum</i>	<i>Pannaria rubiginosa</i>
<i>Caloplaca coralloides</i>	<i>Hafellia fosteri</i>	<i>Placynthiella hyporhoda</i>
<i>Caloplaca flavogranulosa</i>	<i>Pannaria maritima</i>	<i>Polychidium contortum</i>
<i>Caloplaca ludificans</i>	<i>Pertusaria suboculata</i>	<i>Pseudocyphellaria</i> sp.
<i>Caloplaca luteominia</i>	<i>Usnea rubicunda</i>	<i>Sigridia californicum</i>
<i>Caloplaca marina</i>		<i>Sticta arctica</i>
<i>Caloplaca rosei</i>	Rare coastal spp, rare or absent inland in Oregon	<i>Teloschistes flavicans</i>
<i>Caloplaca stantonii</i>	<i>Acarospora subrufula</i>	<i>Toninia ruginosa</i> ssp. <i>pacifica</i>
<i>Catillaria chalybeia</i>	<i>Anaptychia setifera</i>	<i>Usnea hesperina</i>
<i>Cladidium bolanderi</i>	<i>Bryoria bicolor</i>	

Bryoria bicolor (Ehrh.) Brodo & Hawksw. The southernmost record of *Bryoria bicolor* in North America reported by Brodo & Hawksworth (1977) was on Saddle Mountain (Clatsop County) in extreme northwest Oregon (Pike 3781, 3812A, OSC). In 1993 the population was still vigorous in stunted *Abies procera* forests on the ridgetop at about 1000 m. Other Oregon populations were found on Neahkahnie Mountain (Tillamook County), 25 km farther south, 500 m elevation, and only 1 km from the coast and on Cascade Head (Tillamook County). Additional populations have been reported (Roger Monthey, personal communication, specimens not seen by us) from Lost Prairie and Jeeter Prairie (Lincoln County) east of Lincoln City. Other populations are likely to be found on windswept summits near the coast.

Bryoria pseudocapillaris Brodo & Hawksw. There are very few records of this western North American endemic (Brodo & Hawksworth, 1977). Only two locations have been known: Humboldt Co., California, and the type locality in Curry Co., Oregon (Cape Blanco, Brodo 20539, on isolated exposed *Picea sitchensis* [CANL, OSC]; Imshaug 17660 [MSC]). A third location near Sutton Creek (Lane County) is now known. At first glance, this species looks like *B. capillaris*, but the habitat is different. Although *B. capillaris*

occurs primarily in sheltered forests, *B. pseudocapillaris* was found in a more exposed site, densely overgrowing a small moribund conifer located between an old-growth *Picea sitchensis* forest and open dunes. The species also differs from *B. capillaris* in its longer, more prominent pseudocyphellae. Although *B. capillaris* becomes medium to dark brown when growing in exposed sites, *B. pseudocapillaris* is very pale, even in its exposed habitat.

Bryoria subcana (Nyl. ex Stiz.) Brodo & Hawksw. Rare in western North America, this species is restricted to the immediate coast and wet forests in the Coast Ranges. Brodo and Hawksworth (1977) reported it from just four sites south of British Columbia; three were in California and one was in Oregon (Clatsop County, Saddle Mountain, Pike 3818, OSC). At Grass Mountain (Benton County) it occurs in a very wet old-growth *Abies procera* forest near the summit. Linda Geiser reports additional sites from the Siuslaw National Forest in the Coast Range.

Bryoria tenuis (Dahl) Brodo & D. Hawksw. This circumpolar oceanic species occurs south along the Pacific Coast to the Queen Charlotte Islands, then disjunct to Saddle Mountain (Brodo and Hawksworth, 1977; Clatsop County, Pike

3763, OSC). No additional sites have been located south of British Columbia. The species is very similar to *B. bicolor*, differing only in habit and degree of branching. *Bryoria bicolor* forms erect, dense tufts and has third-order perpendicular branches while *B. tenuis* is erect to decumbent and usually lacks third-order branches.

Buellia oidalea (Nyl.) Tuck. This primarily Californian species (Imshaug, 1951) has been found scattered up the coast to British Columbia. At the Sixes River (Curry County), it co-occurs with *Niebla cephalota*, *Sigridia californicum*, and *Pyrrhospora querneae*. Its occurrence on young *Pinus contorta* on the deflation plain coastward from Carter Lake (Douglas County) suggests that it is more common than the few records would indicate.

Caloplaca ludificans Arup. This species of supralittoral rocks is common in the San Francisco Bay area and southward (Arup, 1995a, b). A single site is known north of the Bay Area: Clatsop County, Oswald West State Park, Arup L89137 (LD).

Caloplaca stantonii W. A. Weber ex Arup. Also a species of supralittoral rocks, *C. stantonii* occurs primarily from Mendocino County, California, to the Los Angeles area, but it is uncommon throughout its range (Arup, 1992, 1995b). It is known from a single site in Oregon (Coos County, Sunset Bay State Park, Arup L89220 and other collections in LD).

Cladidium bolanderi (Tuck.) Ryan. This Californian species of seashore rocks is most common on the coast from San Luis Obispo to Sonoma County (Ryan, 1989). Two localities are known for Oregon, the northernmost sites for this species: Curry County, Harris Beach State Park (Ryan, 1989), and on a seastack near Seal Rock, Lincoln County (Rosentreter 8438).

Collema furfuraceum (Arn.) DR. var. *luzonense* (Räs.) Degel. Certainly uncommon, but possibly overlooked, this mainly pantropical to subtropical taxon (Degelius, 1974) was found very close to the rocky coast at Harris Beach State Park (Curry County, 42°04'N 124°19'W), on large aging shrubs in sheltered microsites where the beach meets the rise to woody vegetation. In North America it is known from Florida and the Pacific Coast, where it is rare from Mexico to the Queen Charlotte Islands (Degelius, 1974).

Erioderma soledatum Gall. & Jørg. Previously reported from the Oregon coast (Lane County, Sutton Creek) by Maass (1983), we relocated it in the same vicinity in 1991 and near Clear Lake in 1995. We also found it at Eel Creek (Coos County) south of Reedsport and on the Bureau of Land Management tract at Heceta Dunes. The species was origi-

nally described by Galloway & Jørgensen (1975) from New Zealand and the Phillipines. In Oregon it is typically found on old ericaceous shrubs (especially *Rhododendron* and *Vaccinium*) in a broken *Pinus contorta* forest covering an old system of dune ridges and swales. Similar in gross appearance to *Leioderma s.*, *Erioderma* is distinguished by its thick erect tomentum and P+ orange reaction in the medulla, as opposed to matted tomentum and P- medulla of the *Leioderma s.*

Flavoparmelia caperata (L.) Hale. Although common in California, this species was previously unknown from Oregon. A single site is now known, on *Alnus* on the shore of Alsea Bay (Lincoln County, coll. W. Daly, 1994).

Heterodermia leucomelos (L.) Poelt. Although this species is globally widespread, and occurs along the coast from Mexico to Alaska, the locations are sparse enough that we should attempt to better document its status. Most of the Oregon locations are from windswept headlands in Coos and Curry Counties, particularly on the edges of dense thickets of *Picea sitchensis*. Known sites include Cape Arago, Cape Blanco, Cape Lookout, Cape Sebastian, Natural Bridge Cove Scenic Point, and 1 km S of Brookings. It is also known from Sand Lake in Tillamook County (*Pike s.n.*, OSC).

Heterodermia sp. A single collection is known of a possibly undescribed species of *Heterodermia* that is similar to *H. obscurata* but lacks the orangish lower surface. The specimen is ecorticate and darkening below, and both cortex and medulla are K+ yellow. The location is in Lane County, 1 mile E of Heceta Junction, 5 km N of Florence, 44°01'N 124°05'W, near Clear Lake, on a stabilized sand dune with open forest of *Pinus contorta* and associated shrubs (*S. Carpenter s.n.*, 1972, OSC #31,324).

Hypogymnia duplicata (Sm. ex Ach.) Rass. Common in coastal southeast Alaska, this species becomes increasingly rare southward through Washington to its southernmost known locations in northwest Oregon. The species occurs on the Pacific coasts of Asia and North America. Only a handful of Oregon populations are known, one in the Cascade Range (Larch Mountain, east of Portland, Multnomah County), and the others in the Coast Range (Neahkahnie Mountain, Saddle Mountain, Lost Prairie, the upper Siletz watershed, and Jeeter Prairie, the latter two sites east of Lincoln City and within 2 km of each other). The populations on Neahkahnie Mountain and upper Siletz are very sparse while sizable populations occur at the other Coast Range sites.

Hypogymnia pulverata (Nyl. ex Crombie) Elix. This common species of South America and Australasia is character-

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TABLE 2. Geographic affinities of rare lichens on the coast of Oregon. *Anema* sp., *Heterodermia* sp., and *Pseudocyphellaria* sp. are not assigned because of lack of adequate information. An asterisk indicates a new record for Oregon. "Repro." indicates primary mode of reproduction: asco = ascospores, frag = fragmentation, sor = soredia. In order, regions listed are Pacific Northwest endemics, southern hemisphere, tropical, subtropical, California, northeast Asia, maritime Arctic, eastern North America, and Europe (including Scandinavia).

Species	Repro.	Region								
		PNW end.	S Hem	Trop	Sub-trop	Cal	NE Asia	Mar Arct	E N Am	Eur + Scan
<i>Acarospora subrufula</i> *	asco									X
<i>Anaptychia setifera</i> *	asco						X		X	X
<i>Bryoria bicolor</i>	frag		X				X	X	X	X
<i>Bryoria pseudocapillaris</i>	frag	X								
<i>Bryoria subcana</i>	sor									X
<i>Bryoria tenuis</i>	frag							X	X	X
<i>Buellia oidalea</i> *	asco					X				
<i>Caloplaca ludificans</i>	asco					X				
<i>Caloplaca stantonii</i>	asco					X				
<i>Cladidium bolanderi</i>	asco					X				
<i>Collema furfuraceum</i> var. <i>luzonense</i> *	asco		X	X	X	X			X	
<i>Erioderma sorediatum</i>	sor		X	X	X					
<i>Flavoparmelia caperata</i>	sor		X	X	X	X	X		X	X
<i>Hypogymnia duplicata</i>	asco						X			
<i>Hypogymnia pulverata</i> *	sor		X				X		X	
<i>Lecanora caesiorubella</i> ssp. <i>merrillii</i>	asco					X				
<i>Leioderma sorediatum</i> *	sor		X	X	X					
<i>Leptogium brebissonii</i> *	sor		X	X	X					X
<i>Niebla cephalota</i> *	sor					X				
<i>Ochrolechia subplicans</i> *	asco						X	X		
<i>Pannaria rubiginosa</i> *	asco		X	X	X	X	X		X	X
<i>Placynthiella hyporhoda</i> *	asco								X	X
<i>Polychidium contortum</i> *	asco		X							
<i>Sigridia californicum</i>	asco					X				
<i>Siicta arctica</i> *	lobule						X	X		
<i>Teloschistes flavicans</i>	sor		X	X	X	X				X
<i>Toninia ruginosa</i> ssp. <i>pacifica</i> *	asco					X				
<i>Usnea hesperina</i>	frag				X				X	X
Total		2	9	9	9	12	8	4	9	11

ized by mainly solid lobes with laminal, often granular soredia (Elix, 1980, 1992). It is also known from China and the Russian Far East (Rassadina, 1971; reported as the sorediate form of *H. mundata* (Nyl.) Rass. s. lat.). Both P+ red and P- chemotypes are known. A single thallus was found in the litterfall under old *Picea sitchensis* near the top of a forested dune on BLM property near Pacific City (Tillamook County). This individual was typical and well developed, 5 cm in diameter, and with a P- medulla. The only other location reported for North America is from the coast of Hudson Bay in Quebec, where P+R material was found on *Picea mariana* (Brodo, 1989).

Lecanora caesiorubella Ach. ssp. *merrillii* Imsh. & Brodo. This subspecies is common on the California coast (Imshaug and Brodo, 1966), but is known from only two sites in Ore-

gon: on *Alnus rubra* at Sutton Creek (Lane County) and on hardwoods along the lower Rogue River (Curry County). This taxon is probably more common than the few records would indicate.

Leioderma sorediatum Gall. & Jørg. Like *Erioderma sorediatum*, *Leioderma s.* represents a circumpacific floristic element, being found in the southern hemisphere as well as Hawaii and western North and South America, where it occurs in damp humid areas such as rainforests and swamps (Galloway and Jørgensen, 1987). In parts of its range it is best developed on disturbed sites, such as edges of secondary forest and road margins. In Oregon it was found at two sites (Sutton Creek and Eel Creek) in the same habitat as *Erioderma s.* (but more commonly than that species) in old *Pinus contorta*-ericaceous shrub communities on stabilized dunes.

Successionally these sites are intermediate, with old individuals of the seral tree species *Pinus contorta*, but with little or no development of a *Picea* canopy.

Leptogium brebissonii Mont. This species has a distinctive, thick, rubbery feel when moist, not unlike some fungi in the genus *Auricularia*. A broadly distributed species of tropical affinities, *Leptogium brebissonii* is known from more than six sites in Oregon, the Olympic Peninsula (Jefferson County, north of Queets), and only one other site in North America (British Columbia; Goward *et al.*, 1994). An annotation on a historical specimen (*Pike L-557*, OSC) reveals that Sierk (1964) included this material in *L. platynum*. Four of the Oregon sites are in Lane County. At Sutton Creek it was found in a semi-exposed site on an old *Rhododendron* adjacent to the edge of an old *Picea-Pinus contorta* forest, and east of Highway 101 on *Vaccinium* (*Perkins L-11*, *Pike L-557*, OSC). Slightly south, at Heceta Dunes, a large population occurs on *Salix* stems in a wetland. A few small individuals also occur on *Picea* twigs at a forest edge in Carl Washburne State Park. A small population occurs on twigs on the summit of Neahkahnie Mountain in Tillamook County. It is also known from Curry County.

Niebla cephalota (Tuck.) Rundel & Bowler. This Californian species occurs only sporadically northward. A small number of sites are known for Oregon. It also occurs in Washington (San Juan County, *Pike 1056*, OSC). In one case it occurs on an old *Pinus contorta* on the seaward edge of an old-growth *Picea sitchensis* forest. In most cases it is on exposed, open-grown *Picea sitchensis* (several locations in Curry, Coos, and Lane Counties). These isolated remnant populations should not be collected further. This species has the peculiar property in storage of developing mold-like, filamentous crystals of lichen substances.

Ochrolechia subplicans (Nyl.) Brodo. The rock-dwelling species *Ochrolechia subplicans* was originally described (as *Pertusaria subplicans* Nyl.) from near the Bering Strait, and is known from coastal Alaska and British Columbia as far south as the Queen Charlotte Islands (Dibben, 1980; Brodo, 1988). Dibben (1980) described its distribution as "coastal trans-Beringian." Two subspecies differing in chemistry, morphology, and habitat are known from the Queen Charlotte Islands. The ssp. *hultenii* (Erichs.) Brodo occurs on shoreline rocks while ssp. *subplicans* occurs on mountain ridges. In Oregon, *O. subplicans* ssp. *subplicans* occurs on Saddle Mountain in Clatsop County. Currently this is the only site known south of the Queen Charlotte Islands.

Pannaria rubiginosa (Ach.) Bory. Although this species is globally widespread, it is scarce and erratic in the Pacific Northwest. In Oregon several coastal sites are known (Lin-

coln County near Waldport, *Bailey s.n.*; Lane County, Heceta Dunes; and Lincoln County, Beaver Creek Marsh). The only known inland site is Fisherman's Bend on the North Santiam River (Marion County, *Pittam 1013*, OSC). At Heceta Dunes a robust population was found growing on stems of old *Salix* in a wetland on the deflation plain.

Placynthiella hyporhoda (Th. Fr.) Coppins & P. James. This species was found over large areas of roadcut through a recent clearcut in the Coast Range, only 15 km from the coast. Its inconspicuous form but abundant presence in a disturbed habitat suggests that this species is probably much more common than this single record would indicate. It is easily distinguished from other *Placynthiella* species by its poorly developed thallus and small apothecia with concave disks. *Placynthiella hyporhoda* is a species of north temperate, more or less oceanic climates. The type is from western Russia (Coppins *et al.*, 1987) and other reports are from Scandinavia, Europe, and eastern North America (Coppins and James, 1984).

Polychidium contortum Henssen. Previously known in North America from B.C. (Brodo, 1995) and from New Zealand (Henssen, 1963), this species is now known from more than six sites in Oregon. These include Opal Creek in the Cascade Range, Marion County, and five sites in the Coast Range: Neahkahnie Mountain on the immediate coast (Tillamook County), Bald Mountain and in and near Valley of the Giants (Polk County), and north of Triangle Lake (Lane County, *Rosso s.n.*). This inconspicuous minutely fruticose cyanolichen may turn out to be more common than its sparse record would suggest. It is readily distinguished from other species of *Polychidium* by making a whole mount under the compound microscope. *Polychidium contortum* has a distinct jigsaw-puzzle pattern formed by the cortical cells, while other species of *Polychidium* the cortical cells are quadrate, with no hint of sinuous walls (lectotype of *P. dendriscum* in H-NYL examined). We have not yet confirmed the presence of *P. dendriscum* in the Pacific Northwest. *Polychidium contortum* might be confused with *Lichenodium canadense* Henssen, but that species is smaller and has irregular cortical cells, not in a pronounced jigsaw pattern (see illustration in Henssen, 1968).

Pseudocyphellaria sp. A species with a yellow medulla but morphologically distinct from *P. crocata* occurs sporadically on the Oregon coast (e.g., Lane County, *Pike 553*). In form it is close to *P. aurata*, having almost exclusively marginal soredia and narrow, linear lobes, a partly or wholly yellow medulla, and a pale lower surface. However, *P. aurata* has a green photobiont while this coastal morph has a blue-green photobiont. *Pseudocyphellaria crocata* has mostly laminal soralia, broader, often rotund lobes, a white or yellow me-

dulla, and typically a dark lower surface. The name *P. mougeotiana* has been applied to this form in the past, but that is a synonym of *P. crocata* (Galloway, 1985). Although *P. crocata* is frequently found in western Oregon, it seems to differ from this narrow-lobed coastal morph. More study is needed to determine whether these characteristics are faithfully maintained without intermediates in populations in coastal *Picea* forests, with individuals of both species growing side by side.

Sigridia californicum (Tuck.) Tehler. This species is known from only one site north of California, on *Picea sitchensis* at the mouth of the Sixes River (Tehler, 1994; McCune 18300, OSC, UPS). Historically it was known from San Francisco to Los Angeles along the coast (Tehler, 1985).

Sticta arctica Degel. Previously known from the Alaskan maritime Arctic and sporadically along the Alaskan coast, Chiska Derr's find of this species on massive moss-covered basalt outcrops on Saddle Mountain, Clatsop Co., Oregon (Derr 881, OSC), extended its range over 1000 km to the south. Since then, additional specimens from BC and Washington were located in COLO (BC: Queen Charlotte Islands, Moresby Island, rocky ledge at edge of beach, Brodo 12609; Washington: Island County, Whidbey Island, Deception Pass State Park, on soil and rocks along ocean bluffs, Rundel 7220, June 1973; both specimens had been named *S. weigeli*). The population at Saddle Mountain is very small and should not be collected. The sparsely lobulate margins fall well within the normal variation in lobulation found in specimens from the Arctic. The habitat and absence of cylindrical isidia separate it from *S. weigeli*.

Teloschistes flavicans (Swartz) Norm. Although very common and widespread in tropical areas, this conspicuous, bright orange to yellowish green lichen is certainly rare in Oregon. It is known in Oregon from only four general localities. Its presence on the long, forested headland at Cape Lookout is conspicuous and well known. There it occurs in an old *Picea* forest, and is common in the litterfall. It is also known from a small old *Picea* forest on BLM property just north of Pacific City, also in Tillamook County. A third, recently discovered site (Rittenhouse 1684, OSC) is also a forested headland, Cape Blanco (Curry County), where it was found on hardwoods beneath sparse *Picea*. The fourth site is another headland near Harris Beach, where a small population occurs on *Picea*.

Toninia ruginosa (Tuck.) Herre ssp. *pacifica* Timdal. Most common from Santa Cruz south to Baja California, this taxon is known from one site in California north of San Francisco (Timdal, 1991). The only Oregon site is on a seastack just south of Coquille Point (Coos County, west of Bandon). The

ssp. *ruginosa* is much more common and widespread than ssp. *pacifica*. The two subspecies are readily distinguished, ssp. *pacifica* having reddish brown squamules and 1–3 septate spores, while ssp. *ruginosa* has a dark blackish green thallus and 3–7 septate spores.

Usnea hesperina Mot. At a distance, and even at arm's length, this lichen can appear like robust colonies of *Alectoria sarmentosa*. Some individuals lack fibrils completely, so that only by breaking a strand will you be convinced that you have an *Usnea*, not *Alectoria*. However, the habitat is atypical for *Alectoria* in our area. So far *Usnea hesperina* has been reported from western North America only from western Oregon. The ssp. *liturata* Mot. included in Pittam (1995) differs from the coastal material cited here, in that the coastal material is mostly non-papillate, non-foveolate, and non-isidiate, and up to 50 cm long. It has been found on *Picea* and *Pinus* in several locations, including the Eel Creek, Sutton Creek, and Heceta Dunes areas (Lane County). Elsewhere it is a widespread subtropical and tropical species (including southeast United States).

GEOGRAPHIC AFFINITIES

The species occurrences reported here include a number of extreme disjunct populations, with affinities to the southern hemisphere, tropical and subtropical areas, California, northeastern Asia, maritime Arctic, eastern North America, and Europe (Table 2).

In general, lichens are more broadly distributed than vascular plants. This is reflected in the low level of endemism among the species discussed here. Only two of these rare species are endemic to the Pacific Northwest. Many lichens that are common in western North America appear to be native also to Asia, Europe, and in some cases the southern Hemisphere.

Of the 28 species highlighted in Table 2, 14 reproduce primarily by spores produced from apothecia, 8 by soredia, none by isidia, one by lobules, and four by fragmentation. It is perhaps significant that most of the species reproduce primarily by one of the two smallest classes of propagules, ascospores and soredia. Species with small propagules probably have higher rates of arrival from distant sources and might therefore be over-represented among lichens with sparse, erratic distributions. This hypothesis would be supported if it could be demonstrated that the proportion of species with small propagules in this group is greater than those of lichens at large.

RATES OF IMMIGRATION AND EXTIRPATION

Because the number of species present in an area depends on the relative rates of arrivals and extirpations, the high number of rare species on the coast should be the result of higher rates of arrival and/or lower rates of extirpations than farther inland.

We propose that both factors operate to enhance the number of unusual lichen species on the coast of Oregon. Higher rates of arrival may result from the heavy use of the Oregon coast by migrating birds. Many birds winter on the coast that breed in more northern areas. The coast serves as a migratory pathway. Perhaps we can think of lichen propagules as litter along migratory highways.

One of the most destructive natural forces for lichen communities is fire. The fairly high fire frequency in much of western North America probably does much to reduce the incidental occurrences of lichen species in the forest matrix at large. Some of the richest lichen habitats in the West are in natural refugia from fire. Examples of refugia from fire are extensive areas of talus and outcrops on north slopes, canyons with moist bottoms and steep rocky walls, and *Sphagnum* bogs. The coastal forests have a low historical fire frequency. The broken topography, natural firebreaks, and ocean spray all act to further reduce the influence of fire on the immediate coast, thus favoring the accumulation of "accidental" species.

CONCENTRATIONS OF RARE SPECIES

It is clear that the rare lichen species of coastal Oregon are not randomly distributed but that certain areas, topographic positions, and landforms have unusual concentrations of the rare species.

Several species are most common on the major headlands and capes. Two examples of this are *Heterodermia leucomelos* and *Teloschistes flavicans*. The promontories most often cited are Cape Arago, Cape Blanco, Cape Lookout, and Cape Sebastian.

The dune sheet from Heceta Head to Coos Bay contains a rich lichen flora with many rare species, including most or all of the Oregon locations for *Bryoria furcellata*, *B. pseudocapillaris*, *Erioderma sorediatum*, *Heterodermia* sp., and *Leioderma sorediatum*. In addition, this area hosts notable populations of *Pannaria rubiginosa* and *Usnea hesperina*. Concentrations of rare species exist at Eel Creek, Heceta Dunes (BLM property), Sutton Creek, and Clear Lake. Two kinds of sand dune vegetation seem to hold the most species: old, open conifer stands with a broken ericaceous understory

and wetlands with large old shrubs. The dunes deserve much more exploration so that we can better set conservation priorities and more confidently distinguish between true rarity and sparseness of field work.

Exposed rocky mountain summits near the coast hold remarkable concentrations of rare species, both epiphytic and growing on the rocks and moss mats. The best known of these is Saddle Mountain, where a number of rare species including *Bryoria bicolor*, *Hypogymnia duplicata*, *Ochrolechia subplicans*, and *Sticta arctica* are found. However, study of other rocky summits is likely to produce many additional records, as evidenced by our finding *Bryoria bicolor*, *Hypogymnia duplicata*, *Leptogium brebissonii*, and *Polychidium contortum* on Neahkahnie Mountain.

Several rare species are also found on littoral and supra-littoral rocks, but at present there does not appear to be an obvious concentration of species in any particular locality. Rare species from this habitat include *Acarospora subrufula*, *Caloplaca ludificans*, *C. stantonii*, *Cladidium bolanderi*, and *Toninia ruginosa* ssp. *pacifica*. Despite the concentration of interesting species on the supralittoral rocks, their lichen flora has been poorly studied, with the exception of studies of Arup (1995b) and Ryan (1988a, b).

Exploration for lichens on the Oregon coast is still in an exciting stage of discovery. As evidence of the rapid increase in knowledge, we note that of the 28 species highlighted here, 15 are new to Oregon, 5 have been described in the last 10 years, and one is new to North America. We hope that this paper will stimulate acquisition of further data on these and other coastal species.

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