

# ANNOTATED BIBLIOGRAPHY OF BEACH AND DUNE PLANT COMMUNITIES IN BRITISH COLUMBIA

Nick Page – Raincoast Applied Ecology  
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1. Barbour, M.G., T.M. De Jong, and A.F. Johnson. 1976. Synecology of beach vegetation along the Pacific Coast of the United States: a first approximation. *Journal of Biogeography* 3: 55–69.

Zonal patterns of beach vegetation development were examined from 34 beaches between Washington State and Mexico. The study focused on profile diagrams describing the spatial distribution of beach plant species, and the identification of species assemblages (stands). Many of the species are found in beaches of coastal BC.

2. Bell, M.A.M. 1972. Flora and vegetation of Pacific Rim National Park: Phase I, Long Beach. Manuscript, Canada Department of Indian and Northern Affairs, Ottawa.

This report provides a summary of vegetation characteristics of two beach and dune plant communities in Pacific Rim National Park Reserve: *Elymus mollis* (*Leymus mollis* spp. *mollis*) beaches and *Carex macrocephala* sand dunes. No detailed plot data are provided.

3. Bell, M.A.M. and A. Harcombe. 1973. Flora and vegetation of Pacific Rim National Park: Phase II, Broken Group Islands. Manuscript, Canada Department of Indian and Northern Affairs, Ottawa.

4. Bornhold, B.D., K.W. Conway, and T. Sagayama. 1996. Coastal sedimentary processes, Savary Island, B.C. – A preliminary assessment. Geological Survey of Canada.

5. Bradfield, G.E. and A. Campbell. 1986. Vegetation–elevation correlation on two dyked marshes of northeastern Vancouver Island: a multivariate analysis. *Can. J. Bot.* 64 (11): 2487-2494.

The study examined estuarine plant communities in two tidal marshes (Koskish and Cluxewe rivers) on northeastern Vancouver Island related them to elevation. The study does not specifically address beach or dune plant communities but some of the plant species are shared with estuaries.

6. Breckon, G.J. and M.G. Barbour. 1974. Review of North American Pacific Coast beach vegetation. *Madrono* 22: 333–360.

Phytogeographic study of patterns of beach plants on the Pacific Coast. It describes several latitudinal bands based on floristics. Useful information on species distribution but very little information on plant communities.

7. Cadrin, C. and L. Lacelle. 2005. Sensitive Ecosystems of Savary Island: A Natural History. Savary Island Land Trust Newsletter. Summer 2005.

8. Calder, J.A. and R.L. Taylor. 1968. Flora of the Queen Charlotte Islands Part 1: Systematics of the Vascular Plants. Research Branch, Canada Department of Agriculture, Monograph Number 4, Part 1. 659 pp.

As well providing detailed records of plant species distribution on the Queen Charlotte Islands (including maps), this research report provides descriptions of plant communities. Descriptions of maritime plant communities include shingle beaches (wave influenced and tidal action only) and sand beaches (crescent beaches and continuous sand beaches). Vegetation on Rose Spit is described in greater detail. Plant communities do not appear to have been described quantitatively and are referred to as 'stands' (e.g., stand of *Carex macrocephala*).

9. Campbell, A. and G.E. Bradfield. 1989. Comparison of plant community–environment relationships in two estuarine marshes of northern British Columbia. *Can. J. Bot.* 67: 146–155.

Characterization of plant communities, vegetation–environment relationships, and species composition in two estuarine marshes in northern BC. Several of the plant communities may be transitional to beach plant communities.

10. Clarke, L.J. 1974. Lewis Clark's Field Guide to Wild Flowers of the Sea Coast in the Pacific Northwest. Gray's Publishing Limited, Sydney, BC.

Field guide focusing on showy wildflowers found in coastal beaches and meadows. Extensive photos but limited discussion of specific ecological requirements or plant community development.

11. Clement, C. 1998. Ecosystem units of James Island. Unpublished report prepared for TerraMar Environmental Research Limited, Sidney, BC.

12. Buchanan, M. 2000. A preliminary flora of Sandy Island Marine Park. Unpublished species list. 6 pp.

A list of 150 vascular plants and 5 mosses recorded from Sandy Island Provincial Park by local naturalists. The list is broken into trees, shrubs, and herbaceous plants.

13. Christy, J.A., J.S. Kagan, and A.M. Wiedemann. 1998. Plant associations of the Oregon Dunes National Recreation Area: Siuslaw National Forest, Oregon. U.S. Dept. of Agriculture, Forest Service, Pacific Northwest Region. Series Technical paper R6-NR-ECOL. 183 pp.

Comprehensive guide to the plant associations of the Oregon Dunes National Recreation Area in central Oregon. It includes information on geology, climate, soils, wildlife, and ecological processes. The study identified 52 plant associations using the methods of the US National Vegetation Classification System. Several of the associations are found in BC. They described several *Festuca rubra*-dominated associations from the Oregon Dunes National Recreation Area but none are considered similar to the association (*Artemisia campestris* – *Festuca rubra* spp. *rubra* / *Racomitrium canescens* Herbaceous Vegetation) described from BC. They also described a *Poa macrantha* association from the Oregon Dunes National Recreation Area that appears to be equivalent to the association described from BC (*Poa macrantha* Sparse Vegetation). It is

included *Poa macrantha* with *Lupinus littoralis*, *Glehnia littoralis* spp. *leiocarpa*, *Potentilla pacifica*, and *Festuca rubra*.

14. Cordes, L.D. 1972. An ecological study of the Sitka spruce forest on the west coast of Vancouver Island. Ph.D. thesis, Department of Botany, University of British Columbia, Vancouver, BC. 132 pp.

Detailed study of the environmental factors influencing soil and vegetation characteristics of the Sitka spruce forest along maritime shorelines on the west coast of Vancouver Island. It focuses on soil chemistry and the ecological effects of salt spray on vegetation.

15. Dunster, K. 2000. Sand dune ecosystems on Savary Island, B.C. with particular reference to D.L. 1375. Prepared for the Savary Island Land Trust.
16. Flynn, S., C. Cadrin, and D. Filatow. 2006. Coastal Sand Dune Ecosystems in British Columbia. Ecosystems in British Columbia at Risk brochure. BC Ministry of Environment. 6 pp.
17. Franklin, J.F. and C.T. Dyrness. 1988. Natural vegetation of Oregon and Washington. Corvallis, Oregon, Oregon State University Press. 417 pp.
18. Golumbia, T. 2001. Classification of plant communities in Gwaii Haanas National Park Reserve and Haida Heritage Site. Unpublished master's thesis in the Faculty of Forestry, University of British Columbia. 183 pp.

Existing vegetation data from the Queen Charlotte Islands (Gwaii Haanas) were classified. This classification identified 9 alliances, 20 associations and 12 subassociations. One association from beaches was described: *Festuca rubra* – *Leymus mollis* Herbaceous Vegetation (*Festuca rubra* – *Hordeum brachyantherum* Herbaceous Vegetation was described from estuaries). The author noted: "it occurs above the high tide and is often transitional to coastal Sitka spruce forest. The substrate is rapidly drained marine sands and gravels occurring as both beach and dune formations." Both associations were grouped in the *Festuca rubra* Herbaceous Vegetation Alliance.

19. Hebda, R.J., R.T. Ogilvie, H. Roemer and A. Banner. 1997. Vegetation of Brooks Peninsula. In: *Brooks Peninsula: An Ice Age Refugium on Vancouver Island*. Hebda, R.J. and J.C. Haggarty (eds.) Occasional Paper No. 5, B.C. Ministry of Environment, Lands and Parks, Victoria, BC.

Excerpted from BEN (Adolf Ceska): "The publication has 16 chapters that deal with various aspects of the Brooks Peninsula (geology and soils, plants and vegetation, terrestrial arthropods, fishes and vertebrates, and ethnographic history and archaeology of the area). Bob Ogilvie's excellent chapter on vascular plants of the area (48 pages) gives a complete list of species and discusses phytogeographical problems, a chapter on vegetation (Richard Hebda *et al.*) describes the main vegetation formations [divided into four major physiognomic types], and palaeobotanical explorations are summarized by Richard Hebda (48 pages). Chromosome numbers of 30 vascular plants are discussed by C.C. Chinnappa, and Wilf Schofield provided a list of bryophytes collected on Brooks Peninsula."

Beach Herbaceous Vegetation was identified as one of fifteen vegetation types. It was described from nine plots (raw data with cover estimated on a Braun-Blanquet scale are included). Beach Herbaceous Vegetation appears to include lower beach communities (e.g., *Cakile edentula*-dominated), upper beach (*Leymus mollis* spp. *mollis*-dominated), and dune (*Poa macrantha*, *Carex macrocephala*, and *Abronia latifolia*). The report is very useful in placing beach vegetation in context with other vegetation types.

20. Kagan, J.S. J.A. Christy, M.P. Murray, and J.A. Titus. 2000. Classification of native vegetation of Oregon. Oregon Natural Heritage Program. 63 pp.

Relatively current list of plant communities of conservation concern in Oregon. It includes a variety of beach and dune plant associations; most are from Christy *et al.* (1998). It includes a *Poa macrantha* association using a synonymous name: *Poa douglasii* ssp. *macrantha* Dunes. It is the only association in the alliance: *Poa douglasii* ssp. *macrantha* Short-Sod Herbaceous Alliance. It is listed as G1S1.

21. Kirkby, J. 2000. Sensitive Ecosystem Inventory of Savary Island. Letter to Liz Webster, Savary Island Land Trust. June 15, 2000 (available at [www.silt.ca](http://www.silt.ca)).

A brief letter describing dune plant communities that were assessed as part of the sensitive ecosystem inventory on Savary Island. Based on the inventory, the letter notes that a new community type named *Artemisia campestris* – *Grindelia integrifolia* (*Festuca rubra*) was described and ranked as S1. This association is encompassed by the association *Artemisia campestris* – *Festuca rubra* spp. *rubra* / *Racomitrium canescens* Herbaceous Vegetation. Other dune plant associations found on Savary Island included: *Carex macrocephala* herbaceous vegetation -S2 (red-listed); *Festuca rubra* – *Ambrosia chamissonis* herbaceous vegetation S2 (red-listed); *Leymus mollis* ssp. *mollis* – *Lathyrus japonicus* herbaceous vegetation S2 (red-listed). Two additional plant associations were noted but require more information: *Pteridium aquilinum* – *Carex inops* – *Zygadenus venenosus* and *Leymus mollis* ssp. *mollis* – *Gaultheria shallon* – *Equisetum hyemale*.

22. Kozloff, E.N. 1983. Seashore Life of the Northern Pacific Coast: An Illustrated Guide to Northern California, Oregon, Washington, and British Columbia. Douglas & McIntyre, Vancouver. 370 pp.

A guide to seashore ecosystems including docks and pilings, rocky shore, and sandy beaches. The emphasis is on zoology but the description of the plants of the backshore and dunes (pp. 268–281) is excellent.

23. Kumler, M.L. 1969. Plant Succession on the sand dunes of the Oregon coast. *Ecology* 50(4):695–704.
24. Kunze, L.M. 1984. Puget Sound coastal wetland sanctuaries: a summary report of recommended sites. Washington Natural Heritage Program, Dept. of Natural Resources, Washington Dept. of Ecology. Olympia, Washington. 154 pp.

This study inventoried coastal wetlands in Puget Sound, Washington to identify candidate sites for estuarine sanctuaries. It also assessed several beach and dunes sites including Dungeness Spit

near Port Angeles and Perego's Lagoon on Whidbey Island. Several beach and dune plant communities or species assemblages are listed with dominant and minor species described. The report is very useful for general vegetation information, but he lacks adequate information on sampling and classification methods to assist in reviewing plant associations. Summary or raw plot data is not included. Kunze described an *Artemisia campestris* – *Lomatium nudicaule* assemblage from several sites in Puget Sound, WA including Dungeness Spit.

25. Kuramoto, R.T. 1965. Plant Associations and Succession in the Vegetation of the Sand Dunes of Long Beach, Vancouver Island. M.Sc. thesis, Department of Botany, University of British Columbia. 88 pp.

Kuramoto's thesis was the first comprehensive ecological study of beach vegetation on the west coast of British Columbia and remains a very important descriptive study. Seven plant associations were identified using Braun-Blanquet sampling, classification, and naming methods from 116 sample plots. The thesis includes some environmental information (e.g., soil chemistry) and interpretation of successional patterns. Several photos are included and summary data is included as an appendix. The associations described are (using older species names): 1) *Cakile edentula* Association; 2) *Poa macrantha* Association; 3) *Arctostaphylos uva-ursi* – *Rhacomitrium canescens* Association; 4) *Elymus vancouverensis* Association; 5) *Aira praecox* – *Ceratodon purpureus* Association; 6) *Arctostaphylos uva-ursi* – *Eurhynchium oreganum* Association; and, 7) *Picea sitchensis* – *Gaultheria shallon* – *Maianthemum dilatatum* Association. Several subassociations, including *Ammophila arenaria* Association, were also described.

26. MacDonald, K.B., and M.G. Barbour. 1974. Beach and salt marsh vegetation of the North American pacific coast. In: *Ecology of halophytes*. R. J. Reimold and W. H. Queen (eds.). Academic Press, New York, New York. 565 pp.

A broad range of information on beach and salt marsh vegetation was reviewed for the Pacific Coast between Baja California and Point Barrow, Alaska. Dune vegetation was excluded. The study was written as a chapter in a book on the ecology of halophytic plants and includes extensive biogeographic information on plant species. Information on plant communities is much sparser.

27. MacKenzie, W., D. Remington and J. Shaw. 1999. Estuaries of the North Coast of British Columbia: a reconnaissance survey. Report prepared for the Ministry of Environment, Lands and Parks and the Ministry of Forests, Research Branch. 95 pp.

One beach plant association was described as part of a reconnaissance survey of 27 estuaries on the north coast of BC: *Leymus mollis* – *Conioselinum pacificum* Herbaceous Vegetation. It notes that: dunegrass sites are common on raised beach ridges or berms where coarse textured materials have been deposited by beach forming processes. The herb layer is dominated by *Leymus mollis*. Other species such as *Conioselinum pacificum*, *Achillia millefolium*, and *Heracleum lanatum* are often scattered throughout. *Ligusticum scoticum* can also be present, sometimes in relatively high abundance, on sites north of Vancouver Island. The tree, shrub, and bryophyte layers are nearly absent.”

28. Meidinger, D. and J. Pojar (eds.). 1991. *Ecosystems of British Columbia*. B.C. Ministry of Forests Special Report Series 6. 330 pp.
29. Neumann, J. 1995. An investigation of possible factors affecting plant species diversity on sandy ocean beaches. Unpublished paper, Bamfield Marine Station, Bamfield, BC.

A student paper (Bamfield Marine Station) was written on the presence and absence of beach plant species on eight sand beaches near Barkley Sound. Species presence was related to environmental factors including beach size, presence of driftwood, slope, sandiness, and human use. It includes a species list.

30. Page, N.A. 2003. Community and regional scale patterns of native and exotic plant species in sand beaches of Vancouver Island, British Columbia. Unpublished master of science thesis in the Institute of Resources, Environment, and Sustainability, University of British Columbia. 79 pp.

Recent master's thesis on beach vegetation patterns on the west coast of Vancouver Island. The thesis focused on identifying and describing seven plant associations from sand beaches, and local (site-level) and regional patterns of native and exotic plant species. Eighteen beaches were inventoried using quantitative assessment methods (approx. 850, 2 x 2 m plots). One hundred and fifty four plant species were present in the 612 plots used to describe and classify seven plant associations: 1) *Cakile edentula* - *Atriplex gmelinii* Sparse Vegetation; 2) *Leymus mollis* spp. *mollis* - *Lathyrus japonicus* Herbaceous Vegetation; 3) *Festuca rubra* - *Fragaria chiloensis* Herbaceous Vegetation; 4) *Ammophila arenaria* Herbaceous Vegetation; 5) *Arctostaphylos uva-ursi* Dwarf Shrubland; 6) *Eurhynchium praelongum* / *Gaultheria shallon* Shrubland; and, 7) *Poa macrantha* Sparse Vegetation. All were noted as having potential conservation concern because the limited development of beach vegetation in coastal British Columbia.

31. Quadra Planning Consultants Ltd. 1996. Boundary Bay Regional Park Plan: 1996. Unpublished report prepared for Greater Vancouver Regional District Parks Department and Environment Canada. 75 pp.

Dune and beach vegetation communities were mapped and described as part of an overall plan for the regional park. The park contains some active dunes along the shore and older stabilized dunes or spits that were affected by historic diking. Specific information on beach or dune plant species is very limited.

32. Radcliffe, G. and G. Porter. 1992. Naikoon Provincial Park: Vegetation and Biodiversity Assessment. Unpublished report prepared for B.C. Minist. Environ., Lands and Parks, Northern Region by Madrone Consultants Ltd. ?? pp.

The authors described a vegetation type they called *Poa douglasii* – *Carex macrocephala* – *Tanacetum huronense* from dunes at Rose Spit at the northeast end of the Queen Charlotte. It is represented by one plot and is not considered a legitimate association based on limited sampling. Note, *Poa douglasii* is a synonym for *Poa macrantha*.

33. Roemer, H. 2000. Ecological significance of Lot 1375 and associated parcels, Savary Island based on land forms and vegetation. Unpublished report prepared for BC Conservation Data Centre and BC Parks. 6 pp.

Brief, unpublished report focusing on vegetation on District Lot 1375, a dune complex on the west coast of Savary Island. It also contains vegetation information from other beach or dunes sites on Savary Island. It is based on a reconnaissance survey conducted on April 10/11, 2000. It contains summary information on the site, a description of the vegetation and landform sequence including species combinations by strata, conservation significance, a table of plant species presence from 13 plots, species list of infrequent plants, and a map of sampling locations.

34. Roemer, H. 2001. Vegetation data from Sandy Island Provincial Park, BC. Unpublished vegetation data. Excel spreadsheet.

Quantitative vegetation data from dune and meadow plant communities on Sandy Island collected on May 17-18, 2001. The author noted a provisional association from fourteen plots as *Artemisia campestris* var. *pacifica* – *Festuca rubra* spp. *arenicola* / *Rhacomitrium canescens* Herbaceous Vegetation but he did not formally describe it at that time. It is encompassed by the association: *Artemisia campestris* – *Festuca rubra* spp. *rubra* / *Racomitrium canescens* Herbaceous Vegetation. Three other provisional communities were described: 1) *Abronia latifolia* – *Tortula ruralis*; 2) *Leymus mollis* spp. *mollis*; 3) *Leymus mollis* spp. *mollis* – *Cerastium arvense*; 4) *Lomatium nudicaule* – *Homalothecium* sp.

35. Roemer, H. 2000. Plant Combinations and Communities on Rose Spit, Ecological Reserve #10. Unpublished report. 2 pp.

The author described a community from Rose Spit Ecological Reserve (ER #10) on the northeast tip of the Queen Charlotte Islands: *Fragaria chiloensis* – *Achillea millefolium* – *Poa confinis* Community. He noted it was found on flat, sandy or gravelly sites. Plot data is not included in his brief summary and it is unknown how this community is related to *Poa macrantha* Sparse Vegetation.

36. Sadler, K. 2000. Bryophytes of Savary Island D.L. 1375. Letter to Liz Webster, Savary Island Land Trust. September 14, 2000.

Unpublished letter with a list of bryophytes identified in the dunes and adjacent areas on Savary Island in June 2000.

37. Seabloom, E.W. and A.M. Wiedemann. 1994. Distribution and effects of *Ammophila breviligulata* Fern. (American Beachgrass) on the foredunes of the Washington coast. *Journal of Coastal Research* 10(1): 178–188.

38. Stockton, S. 2003. Vegetation data from Laskeek Bay, Queen Charlotte Islands. Unpublished vegetation data. Excel spreadsheet.

Quantitative vegetation data from 70 shoreline plots (3.6m radius) on seven islands in Laskeek Bay, Queen Charlotte Islands, BC. Data collected from rocky shorelines, as well as sand or cobble beaches. Includes several plots that were included in the *Leymus mollis* spp. *mollis* Herbaceous Vegetation Alliance.

39. Strix Environmental Consulting. 2003. Savary Island Dune and Shoreline Study: Ecological Component. Unpublished report prepared for Powell River Regional District (in association with Thurber Engineering Ltd.) 35 pp.

A recent report describing the physical and ecological characteristics of shoreline areas on Savary Island, BC to provide context for evaluating the ecological effects of shoreline change. Some descriptive information on plant distribution and soil characteristics is provided but detailed plot information is not.

40. Thomson, R.E. 1981. *Oceanography of the British Columbia Coast*. Canadian Special Publication of Fisheries and Aquatic Sciences 56. Ottawa, Ontario. 291 pp.

This report does not provide information on vegetation but does describe coastal processes (e.g., tides, waves, sand movement, etc) that are relevant to understanding the development of beach plant communities.

41. Ward, P., G. Radcliffe, J. Kirkby, J. Illingworth and C. Cadrin. 1998. Sensitive Ecosystems Inventory: East Vancouver Island and Gulf Islands, 1993 - 1997. Volume 1: Methodology, Ecological Descriptions and Results. Technical Report Series No. 320, Canadian Wildlife Service, Pacific and Yukon Region, British Columbia. 147 pp.

Beach and dune ecosystems were inventoried as part of a landscape scale assessment of a variety of sensitive ecosystems on the east coast of Vancouver Island and the Gulf Islands. Beach and dune ecosystems were generally classified as Sparsely Vegetated sensitive ecosystems. The report provides some descriptive information on ecosystem characteristics. Eighty six Sparsely Vegetated sensitive ecosystem sites were identified which accounted for 340.4 ha. in the study area (<0.1%). A second volume provides information on the management of sensitive ecosystems.

42. Wiedemann, A.M. 1966. Contributions to the plant ecology of the Oregon coastal sand dunes. Ph.D. dissertation. Oregon State University, Corvallis. 255 pp.

Not reviewed. Likely similar to report immediately below.

43. Wiedemann, A.M. 1984. The ecology of Pacific Northwest coastal sand dunes: a community profile. USFWS FWS/OBS-84/04. 130 pp.

Comprehensive report on the geology, climate, vegetation, wildlife, and ecological processes of coastal dunes in the Pacific Northwest, with emphasis on Oregon. It describes 21 plant communities. Many are not found in BC, however, several are equivalent or similar including *Poa macrantha*–*Lathyrus littoralis* and *Ammophila arenaria* Plant Communities. The *Poa macrantha* – *Lathyrus littoralis* association is structurally very similar but floristically distinct from *Poa macrantha* Sparse Vegetation because of the presence of *Lathyrus littoralis* (*L. littoralis* is rare in dunes and beaches of the west coast of Vancouver Island; it has been recorded only once in dunes at Radar Beach, PRNPR). It is perhaps better described as a subassociation of *Poa macrantha* Sparse Vegetation.

44. Wiedemann, A.M. 1993. Dry coastal ecosystems of northwestern North America. In: *Ecosystems of the World: Dry Coastal Ecosystems*. E. van der Maarel (ed.). Elsevier, New York. Pp. 341–358.

Restatement of previous work by A. Wiedemann (see above).

45. Wiedemann, A.M. and A. Pickart. 1996. The *Ammophila* problem on the Northwest Coast of North America. *Landscape and Urban Planning* 34: 287–299.

Review of the causes and effects of *Ammophila arenaria* invasion on beach plants and plant communities on the Pacific Coast.

46. Wiedemann, A.M. L.J. Dennis, and F.H. Smith. 1999. *Plants of the Oregon Coastal Dunes*. University of Oregon Press, Corvallis. 128 pp.

Field guide to plants of the Oregon dunes; emphasis on identification with excellent photos. Very little information on plant communities.