

## **Ecological site F004AC206OR Dune Forest**

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### **General information**

**Provisional.** A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

### **MLRA notes**

Major Land Resource Area (MLRA): 004A—Sitka Spruce Belt

This resource area is along the coast of the Pacific Ocean. It is characterized by a marine climate and coastal fog belt. The parent material is primarily glacial, marine, or alluvial sediment and some scattered areas of Tertiary sedimentary rock and organic deposits. Glacial deposits are dominant in the northern part of the MLRA in Washington; marine and alluvial deposits and eolian sand are dominant along the southern part of the Washington coast and extending into Oregon. The mean annual precipitation ranges from 52 to 60 inches near the beaches to more than 190 inches in the inland areas of the MLRA.

Andisols and Inceptisols are the dominant soil orders in the MLRA, but Spodosols, Entisols, and Histosols are also present. The soils are shallow to very deep and very poorly drained to somewhat excessively drained. They are on hilly marine terraces and drift plains; coastal uplands, hills, and foothills; flood plains; and coastal dunes, marshes, and estuaries.

The soil temperature regimes of MLRA 4A are moderated by the proximity to the Pacific Ocean, which eases the differences between the mean summer and winter temperatures. The seasonal differences in temperature are more pronounced in adjacent MLRAs further inland. Included in MLRA 4A are soils in cooler areas at higher elevations or on northerly aspects that have an isofrigid temperature regime.

The soil moisture regimes of MLRA 4A are typified by soils that do not have an extended dry period during normal years. Many of the soils further inland in MLRA 2 have a dry period in summer. Soils in low-lying areas and depressions of MLRA 4A are saturated in the rooting zone for extended periods due to a high water table or long or very long periods of flooding or ponding.

#### **MLRA 4A Soil Temperature Regimes**

**Isomesic** The mean annual soil temperature (measured at a depth of 20 inches) is 46 to 59 degrees F, and the difference between the mean winter and summer temperatures is less than 11 degrees. The seasonal soil temperatures and difference between the mean winter and summer temperatures are moderated by the proximity to the ocean and the effects of fog in summer.

**Isofrigid** The mean annual soil temperature (measured at a depth of 20 inches) is 32 degrees F to less than 46 degrees, and the difference between the mean winter and mean summer temperatures is less than 11 degrees. The seasonal soil temperatures and difference between the mean winter and summer temperatures are moderated by the proximity to the ocean and the effects of fog in summer. The temperatures are cooler than in surrounding lowlands because of the higher elevation and differences in slope and aspect.

#### **MLRA 4A Soil Moisture Regimes**

**Udic** The soil rooting zone is not dry in any part for more than 90 cumulative days in normal years. Soil moisture does not limit plant growth because of the fog in summer.

**Aquic** The soil is virtually free of dissolved oxygen due to saturation of the rooting zone. The soils are saturated for extended periods during the growing season and may be subject to long or very long periods of ponding and flooding.

Refer to Keys to Soil Taxonomy for complete definitions of the soil temperature and moisture regimes.

LRU notes

The Southern Sitka Spruce Belt land resource unit (LRU C) of MLRA 4A is along the west coast of Oregon. This LRU extends from the northern edge of South Slough to the Chetco River, and it is bounded on the west by the Pacific Ocean. The area consists of sand dunes, flood plains, and marine terraces that extend a few miles east and are parallel to the Pacific Ocean, and it transitions to steeper, higher elevation ridges and foothills of the western slopes of the Coast Range. The soils in the coastal lowland areas dominantly formed in eolian (wind-deposited) sand, alluvium, and marine sediment. The soils in the coastal foothills formed in residuum, colluvium, and landslide deposits derived from sedimentary and basaltic rock. Minor additions of recent alluvium are along the river valleys. Several major rivers that have headwaters in the coastal mountains carved steep, narrow valleys through the foothills before entering the broader coastal valleys. Subduction zones along the Pacific Coast may cause significant earthquakes and tsunamis, which would disrupt the ecological processes beyond what is described in this ecological site description.

Classification relationships

National vegetation classification: G205 Vancouverian Dry Coastal and Lowland Beach Pine Forest and Woodland; A3717 Sand Dune Woodland Alliance  
Plant associations of the Oregon Dunes National Recreation Area: Shore pine-Sitka spruce/Evergreen Huckleberry Forest; Sitka spruce/Evergreen Huckleberry Forest

Ecological site concept

This ecological site is on the western coastline of the Pacific Northwest, from central to southern Oregon. It is inland from coastal beaches and foredunes. This site develops on mature, stabilized dunes in areas where tree species root and become established. Note that this site is different than the stabilization of dunes from invasive species in the Foredune Scrub and Grassland (R04AC205OR) ecological site.

The maritime climate is characterized by cool, moist summers and cool, wet winters. The mean annual precipitation is 55 to 90 inches. Coastal fog provides supplemental moisture in summer. The mean annual air temperature is 50 to 54 degrees F. Snowfall is rare, and it is not persistent when it occurs.

The soils associated with this site are very deep and somewhat poorly drained to well drained. They formed in mixed eolian sand. They have limited available water capacity due to the sandy texture. Some of the older dunes have been stabilized long enough to start developing a spodic horizon; however, it is weakly expressed because of the relative young age of the soil material. The process of podzolization occurs when organic acids form soluble complexes with aluminum and iron in the soil, creating a distinct zone of eluviation (albic horizon) and distinct redder zone of accumulated iron (spodic horizon).

The dominant vegetation is tolerant of strong winds, a seasonal high water table, wind desiccation, low nutrient availability, and salt spray. The most common species include shore pine (*Pinus contorta* var. *contorta*), Sitka spruce (*Picea sitchensis*), California wax myrtle (*Morella californica*), evergreen huckleberry (*Vaccinium ovatum*), salal (*Gaultheria shallon*), kinnikinnick (*Arctostaphylos uva-ursi*), western azalea (*Rhododendron occidentale*), and coyotebrush (*Baccharis pilularis*). The most common natural disturbance is strong windstorms. Fire and tidal surges during storms occur infrequently.

Table 1. Dominant plant species

Tree	(1) <i>Pinus contorta</i> var. <i>contorta</i> (2) <i>Picea sitchensis</i>
Shrub	(1) <i>Morella californica</i> (2) <i>Vaccinium ovatum</i>
Herbaceous	Not specified

Physiographic features

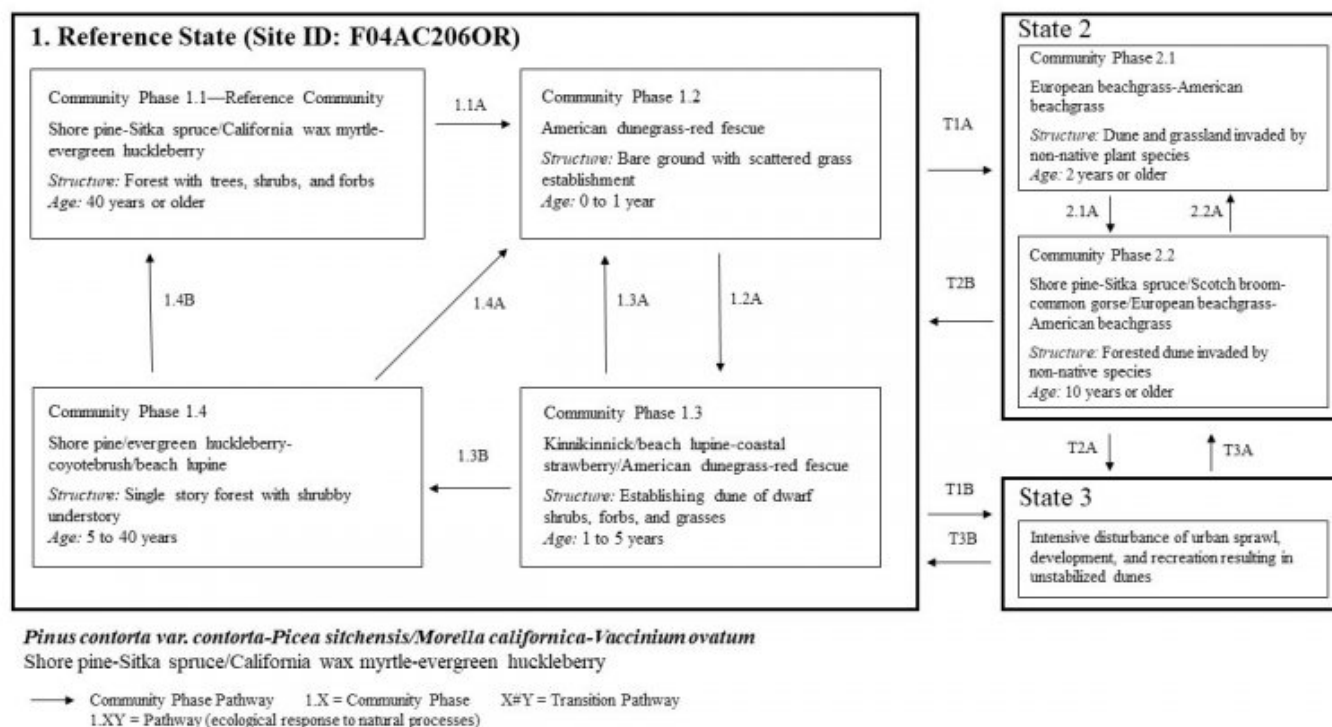
Climatic features

## Influencing water features

## Soil features

## Ecological dynamics

## State and transition model



## State 1

### Reference

### Community 1.1

#### Shore Pine, Sitka Spruce, California Wax Myrtle, and Evergreen Huckleberry

Structure: Forest with trees, shrubs, and forbs The reference community is a stabilized dune forest that consists primarily of trees and shrubs. Forbs and grasses commonly are sparse as a result of the dense canopy and salt influence. Mosses and lichens play an important role in this ecosystem by forming a thin, fragile mat on the surface, which helps to stabilize the soil. The most common tree species are Sitka spruce and shore pine, but Douglas-fir (*Pseudotsuga menziesii*) may be on very old, stabilized dunes. Common shrubs are evergreen huckleberry, salal, coyotebrush, kinnikinnick, California wax myrtle, and western azalea. The herbaceous understory is sparse, but it commonly includes western brackenfern (*Pteridium aquilinum*), beach lupine (*Lupinus littoralis*), and beach strawberry (*Fragaria chiloensis*). The reference community is influenced by frequent salt spray, and it is subject to wind pruning and windthrow. A large amount of coarse woody debris is common. This site represents a lack of major disturbance and unnatural modifications.

### Community 1.2

#### American Dunegrass and Red Fescue

Structure: Bare ground with scattered grass establishment Community phase 1.2 represents a forested dune that has been affected by a major disturbance and is at the initiation phase of regeneration. This phase is sparsely vegetated by emerging American dunegrass (*Leymus mollis* spp. *mollis*) and red fescue (*Festuca rubra*). The unstable dune is highly susceptible to wind erosion, trampling, and drought. Minimizing disturbance (natural and unnatural) is important to the vegetative recovery of the site. Monitoring for establishment of non-native species,

primarily European beachgrass (*Ammophila arenaria*), is imperative for a successful native dune plant community.

### **Community 1.3**

#### **Kinnikinnick, Beach Lupine, Coastal Strawberry, American Dunegrass and Red Fescue**

Structure: Establishing dune of dwarf shrubs, forbs, and grasses Community phase 1.3 represents a dune that is quickly stabilizing and has a higher diversity of plant life. Forbs begin to establish as the American dunegrass stabilizes and creates mats. Low-growing ericaceous shrubs such as kinnikinnick may establish during this phase and increase the stability of the dune. Depending on the seed source and condition of the site, shrubs may be entirely absent in some areas. Forbs such as seashore lupine and beach strawberry may be intermixed. Red fescue and seashore bluegrass (*Poa macrantha*) may be in the grass community.

### **Community 1.4**

#### **Shore Pine, Evergreen Huckleberry, Coyotebrush, and Beach Lupine**



Structure: Single story forest with shrubby understory Community phase 1.4 represents a forested dune that is stabilizing with conifer establishment. Shore pine commonly is the first conifer to establish. Depending on the seed source, Sitka spruce may be dominant in some areas. Shrubs such as evergreen huckleberry, coyotebrush, salal, western azalea, and California wax myrtle will begin to mature. As the canopy cover increases, forbs and grasses will diminish.

### **Pathway 1.1A**

#### **Community 1.1 to 1.2**

This pathway represents a major disturbance from a massive tidal surge, an excessively damaging windstorm, wildfire, or extended drought that removes most, if not all, of the existing vegetation.

### **Pathway 1.2A**

#### **Community 1.2 to 1.3**

This pathway represents a transition toward dune stabilization from increased plant diversity and cover.

### **Pathway 1.3A**

#### **Community 1.3 to 1.2**

This pathway represents a major disturbance from a massive tidal surge, an excessively damaging windstorm, wildfire, or extended drought that removes most, if not all, of the existing vegetation.

### **Pathway 1.3B**

#### **Community 1.3 to 1.4**

This pathway represents a transition toward dune stabilization from increased plant diversity and cover.

## **Pathway 1.4B**

### **Community 1.4 to 1.1**

This pathway represents a transition toward dune stabilization from increased plant diversity and cover.

## **Pathway 1.4A**

### **Community 1.4 to 1.2**

This pathway represents a major disturbance from a massive tidal surge, an excessively damaging windstorm, wildfire, or extended drought that removes most, if not all, of the existing vegetation.

## **State 2**

### **Disturbed**

## **Community 2.1**

### **European Beachgrass and American Beachgrass**

Structure: Dune and grassland invaded by non-native plant species Community phase 2.1 represents an unstable dune that has been entirely disturbed and is susceptible to invasion by non-native species. European beachgrass (*Ammophila arenaria*) and American beachgrass (*Ammophila breviligulata*) are exotic grasses that have been used to stabilize dunes. They are highly successful at building thick mats very rapidly. They can tolerate salt spray, wind erosion, and excessive drought. A small remnant community of American dunegrass, seashore lupine, and coastal strawberry may be present. Other common non-native species include little hairgrass (*Aira caryophyllea*) and hairy cat's ear (*Hypochaeris radicata*).

## **Community 2.2**

### **Shore Pine, Sitka Spruce, Scotch Broom, Common Gorse, European Beachgrass, and American Beachgrass**

Structure: Forested dune invaded by non-native species Community phase 2.2 represents a forested dune that has been susceptible to non-native species. Tree species such as shore pine and Sitka spruce are dominant in the conifer canopy; however, the understory plant community has been significantly altered. Scotch broom (*Cytisus scoparius*) and common gorse (*Ulex europaeus*) are exotic shrubs that can spread widely. Depending on specific site dynamics and seed sources, the prevalence of Scotch broom, common gorse, Sitka spruce, and shore pine may be limited to one major shrub and tree species on the site. A small remnant community of evergreen huckleberry, coyotebrush, California wax myrtle, kinnikinnick, and western brackenfern may be present.

## **Pathway 2.1A**

### **Community 2.1 to 2.2**

This pathway represents growth over time with increased establishment of non-native plants.

## **Pathway 2.2A**

### **Community 2.2 to 2.1**

This pathway represents a major disturbance from a massive tidal surge, an excessively damaging windstorm, wildfire, or extended drought that removes most, if not all, of the existing vegetation.

## **State 3**

### **Developed**

This state represents a full departure from the native reference state as a result of human-caused impacts. Off-road vehicle use, residential development, and roadway construction will increase susceptibility to non-native species, restrict sand movement necessary for healthy dunes, and reduce habitat.

## **Transition T1A**

## **State 1 to 2**

This pathway represents a major disturbance from a massive tidal surge, an excessively damaging windstorm, wildfire, or extended drought that removes most, if not all, of the existing vegetation. It also represents a transition from a native plant community to a non-native, invaded plant community. Non-native seed disbursement is introduced (intentionally or unintentionally), which changes the reference community.

## **Transition T1B**

### **State 1 to 3**

This pathway represents human-influenced disturbance from urban sprawl or other development or from excessive use of recreational off-road vehicles. The stabilized dunes and habitat are diminished or completely lost.

## **Transition T2B**

### **State 2 to 1**

This pathway represents restoration of the native plant community. It is extraordinarily difficult to successfully remove established Scotch broom, common gorse, European beachgrass, and American beachgrass. Native seed sources and extensive management and mitigation of brush and non-native species are needed.

## **Transition T2A**

### **State 2 to 3**

This pathway represents human-influenced disturbance from urban sprawl or other development or from excessive use of recreational off-road vehicles. The stabilized dunes and habitat are diminished or completely lost.

## **Transition T3B**

### **State 3 to 1**

This pathway represents restoration of the native plant community and removal of man-made structures. Native seed sources and extensive management and mitigation of brush and non-native species are needed.

## **Transition T3A**

### **State 3 to 2**

This pathway represents removal of man-made structures. Non-native seed disbursement is introduced (intentionally or unintentionally), which changes the reference community.

## **Additional community tables**

### **Other references**

Christy, J., J. Kagan, and A. Wiedemann. 1998. Plant associations of the Oregon Dunes National Recreation Area. U.S. Department of Agriculture, Forest Service, Pacific Northwest Region Technical Paper R6-NR-ECOL-TP-09-98.

Franklin, J.F., and C.T. Dyrness. 1973. Natural vegetation of Oregon and Washington. Oregon State University Press, Corvallis, OR.

Peterson, E.B., N.M. Peterson, G.F. Weetman, and P.J. Martin. 1997. Ecology and management of Sitka spruce: Emphasizing its natural range in British Columbia. University of British Columbia Press, Vancouver, British Columbia.

Pojar, J., and A. MacKinnon. 1994. Plants of the Pacific Northwest coast. Lone Pine Publishing, Vancouver, British Columbia.

PRISM Climate Group. Oregon State University. <http://prism.oregonstate.edu>. Accessed July 2018.

Roccio, J., and R. Crawford. 2015. Ecological systems of Washington State. A guide to identification. Washington Department of Natural Resources, Natural Heritage Report 2015-04.

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.

Soil Survey Staff. 2014. Keys to soil taxonomy. 12th edition. U.S. Department of Agriculture, Natural Resources Conservation Service.

United States Department of Agriculture, Natural Resources Conservation Service. 2003. Soil Survey of Douglas County Area, Oregon.

United States Department of Agriculture, Natural Resources Conservation Service. 2013. Soil Survey of Tillamook County, Oregon.

United States National Vegetation Classification. 2016. United States national vegetation classification database, V2.0. Federal Geographic Data Committee, Vegetation Subcommittee, Washington, D.C. Accessed November 28, 2016.

Washington Department of Natural Resources, Natural Heritage Program. 2015. Ecological systems of Washington State. A guide to identification.

Wiedemann, A. 1966. Contributions to the plant ecology of the Oregon coastal sand dunes. Oregon State University. PhD dissertation.

Wiedemann, A. 1998. Coastal foredune development, Oregon, USA. Journal of Coastal Research. Special Issue 26, pages 45-51.

## Approval

Kirt Walstad, 1/23/2025

## Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	05/07/2024
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

### 1. Number and extent of rills:

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### 2. Presence of water flow patterns:

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### 3. Number and height of erosional pedestals or terracettes:

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### 4. Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):

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### 5. Number of gullies and erosion associated with gullies:

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6. **Extent of wind scoured, blowouts and/or depositional areas:**
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7. **Amount of litter movement (describe size and distance expected to travel):**
- 
8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**
- 
9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**
- 
10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**
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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**
- 
12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**
- Dominant:
- Sub-dominant:
- Other:
- Additional:
- 
13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**
- 
14. **Average percent litter cover (%) and depth ( in):**
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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**
- 
16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state**



for the ecological site:

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17. **Perennial plant reproductive capability:**

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