4.4 UPLAND VEGETATION AND TIMBER

4.4.1 Vegetation

The proposed Project lies within four ecoregions: 1) the Coastal Range that consists mainly of Douglas-fir plantations; 2) the Klamath Mountains which support a mosaic of northern California and Pacific Northwest conifers and hardwoods characteristic of areas with lengthy summer droughts; 3) the Cascades, which have a moist, temperate climate and contain an extensive and highly productive coniferous forest; and 4) the Eastern Cascades Slopes and Foothills that supports open forests of ponderosa pine (*Pinus ponderosa*) and some shore pine (*Pinus contorta*) that are adapted to the prevailing dry, continental climate and frequent fires (Bryce et al. 2003). Each ecoregion within Oregon has been divided into sub-ecoregions.

Within the Coast Range ecoregion there are three sub-ecoregions, the Coastal Lowlands, Coastal Uplands, and Mid-Coastal Sedimentary sub-ecoregions (Bryce et al. 2003). The Coastal Lowlands sub-ecoregion consists of beaches, dunes, and marine terraces (<400 feet) with wet forests, lakes, estuarine marshes, and tannic streams. Within this sub-ecoregion, many wetlands have been drained and converted to pastures. Residential, commercial, and recreational developments are currently expanding within this sub-ecoregion. The Coastal Uplands sub-ecoregion consists of headlands and low mountains. The Mid-Coastal Sedimentary sub-ecoregion consists of Douglas-fir forests, which lie outside the coastal fog zone and are intensively managed for logging. Because this area is typically underlain by sandstone and siltstone, slope stability and streams are susceptible when disturbed.

Within the Klamath Mountains ecoregion there are three sub-ecoregions, the Umpqua Interior Foothills, Inland Siskiyous, and Oak Savanna Foothills sub-ecoregions (Bryce et al. 2003). The Umpqua Interior Foothills sub-ecoregion consists of a complex of foothills and narrow valleys containing fluvial terraces, floodplains, and a xeric moisture regime. Dominant species present include Oregon white oak woodland, Douglas-fir (*Pseudotsuga menziesii*), ponderosa pine, madrone (*Arbutus menziesii)*, and an understory chaparral community, intermixed with pastureland, vineyards, orchards, and row crops. Within the Inland Siskiyous sub-ecoregion, forest cover is diverse, with a multi-layered mix of conifers, broadleaf evergreens, and deciduous trees. This area experiences a higher fire frequency with less annual precipitation and longer summer droughts than the Coastal areas. It is more mountainous and at higher elevations than neighboring ecoregions. The Oak Savanna Foothills has two distinct components: 1) the driest area east of Medford that is dominated by oak woodlands, grassland-savanna, ponderosa pine, and Douglas-fir; and 2) the wetter foothills in the Illinois Valley that support Douglas-fir, Pacific madrone, and incense cedar (*Libocedrus decurrens*).

Only one sub-ecoregion (Southern Cascades) is crossed by the proposed Project within the Cascades ecoregion (Bryce et al. 2003). Tree species present within the Southern Cascades sub-ecoregion are western hemlock (*Tsuga heterophylla*), western red cedar (*Thuja plicata*), and Sierra Nevada species, such as incense cedar, white fir (*Abies concolor*), and Shasta red fir (*Abies magnifica* var. *shastensis*) that can tolerate prolonged summer drought. The Southern Cascades are low in elevation and lack steep slopes, therefore river and stream discharge is low.

Within the Eastern Cascades Slopes and Foothills ecoregion there are three sub-ecoregions, the Southern Cascade Slope, Klamath/Goose Lake Basins, and Klamath Juniper Woodland sub-ecoregions (Bryce et al. 2003). The Southern Cascade Slope sub-ecoregion is considered a transition zone between the Cascades and the drier Eastern Cascades, this sub-ecoregion has a mix of forest types, including ponderosa pine Woodlands, white fir, incense cedar, Shasta red fir, and Douglas-fir (at higher elevations). Historically, the Klamath/Goose Lake Basins consists of a variety of wildrye, bluegrass, and wheatgrass species; however, most of the wet meadows and wetlands have been drained and converted for agriculture. This sub-ecoregion consists of river floodplains, terraces, and lake basins. The Klamath Juniper Woodland is composed of hills, benches, and escarpments that are covered with a mosaic of rangeland and woodland, providing important habitat for wildlife. Western juniper (*Juniperus occidentalis*) grows on shallow, rocky soils with an understory of low sagebrush (*Artemisia arbuscula*), big sagebrush (*Artemisia tridentate*), bitterbrush (*Purshia tridentate*), and bunchgrasses. Other shrubland/grasslands include species uncommon in eastern Oregon, such as woolly wyethia (*Wyethia mollis*), Klamath plum (*Prunus subcordata*), and birchleaf mountain mahogany (*Cercocarpus montanus* var. *glaber*).

Table 4.4.1-1 lists the total proposed Project related impacts to various vegetation types. These impacts are discussed in more detail and are broken down by Project component within the "impact and mitigation" sections below.

TABLE 4.4.1-1.

General Vegetation Types Affected by the Proposed Project

	Vegetation Type					
	Forest/Woodland	**Grasslands & Shrublands**	**Riparian**	**Agriculture**	**Developed**	**Barren/Disturbed**
Construction						
LNG	68.7	77.6	0.0	0.0	0.0	38.9
Pipeline	2976.9	444.4	139.5	589.7	269.4	231.0
Operation						
LNG	68.7	77.4	0.0	0.0	0.0	36.0
Pipeline	1059.7	198.4	63.1	287.5	21.1	79.0

Refer to tables 4.4.1.2-2, 4.4.2.3-4, and 4.4.2.3-5 for more detail.

4.4.1.1 Waterway for LNG Marine Traffic

Existing Vegetation Resources

With the exception of wetlands (discussed in section 4.3.3) and the vegetation occurring at the LNG import terminal (discussed below), vegetation occurring along the LNG carrier transit route within the 0.3-mile, 1.0-mile, and 2.2-mile Zones of Concern have not been surveyed extensively; however, vegetative communities within this area would likely be typical of the Coos Bay region. Figure 4.4-1 depicts the vegetation found within the 0.3 mile, 1.0 mile, and 2.2 mile Zones of Concern. Lands within the Zones of Concern on the western side of the inlet are predominantly developed. Vegetated areas within the Zones of Concern consist of forest, woodland, shrubland, and herbaceous plant associations with a component of wetland areas (salt and freshwater marshes, see section 4.3.3). The most prominent vegetation within this area

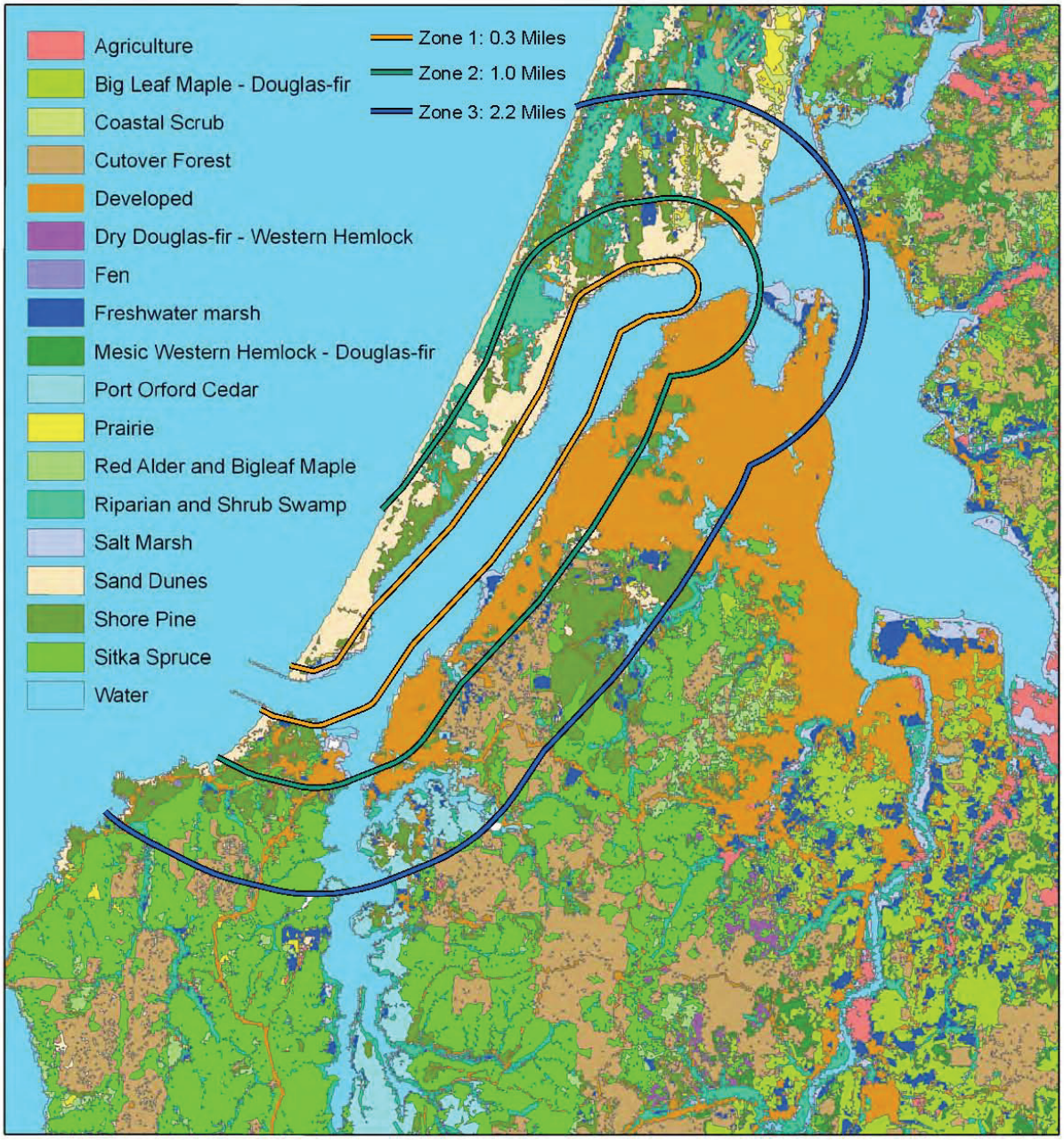

Figure 4.4-1 Vegetation Along the Waterway

Oregon Natural Heritage Information Center,
Oregon State University, July 2008

0 1.5 3 6 Miles

N

includes a mix of herbaceous sand dunes, shore pine forest association, Sitka spruce forest association, Port-Oxford Cedar forest association, salt marsh, and freshwater marshes.

Forested Associations

Forest associations are defined as areas where tree species comprise at least 60 percent of the vegetation cover. Several forest associations have been classified within the area. Collectively, the forest associations are referred to as dune forests. The dune forests are further classified into associations based on the presence of dominant species. These various classifications of dune forest associations are discussed below in detail. Species composition is fairly consistent throughout the forest associations and varies only in species abundance, except for stands that are solely dominated by shore pine and lack a co-dominant. Species diversity is reduced in those stands and mature trees consist entirely of shore pine.

Shore pine/Scotch Broom/European Beachgrass Forest Association

The shore pine/scotch broom/European beachgrass forest association is relatively widespread throughout the study area. This vegetation type is dominated by shore pine with scattered Douglas-fir. The shrub layer within younger forest stands is dominated by scotch broom (*Cytisus scoparius*) and coyote bush (*Baccharis pilularis*) with a subcomponent of hairy manzanita (*Arctostaphylos columbiana*). The herbaceous layer varies from depauperate, where there is a substantial cover of scotch broom, to moderately vegetated in areas that lack dense shrub cover. Dominant herbaceous species include European beachgrass (*Ammophila arenaria*), silver hairgrass (*Aira caryophyllea*), little hairgrass (*Aira praecox*), hairy cat's ear (*Hypochaeris radicata*), bracken fern (*Pteridium aquilinum*), and sheep sorrel (*Rumex acetosella*). Moss cover within the understory of the shore pine/Scotch broom/European beachgrass forest varies from low to moderate, depending on the overstory cover. Christy et al. (1998) reports this association as occurring on dry sand, on all aspects and slopes, between deflation plains, and along forest edges. This association is early to mid-seral and is typically the first forest association to develop in and replace European beachgrass dominated areas (Christy et al. 1998). With the exception of shore pine and some herbaceous species, this association is dominated by weedy, non-native species.

Shore pine-Sitka Spruce/Evergreen Huckleberry Association

The shore pine-Sitka spruce/evergreen huckleberry association is widespread throughout the area and occurs on a variety of slopes and aspects. The overstory within this association is dominated by shore pine and Sitka spruce, with scattered Douglas-fir. Madrone is not abundant in this association, but is found scattered along dune ridges. Western hemlock is only present in troughs that are sheltered from salt spray. Evergreen huckleberry (*Vaccinium ovatum*), salal (*Gaultheria shallon*), and wax myrtle (*Myrica californica*) are dominant shrubs, with a lesser component of Pacific rhododendron (*Rhododendron macrophyllum*). Herbaceous species are lacking for the most part, but often include candy-stick (*Allotropa virgata*), rattlesnake plantain (*Goodyera oblongifolia*), and bracken fern along edges or gaps in the overstory. Moss cover is moderately abundant within this association. This association is common on dry stabilized dunes, tree islands, and deflation plains (Christy et al. 1998). The shore pine-Sitka spruce/evergreen huckleberry association is mid-seral and successionally replaces the shore pine/Scotch broom/European beachgrass forest (Christy et al. 1998).

Shore Pine-Douglas-fir/Wax Myrtle-Evergreen Huckleberry Forest Association
The shore pine-Douglas-fir/wax myrtle-evergreen huckleberry forest association occurs throughout the area on a variety of slopes and aspects, but particularly on stabilized dunes. The shore pine-Douglas-fir association is differentiated from the shore pine-Sitka spruce association by the presence of western hemlock, which is more widespread in the shore pine-Douglas-fir/wax myrtle-evergreen huckleberry association. Pacific rhododendron is also more widespread in the shore pine-Douglas-fir association compared to the shore pine-Sitka spruce/evergreen huckleberry. The dense to nearly impenetrable shrub layer appears equally dominated by evergreen huckleberry, salal, Pacific rhododendron, and wax myrtle when compared to the shore pine-Sitka spruce/evergreen huckleberry.

Port-Orford-Cedar/Evergreen Huckleberry Forest Association
The Port-Orford cedar/evergreen huckleberry forest association is unique and occurs in all aspects and slopes on narrow, dry stabilized dune ridges, troughs, and seasonally dry deflations basins at the southern end of the Oregon Dunes National Recreation Area. This forest association is unique because it is being decimated throughout its limited range by the Port-Orford cedar root rot disease which is caused by the fungal root rot *Phytopthora lateralis* (Christy et al. 1998). Port-Orford cedar (*Chamaecyparis lawsoniana*), Sitka spruce, and Douglas-fir dominate the overstory with scattered western hemlock.

Shore pine/Slough Sedge Seasonally Flooded Forest Association
The shore pine/slough sedge seasonally flooded forest association occurs on deflation plains. The overstory within this forest association consists entirely of shore pine. Herbaceous coverage varies from moderately open to dense and consists almost entirely of slough sedge, with scattered hairy cat's ear and non-native grass species.

Woodland Associations

Woodland associations are defined as open stands with tree cover varying from 25 percent to 60 percent. They occur on all aspects of dry, well-drained, partially stabilized dune ridges, slopes, and flats between the sand and the forest edge (Christy et al. 1998).

Shore Pine/Bearberry Woodland Association
The shore pine/bearberry woodland association's overstory consists entirely of shore pine. The shrub layer is dominated by the low growing shrub bearberry (*Arctostaphylos uva-ursi*) with hairy manzanita in scattered patches. The understory is comprised almost entirely of moss and lichen species expect for scattered little hairgrass, hairy cat's ear, and shrub starts. This association is unique due to its limited distribution, which is restricted to a thin band adjacent to the coastline, and the fact that it is easily damaged by human disturbances.

Shore Pine/Hairy Manzanita Woodland Association
The shore pine/hairy manzanita woodland association's overstory is moderately open and is dominated by shore pine with scattered Douglas-fir trees. The shrub layer varies from moderately dense to dense in areas where the canopy is patchy. Hairy manzanita is the dominant shrub species with scattered evergreen huckleberry and bearberry along edges. The herbaceous layer varies from depauperate to moderately covered, with nonvascular plants and non-native herbs. The shore pine/hairy manzanita association successionally replaces the shore pine/bearberry association.

Shrubland Associations

Shrubland associations consist of at least 25 percent shrub cover. Density and distribution of shrubland is correlated to hydrology and topography. Minor variation affects the distribution of herbaceous and shrub species. The lowest-lying areas are frequently inundated and may be dominated with emergent hydrophytes. The overstory within the shrubland varies from patchy to dense and is dominated by Hooker's and Sitka willow (*Salix hookeriana* and *S. sitchensis*) and Douglas spiraea (*Spiraea douglasii*). There are few trees, consisting mostly of scattered shore pine and Sitka spruce. Slough sedge (*Carex obnupta*) is the most abundant herbaceous species; other species include rushes (*Juncus* spp.), bent-grasses (*Agrostis* spp.), reed canary grass (*Phalaris arundinacea*), northern willowherb (*Epilobium ciliatum*), tall mannagrass (*Glyceria elata*), and lowland cudweed (*Gnaphalium palustre*).

Herbaceous Associations

Herbaceous associations and sand dunes are defined as communities with less than 25 percent shrub cover. Sand dune areas are scattered throughout the area and are composed almost entirely of herbaceous species because shrubs and trees cannot tolerate the degree of sand movement that occurs within this association. They include plants that are adapted for sand burial and desiccating winds.

European Beachgrass Herbaceous Association

European beachgrass is always the dominant species with scattered silver hairgrass, little hairgrass, and yellow sand verbena (*Abronia latifolia*). Lesser amounts of other species occur, particularly in areas that are not densely covered with European beachgrass and may be intergrading with the red fescue association or are relics of the native American dunegrass association. Other species include silver burweed (*Ambrosia chamissonis*), sand pea (*Lathyrus japonicus*), seashore lupine (*Lupinus littoralis*), beach silvertop (*Glehnia littoralis*), and beach evening primrose (*Camissonia cheiranthifolia*). Shrubs, such as, scotch broom and tree lupine (*Lupinus arboreus*) can be found in areas were sand movement is less active, particularly areas that are sheltered from winter winds and appear to be succeeding to other vegetation associations.

Red fescue Herbaceous Association

The red fescue herbaceous association is generally located within sandy areas that are not dominated by European beachgrass and have limited sand movement. Red fescue (*Festuca rubra*) is the dominant grass; associate species are similar to the species found in the European beachgrass association, but also include bracken fern. European beachgrass is scattered in this association, but is not a dominant species because sand is partially stable.

American Dunegrass Herbaceous Association

The American dunegrass herbaceous association is widespread on upper beaches and foredunes prior to the introduction and establishment of European beachgrass. This association is comprised entirely of herbaceous plants and may contain a high percentage of bare ground. Along with American dunegrass (*Leymus mollis*) other species include seashore bluegrass (*Poa macrantha*), beach morning glory (*Calystegia soldanella*), beach silvertop, silver burweed, sea rocket (Cakile spp.), yellow sand verbena, beach evening primrose, seashore lupine, and sand pea.

Wetlands and Semi-permanently Flooded Areas

Semi-permanently flooded areas include floating water-pennywort (*Hydrocotyle ranunculoides*), yellow pond lily (*Nuphar lutea* ssp. *polysepala*), floating-leaved pondweed (*Potamogeton natans*), parrotfeather (*Myriophyllum aquaticum*), water shield (*Brasenia schreberi*), and common bladderwort (*Utricularia macrorhiza*) and are described in more detail in section 4.3.3.

Vegetative Communities of Special Concern or Value

Both the Port-Orford cedar/evergreen huckleberry forest association and the Shore pine/bearberry woodland association are sensitive vegetation communities. As discussed above, the Port-Orford cedar/evergreen huckleberry forest association is sensitive because it is being decimated throughout its limited range by the Port-Orford cedar root rot disease. The Shore pine/bearberry woodland association is sensitive due to its limited distribution, which is restricted to a thin band adjacent to the coastline, and the fact that it is easily damaged by human disturbances.

Vegetative Species of Special Concern or Value

Western lily (*Lilium occidentale*) (federal and state endangered species) occurs within four miles of the coast, generally on marine terraces below 300 feet above MSL (CNDDB 2005). Habitats in which this species are associated include coastal bluff scrub, coastal prairie, and openings in coastal coniferous forest (Sitka spruce dominated) including freshwater marshes and swamps (CNDDB 2005). Western lily has been documented within the LNG carrier transit route (ORNHIC 2005) and suitable habitat is located throughout the terrestrial portion of the LNG carrier transit route in Coos Bay. Species of Special Concern are discussed in detail within section 4.6.

Impacts and Mitigation

Vegetative communities located nearer to the navigation channel have some potential to be affected by vessel transit as a result of wave action from LNG carriers. This is not expected to be measurably above baseline conditions because vessels would transit the bay at slow speed, thereby minimizing wave actions, bank erosion, and sedimentation. Impacts from LNG carriers on shoreline vegetation would be similar to conditions resulting from existing ship traffic within Coos Bay.

During transit to the LNG terminal, the potential exists for an accidental or intentional breach of an LNG carrier resulting in a release of LNG; however, LNG is less dense than freshwater or saltwater so it would float on the water's surface. Immediately upon contact with any warmer substance such as water or air, it would begin to evaporate. Because LNG is not soluble in water and the LNG would completely vaporize shortly after being spilled, there would be no liquid left that could mix with and/or contaminate the water or sediments. As the LNG vaporizes, a vapor cloud may form that is initially heavier than air and may be dispersed by wind. An LNG vapor cloud cannot explode in the open atmosphere, but can burn. If the LNG vapor cloud were to ignite adjacent to the shoreline, then vegetation along the Coos Bay navigation channel could be damaged. Given the relatively high precipitation in the region, large forest fires in the area are infrequent, but they can be severe when they do occur. The intensity and extent of a potential forest fire would be highly dependent on a number of variables including available fuel (e.g., woody material), moisture and temperature, fuel composition, wind, and topography. As

discussed in section 4.12, the risk of an accidental or intentional release of LNG during transit of the LNG carriers is extremely low and can be managed by implementing the recommendations in the Coast Guard's WSR (appendix B). Effects on shoreline vegetation within the Zones of Concern would be greatest in Zone 1 (0.3 mile buffer) and lessen through Zone 3 (2.2 mile buffer).

Vegetative Species of Special Concern or Value

The proposed Project is not expected to impact Western lily or its habitat. The effects to Species of Special Concern are discussed in more detail within section 4.6.

4.4.1.2 Jordan Cove LNG Import Terminal

Existing Vegetation Resources

The vegetation associations within the LNG terminal area are shown in figure 4.4-2. The proposed LNG terminal would be situated to the north and west sides of both the Roseburg chip facility, and the remaining infrastructure (concrete slab, water tanks, roads, etc.) of the Weyerhaeuser Company cardboard manufacturing facility. The Weyerhaeuser Company cardboard manufacturing facility has been abandoned and is classified as a "disturbed area" (defined below), and this location would be used to dispose of a portion of the dredge created during the construction of the slip. To the north of the proposed site is open land, including wetlands and the Oregon Dunes National Recreation Area, which is administered by the USFS. There is also a plot of land owned by the BLM immediately adjacent to the northeast portion of the proposed site. To the west is Henderson Marsh, beyond which is a BLM Special Recreation Management Area and an Area of Critical Environmental Concern.

Vegetation within the proposed LNG terminal site includes forest, woodland, shrubland, and herbaceous plant associations as described in Christy et al. 1998, and disturbed areas resulting from the placement of fill from historical dredging operations. It is typical of the North Spit of Coos Bay. The forest and woodland areas cover approximately 60 percent of the proposed site (approximately 80 acres). There are approximately 1.4 acres of shrubland association vegetation and 35.3 acres of herbaceous association vegetation within the LNG site. The only vegetated areas that would be affected by construction and operation in the proposed LNG terminal facilities are portions of the terminal itself and the Port Commercial Sand Stockpile area. All other areas are not vegetated, but are instead gravel or cement industrial areas.

Vegetative associations found within the Coos Bay area, including those within the proposed LNG terminal site, are described above in the Waterway for the LNG Marine Traffic section. The location of these vegetative associations and site-specific information relevant to the LNG terminal are discussed below.

Forested Associations

Forests on the LNG terminal site are dominated by coniferous species with scattered hardwoods, generally along ridges and toe slopes. Forests vary in age and seral stages. The youngest forests are generally located along the perimeter of the developed portions of the site and adjacent to the Trans-Pacific Highway to the north. These young forests are associated with anthropogenic disturbance. More successionally mature forests are located in the interior portions of the site on stabilized dune ridges, troughs, and dry deflation basins. Several forest associations have been

Figure 4.4-2 Vegetation at the LNG Site

identified in the study area. These various classifications of forest associations are discussed above in the Waterway for LNG Marine Traffic section. Collectively, the forest associations are referred to as dune forests and have been grouped into three areas with the LNG site, referred to as Dune Forest A, B, and C, as depicted in figure 4.4-2.

Shore Pine/Scotch Broom/European Beachgrass Forest Association
This association is widespread in the eastern portion of the study area, particularly along the southern edge of Dune Forest A. This association is also prevalent throughout the trails located in Dune Forest B and along the southern and eastern edges of the Dune Forest, as well as other areas scattered throughout the site that have some active sand movement and anthropogenic disturbance. Due to the dynamic nature of this coastal habitat and long history anthropogenic influence, not all pockets of shore pine/Scotch broom/European beachgrass associations are delineated.

Shore Pine-Sitka Spruce/Evergreen Huckleberry Association
The shore pine-Sitka spruce/evergreen huckleberry association is most widespread on the windward side of Dune Forest A, and scattered throughout Dune Forest B.

Shore Pine-Douglas-fir/Wax Myrtle-Evergreen Huckleberry Forest Association
The shore pine-Douglas-fir/wax myrtle-evergreen huckleberry forest association occurs throughout the LNG terminal area on a variety of slopes and aspects, but particularly on stabilized dunes. This association is particularly widespread throughout Dune Forest B, the northern portion of which mainly consists of shrub dominated areas. The shore pine-Douglas-fir/wax myrtle-evergreen huckleberry association is also located in Dune Forest A, but it intergrades with the shore pine-Sitka spruce association.

Port-Orford cedar/Evergreen Huckleberry Forest Association
A small component of this forest association is located in an area adjacent to the proposed LNG terminal site, upslope from the southwestern shore of Jordan Lake. This area would not be affected by the proposed Project.

Shore Pine/Slough Sedge Seasonally Flooded Forest Association
The shore pine/slough sedge seasonally flooded forest association occurs on deflation plains. This association is not widespread throughout the LNG terminal site, but is scattered in lowland areas of the North Central Wetland.

Dune Forest A
Dune Forest A is located in the eastern portion of the LNG terminal site (figure 4.4-2). The windward side of Dune Forest A is dominated by shore pine-Sitka spruce/evergreen huckleberry association. The leeward side of Dune Forest A is more characteristic of the shore pine-Douglas-fir/wax myrtle-evergreen huckleberry association due to the presence of western hemlock. The western edge of Dune Forest A contains a small area of red fescue herbaceous association.

Dune Forest B
Dune Forest B is located in the southern portion of the LNG terminal site, with large portions located within the proposed location for the slip. Multiple trails are located throughout the Dune Forest B, and are dominated by shore pine/Scotch broom/European beachgrass forest. The shore pine-Sitka spruce/evergreen huckleberry association is scattered throughout this forest. The most

dominant association within Dune Forest B is the shore pine-Douglas-fir/wax myrtle-evergreen huckleberry association. The west side of Dune Forest B has a slightly different species composition due to a lack of western hemlock and presence of salt-spray tolerant shrub silk tassel (*Garrya elliptica*).

Dune Forest C

Dune Forest C is located in the northwestern portion of the LNG terminal site. The southern edge of Dune Forest C is more characteristic of an early succession shore pine-Douglas-fir/wax myrtle-evergreen huckleberry forest that still has relic features of the shore pine/bearberry association that was once more widespread. Canopy cover along the southern portion of Dune Forest C is less than 50 percent and is dominated by Douglas-fir and shore pine with a shrub layer of hairy manzanita, evergreen huckleberry, and bearberry. The interior of Dune Forest C is more representative of the shore pine-Douglas-fir/wax myrtle evergreen huckleberry association, except there is a high occurrence of Port-Orford cedar and western hemlock seedlings and saplings; this may be attributed to succession. Trails are scattered throughout Dune Forest C and are vegetated with salal, evergreen huckleberry, hairy manzanita, bracken fern, Pacific bramble (*Rubus ursinus*), hairy cat's ear, and a variety of non-native grasses. The shrub layer within the shore pine-Douglas-fir/wax myrtle-evergreen huckleberry association is also slightly denser than the shore pine-Sitka spruce association. Increased shrub cover is evident by the lack of herbaceous species and reduced moss cover, except for areas bordering old trails and forest edges or gaps in the canopy.

Woodland Associations

Two woodland associations occur within the proposed LNG terminal site, but are not well represented.

Shore Pine/Bearberry Woodland Association

The shore pine/bearberry association has small portions scattered throughout the LNG terminal site, with the most substantial occurrence on the stabilized dune ridge, upslope from the northern Roseburg building (figure 4.4-2).

Shore Pine/Hairy Manzanita Woodland Association

A small area of this association is located along the eastern boundary of the dune forest and south of the scrub shrub wetland on the north end of the site (figure 4.4-2).

Shrubland Associations

Shrubland associations are found predominantly within wetland areas near the eastern portion of the LNG terminal site (figure 4.4-2).

Herbaceous Associations

The herbaceous communities are the most variable of the plant communities found on the LNG terminal site.

European Beachgrass Herbaceous Association

The European beachgrass herbaceous association is scattered throughout the Project area; although in most locations, it intergrades with other associations including the shore pine/Scotch broom forest association and the red fescue herbaceous association.

Red Fescue Herbaceous Association
This association is scattered throughout the study area, but primarily occurs on the western edge of Dune Forest A, and between Henderson Marsh and Dune Forest B, where partially stabilized bare sand is present (figure 4.4-2). This association is generally lacking east of Dune Forest A, where sand movement is widespread.

American Dunegrass Herbaceous Association
American dunegrass is located in the northern portion of the disturbed habitat between Henderson Marsh and Dune Forest B (figure 4.4-2).

Disturbed Associations

Multiple disturbed areas are located within the LNG site, including the Weyerhaeuser Company cardboard manufacturing facility which would be used to dispose of a portion of the dredge created during the construction of the slip. Species composition within these disturbed areas consists of both native and non-native weedy herbaceous species with scattered shrubs. Forbs are more prevalent in areas that are heavily disturbed and compacted; grasses are widespread in areas that are moderately disturbed and are located along forest edges. Dominant species within the disturbed association include sweet vernal grass (*Anthoxanthum odoratum*), Queen Ann's lace (*Daucus carota*), hedgehog dogtail grass (*Cynosurus echinatus*), bird's foot trefoil (Lotus corniculatus), little hairgrass, silver hairgrass, hairy cat's ear, velvet grass (*Holcus lanatus*), English plantain (*Plantago lanceolata*), yarrow (*Achillea millefolium*), pearly everlasting (*Anaphalis margaritacea*), black mustard (*Brassica nigra*), small-head clover (*Trifolium microcephalum*), hop clover (*T. dubium*), white clover (*T. repen*s), yellow parentucellia (*Parentucellia viscosa*), and wild radish (*Raphanus sativus*). In areas where this association has 50 percent cover or more of grasses, dominant species include tall fescue, wild oats (*Avena* spp.), orchard grass (*Dactylis glomerata*), bent grasses (*Agrostis stolonifera* and *A. exarata*), and brome grasses (*Bromus* spp.) with scattered Pacific reed grass (*Calamagrostis nutkaensis*) and a variety of herbs listed above.

Port Commercial Sand Stockpile Area

The Port Commercial Sand Stockpile area would be used to store dredged material generated during construction of the slip. Habitat at this location has been disturbed both recently and historically. Recent disturbance includes site preparation associated with construction of the Southport Lumber Company and recreational site use, particularly by OHVs. Portions of the site have substantial amounts of clamshell and wood chip deposits, which suggest that portions of the site have been historically filled. The site contains three vegetation types: coniferous dune forest associations, herbaceous dominated associations, and combinations of emergent and scrub-shrub wetlands associations (see section 4.3.3). The upland coniferous dune forest is found in patches throughout the site, and integrates with the herbaceous dominated areas in some locations. The most intact stands of coniferous dune forest are located near the western property boundary, east of the Trans-Pacific Parkway and upslope from wetlands. The upland herbaceous vegetation occurs within a mosaic of actively moving dunes that lack dense vegetation to semi-stable dunes with scattered to dense vegetation. Wetland vegetation in the LNG terminal area varies from semi-dense stands of scrub-shrub with an herbaceous component, to open water areas virtually devoid of vegetation. The most substantial area of wetland vegetation in the LNG terminal area

is located in the northwestern portion of this site. Vegetation located at the Port Commercial Sand Stockpile area is shown in figure 4.3-2.

Vegetative Communities of Special Concern or Value

Both the Port-Orford cedar/evergreen huckleberry forest association and the Shore pine/bearberry woodland association are sensitive vegetation communities. As discussed above, the Port-Orford cedar/evergreen huckleberry forest association is sensitive because it is being decimated throughout its limited range by the Port-Orford cedar root rot disease. The Shore pine/bearberry woodland association is sensitive due to its limited distribution, which is restricted to a thin band adjacent to the coastline, and the fact that it is easily damaged by human disturbances.

Vegetative Species of Special Concern or Value

Suitable habitat within the LNG terminal site is present for five state or federally listed plant species, including pink sand verbena (*Abronia umbellate* ssp. *breviflora*), Point Reyes bird-beak (*Cordyanthus maritimus* spp. *palustris*), western lily, Wolf's evening primrose (*Oenothera wolfii*), and silvery phacelia (*Phacelia argentea*); however only Point Reyes bird-beak was found during botanical surveys. It was located within the southeastern portion of the LNG terminal property, outside of potential impact areas. Species of Special Concern are discussed in detail within section 4.6.

Noxious Weeds

Noxious weeds and other invasive plant species are non-native, undesirable native, or introduced species that are able to exclude and out-compete desirable native species, and thereby decrease overall species diversity. Noxious weeds often invade and persist in areas after the vegetation and ground has been disturbed and can hinder restoration. The ODA Noxious Weed Control Program and the Oregon State Weed Board (OSWB) maintain the State Noxious Weed List for the State of Oregon. There are three classes of listed noxious weeds under the ODA Noxious Weed Control Classification System: Class A, Class B, and Class T, which are described within table 4.4.1.2-1.

Species listed in the 2008 Noxious Weed Policy and Classification System and in the Oregon Aquatic Nuisance Species Management Plan that could potentially occur within the proposed LNG terminal area are summarized in table 4.4.1.2.-1.

TABLE 4.4.1.2-1

Invasive Weed Species Reported for Coos County which Could Potentially Occur within the LNG Terminal Site

Common Name	Scientific Name	Oregon DOA Class	Occurrence On Proposed Site
2008 Noxious Weed Policy and Classification System			
Spotted knapweed	*Centaurea maculosa*	B	No
Yellow starthistle	*Centaurea solstitialis*	B	No
scotch broom	*Cytisus scoparius*	B(T)	Yes
Giant knotweed	*Polygonum sachalinense*	B (T)	No
Himalayan knotweed	*Polygonum polystachyum*	B (T)	No
Japanese knotweed	*Polygonum cuspidatum*	B (T)	No
Tansy ragwort	*Senecio jacobaea*	B (T)	No
Gorse	*Ulex europaeus*	B (T)	No
Smooth cordgrass a/	*Spartina alterniflora*	A (T)	Yes
Purple loosestrife a/	*Lythrum salicaria*	B (T)	No
Oregon Aquatic Nuisance Species*			
Egeria	*Egeria densa*	B	No
Hydrilla	*Hydrilla verticillata*	A	No
Yellow iris	*Iris pseudacorus*	B	No
Parrot-feather milfoil	*Myriophyllum aquaticum*	B	Yes
Eurasian watermilfoil	*Myriophyllum spicatum*	B	No
Water chestnut	*Trapa natans*	A	No

a/ Smooth cordgrass and purple loosestrife are classified under both the 2008 Noxious Weed Policy and Classification System and the Oregon Aquatic Nuisance Species list.

-Class A weeds occur in small enough infestations to make eradication or containment possible or is not known to occur in Oregon, but is present in neighboring states making occurrence in Oregon seem imminent.

-Class B weeds are regionally abundant, but may have limited distribution in some counties.

-Class T weeds are selected from the A or B lists and are designated as a target species.

Three invasive plant species were encountered during the field surveys of the proposed LNG terminal site. These were scotch broom, parrot-feather milfoil, and smooth cordgrass (*Spartina alterniflora*). Although surveys targeting aquatic species were not conducted, when an invasive aquatic species was discovered (such as parrot-feather milfoil) they were recorded. Smooth cordgrass and scotch broom are listed on the State Noxious Weed List as Class T weeds, while parrot-feather milfoil is listed as a Class B weed and acknowledged in the Oregon Aquatic Nuisance Species Management Plan as being an aquatic nuisance species (Hanson and Sytsma 2001). Once parrot feather becomes established in a natural waterbody, it can quickly grow into dense mats that shade out native plants and algae, while reducing fish habitat and recreational use. Parrot feather is a dominant species within yellow pond lily wetlands within the proposed Project area. Monocultures of smooth cordgrass alter estuary hydrology and ecosystem functions through increased sedimentation and accretion, raising the elevation of infested areas several feet. Smooth cordgrass inhabits the intertidal zones in estuaries and occurs within the salt marsh in the eastern portion of the study area. Scotch broom readily invades areas of recent disturbance, such as pastures, agricultural lands, harvested timberlands, roadsides, trails, state parks and vacant lots, and can increase the risk of fire within affected areas due to increase in flammable fuel loads. Scotch broom is intermixed within the forest and shrub associations, primarily near disturbed areas.

Vegetative Pathogens

Port-Orford cedar root rot disease is caused by the fungus *Phytophthora lateralis*. The disease was first discovered in Port-Orford cedar's natural range in 1952 and since has spread throughout the host's range. The fungus invades the roots of Port-Orford cedar and eventually colonizes the entire root system until the tree eventually dies from girdling. Port-Orford cedar root rot disease affects both seedlings and mature trees. Evidence of infected trees includes lighter colored foliage that eventually turns red to brown and dies and discolored inner bark. The spores live in the soil and are spread through contact with contaminated soil or via free water. The disease is primarily spread through soil disturbance and moving water. Furthermore, spread of the disease over long distances occurs from contaminated equipment and livestock. Surveys for Port-Orford cedar root rot disease were not conducted on the LNG terminal site, but based on what is known about the disease, it is likely to be present in the Coos Bay area, regardless of whether or not infected trees have been identified.

Impacts and Mitigation

Table 4.4.1.2-2 lists the impacts to vegetation which would result from construction and operation of the proposed LNG terminal, while table 4.4.1.2-3 breaks down the impacts to vegetation by the various components of the LNG terminal site. Construction activities would impact approximately 117.2 acres of vegetation at the LNG terminal site, of which 114.2 acres would be permanently impacted. Of these 114.2 acres of permanent impacts, approximately 61.5 acres would occur to Dune Forests (9.7 acres of open canopy and 51.8 acres of closed canopy forest), 16.7 acres of herbaceous vegetation, and 36.0 acres of disturbed habitat. These values do not include impacts to vegetation located at the Port Commercial Sand Stockpile, which is discussed in more detail below within the Port Commercial Sand Stockpile section; however, when impact to vegetation at the Port Commercial Sand Stockpile are included, permanent impacts to Dune Forests increase to 68.7 acres of permanent impacts, while impacts to herbaceous vegetation increase to 77.4 acres of permanent impacts. These permanent impacts would constitute a long-term adverse effect. The majority of the permanent impacts to forested vegetation occurs to the shore pine/Sitka spruce and/or shore pine/Douglas-fir associations, where approximately 50.8 acres of permanent impacts are expected to occur.

The area identified as Dune Forest B would be the most heavily impacted area within the LNG terminal site (figure 4.4-2). Project components that would be located within this area would be the slip, LNG unloading berth (depicted as point E4 on figure 4.4-2 and table 4.4.1.2-3), and the Marine Access/Pipelay area (depicted as point 3 on figure 4.4-2 and table 4.4.1.2-3). A total of 33.7 acres of permanent impacts would occur to Dune Forest B, with 29.1 acres of this permanent impact occurring to shore pine/Sitka Spruce and shore pine/Douglas-fir associations (table 4.4.1.2-3).

The removal of a portion of the dune forest during construction would indirectly impact the vegetation at the newly exposed edge of the coniferous forest by changing the micro-climate factors (wind, light, salt spray, organisms that prefer edges). The existing vegetation would be exposed to the environmental elements experienced by a forest edge, which could lead to a change in species composition.

Mitigation for the loss of vegetation on the LNG terminal site would be accomplished through out-of-kind, off proximity habitat enhancement or protection to achieve the habitat replacement

TABLE 4.4.1.2-2

Impact on Vegetation Type from the Jordon Cove LNG Import Terminal

	Total Acreage Within the LNG Project Area	Construction Impact (acres)	Operation Impact (acres)
Coniferous Dune Forest - Open to Moderate Open Canopy			
Coniferous Dune Forest located at Port Commercial Sand Stockpile	3.0	3.0	3.0
Coniferous Dune Forest with scattered herbaceous vegetation located at Port Commercial Sand Stockpile	4.3	4.3	4.3
Shore Pine/Scotch Broom	7.4	4.9	4.9
Shore Pine/Hairy Manzanita (Woodland)	0.6	0.5	0.5
Shore Pine/Slough Sedge	2.1	0.8	0.8
Shore Pine/Hairy Manzanita and Shore Pine/Douglas-fir (Woodland)	2.5	2.5	2.5
European Beach Grass	0.9	0.9	0.9
Subtotal:	20.8	16.9	16.9
Coniferous Dune Forest - Closed Canopy			
Shore Pine/Douglas-fir	15.9	1.3	1.3
Shore Pine/Sitka Spruce	1.5	0	0
Port Orford Cedar	2.7	0	0
Mix of Shore Pine/Douglas-fir and Shore Pine/Bearberry	4.1	1.1	1.1
Mix of Shore Pine/Sitka Spruce and Shore Pine/Douglas-fir	71.3	49.5	49.5
Subtotal:	95.5	51.6	51.9
Herbaceous Associations - Upland			
European Beachgrass located at Port Commercial Sand Stockpile	60.7	60.7	60.7
Scattered Red Fescue	12.1	11.5	11.3
Scattered American Dune Grass	6.3	5.4	5.4
Subtotal:	79.1	77.6	77.4
Herbaceous Associations - Wetland			
Approximate Wetland Boundary in North Central Wetland	16.2	0.0	0.0
Palustrine Scrub-Shrub Wetland Area	0.5	0.0	0.0
Subtotal:	16.7	0.0	0.0
Shrubland Association			
Palustrine Scrub-Shrub w/Semi Permanently Flooded Areas located at Port Commercial Sand Stockpile	0.1	0.1	0.1
Palustrine Scrub-Shrub w/Semi Permanently Flooded Areas	1.4	0.0	0.0
Subtotal:	1.5	0.1	0.1
Disturbed	74.5	38.9	36.0
Grand Total:	**288.3**	**185.3**	**182.3**

Columns and rows do not necessarily sum correctly due to rounding.

TABLE 4.4.1.2-3

Summary of Construction and Operation-Related Disturbance to Vegetation from the Jordan Cove LNG Import Terminal

	Total Acreage Within the LNG Project Area	Construction Impact (acre)	Operation Impact (acre)
LNG TERMINAL FACILITIES			
Batch Plant/Tank Roof Assembly Area (1) a/			
Scattered American Dune Grass	3.4	3.4	3.4
Scattered Red Fescue	0.03	0.03	0.03
Palustrine Scrub-Shrub Wetland Area	0.2	0	0
Disturbed Area	10.3	0.6	0.6
Subtotal:	13.9	4.0	4.0
Access/Admin (2)			
Shore Pine/Scotch Broom	1.8	1.8	1.8
Shore Pine/Hairy Manzanita (Woodland)	0.5	0.5	0.5
Shore Pine/Slough Sedge	0.5	0.5	0.5
Shore Pine/Douglas-fir	0.3	0	0
Shore Pine/Sitka spruce	1.5	0	0
Port Orford Cedar	2.7	0	0
Scattered Red Fescue	2.2	2.0	2.0
Approximate Wetland Boundary in North Central Wetland	0.0007	0	0
Disturbed Area	8.6	1.4	1.4
Subtotal:	18.1	6.2	6.2
Marine Access/Pipelay Area (3)			
Mix of Shore Pine/Sitka Spruce and Shore Pine/Douglas-fir	10.2	10.2	10.2
Scattered Red Fescue	2.4	2.4	2.2
Disturbed Area	3.2	2.2	0
Subtotal:	15.7	14.7	12.4
Process Area (4)			
Shore Pine/Scotch Broom	0.1	0.1	0.1
Shore Pine/Slough Sedge	0.3	0.3	0.3
Shore Pine/Hairy Manzanita and Shore Pine/Douglas-fir (Woodland)	1.4	1.4	1.4
Shore Pine/Douglas-fir	1.3	1.3	1.3
Mix of Shore Pine/Douglas-fir and Shore Pine/Bearberry	1.1	1.1	1.1
Mix of Shore Pine/Sitka Spruce and Shore Pine/Douglas-fir	15.9	15.9	15.9
Approximate Wetland Boundary in North Central Wetland	0.04	0.04	0.04
Disturbed Area	0.2	0.2	0.2
Subtotal:	20.3	20.3	20.3
LNG Tank Area (5)			
Mix of Shore Pine/Sitka Spruce and Shore Pine/Douglas-fir	2.6	2.6	2.6
Scattered Red Fescue	7.1	7.1	7.1
Scattered American Dune Grass	2.0	2.0	2.0
Disturbed Area	7.7	7.7	7.7
Subtotal:	19.3	19.3	19.3
Firewater Pond (6)			
Shore Pine/Scotch Broom	0.6	0.6	0.6
Shore Pine/Hairy Manzanita and Shore Pine/Douglas-fir (Woodland)	1.1	1.1	1.1
Mix of Shore Pine/Sitka Spruce and Shore Pine/Douglas-fir	1.9	1.9	1.9
Disturbed Area	0.1	0.1	0.1
Subtotal:	3.7	3.7	3.7
Wetland Area (E1)			
Shore Pine/Hairy Manzanita (Woodland)	0.1	0	0
Shore Pine/Slough Sedge	1.3	0	0

TABLE 4.4.1.2-3

Summary of Construction and Operation-Related Disturbance to Vegetation from the Jordan Cove LNG Import Terminal

	Total Acreage Within the LNG Project Area	Construction Impact (acre)	Operation Impact (acre)
Shore Pine/Douglas-fir	1.3	0	0
Mix of Shore Pine/Douglas-fir and Shore Pine/Bearberry	0.2	0	0
Mix of Shore Pine/Sitka Spruce and Shore Pine/Douglas-fir	9.3	0	0
Approximate Wetland Boundary in North Central Wetland	16.2	0	0
Subtotal:	28.4	0	0
Sand Dune Area (E2)			
Shore Pine/Douglas-fir	10.1	0	0
Mix of Shore Pine/Douglas-fir and Shore Pine/Bearberry	2.8	0	0
Mix of Shore Pine/Sitka Spruce and Shore Pine/Douglas-fir	5.8	0	0
Scattered American Dune Grass	1.0	0	0
Disturbed Area	0.6	0	0
Subtotal:	20.2	0	0
LNG Unloading Berth Dune (E4)			
Shore Pine/Scotch Broom	2.9	0.4	0.4
Mix of Shore Pine/Sitka Spruce and Shore Pine/Douglas-fir	7.7	0.9	0.9
Disturbed Area	2.6	0.7	0
Subtotal:	13.2	2.0	1.3
Sand Dune Area (E5)			
Palustrine Scrub-Shrub w/Semi Permanently Flooded Areas	1.4	0	0
Disturbed Area	4.6	0	0
Subtotal:	6.0	0	0
EASEMENT AREAS			
Wetland Area (E3)			
Shore Pine/Douglas-fir	3.0	0	0
Scattered Red Fescue	0.4	0	0
Palustrine Scrub-Shrub Wetland Area	0.3	0	0
Disturbed Area	10.7	0	0
Subtotal:	14.4	0	0
PORT FACILITIES			
Slip			
Shore Pine/Scotch Broom	2.0	2.0	2.0
Mix of Shore Pine/Sitka Spruce and Shore Pine/Douglas-fir	18.0	18.0	18.0
European Beach Grass	0.9	0.9	0.9
Disturbed Area	26.0	26.0	26.0
Subtotal:	47.0	47.0	47.0
PORT COMMERCIAL SAND STOCKPILE AREA			
Coniferous Dune Forest	3.0	3.0	3.0
Coniferous Dune Forest with Scattered Herbaceous Areas	4.3	4.3	4.3
European Beachgrass	60.7	60.7	60.7
Palustrine Scrub-Shrub w/Semi Permanently Flooded Areas	0.1	0.1	0.1
Subtotal:	68.1	68.1	68.1
Total Vegetated Areas	213.8	146.4	146.3
Total Disturbed Areas	74.5	38.9	36.0
Grand Total:	**288.3**	**185.3**	**182.3**

a/ After construction, the Batch Plant/Tank Roof Assembly Area would be converted to a dune from material dredged from slip and replanted with native vegetation to discourage the use of the area by snowy plovers. See section 4.6.
Numbers in parentheses correspond to Project components depicted by the corresponding number within figure 4.4-2.
Columns and rows do not necessarily sum correctly due to rounding.

ratios acceptable to ODFW in terms of quantity and quality. The mitigation strategy that Jordan Cove has proposed for the upland habitat affected by the LNG terminal involves the restoration/enhancement of approximately 54 additional acres in the Port's planned mitigation area (Lyon's Property) in Isthmus Slough.

To reduce effects on vegetation within the construction area and improve the potential for revegetation, Jordan Cove would implement measures from its ECRP during construction and restoration. Areas that are disturbed by construction activities but are not affected by a facility component would be revegetated with native species, to the extent practicable, to achieve stabilization and prevent erosion of the disturbed areas. In these temporary construction areas, monitoring would continue until an herbaceous cover is established so that visual survey confirms that the density and cover of non-nuisance vegetation are similar in density and cover to adjacent undisturbed lands.

Restoration of areas disturbed by construction of LNG terminal facility components would be stabilized to prevent erosion by the planting of non-invasive species. Site areas that are disturbed only by temporary construction activities (i.e., would not be permanently affected by a facility component) would be restored using non-invasive native plant species, to the extent practical to achieve stabilization and prevent erosion of the areas disturbed. The east and west Weyerhaeuser Linerboard dredge spoil sites would be stabilized and vegetated with native species to prevent snowy plover nesting. Environmental monitoring to be conducted in all of the areas disturbed would focus upon stabilization and prevention of erosion and would be an ongoing activity on the LNG terminal site. In areas temporarily disturbed by construction, environmental monitoring would continue until a sufficient herbaceous cover has become established per the requirements of Jordan Cove's Plan.

Port Commercial Sand Stockpile Area

Use of the Port Commercial Sand Stockpile area to store sand generated during construction of the slip would impact approximately 3.0 acres of Coniferous Dune Forest, 4.3 acres of Coniferous Dune Forest with associated scattered herbaceous areas, 60.69 acres of semi-stabilized dunes with European beachgrass, and 0.1 acre of palustrine scrub-shrub wetlands. As sand would be stored at this location for up to 7 years, these would be long-term adverse impacts. After the sand has been cleared from this location (after approximately 7 years) Jordan Cove is prepared to undertake revegetation efforts at this location; however, the implementation of these revegetation efforts would be dependent on the land use proposed by the Port for the area after the 7-year period.

Vegetative Communities of Special Concern or Value

As described above, both the Port-Orford cedar/evergreen huckleberry forest association and the shore pine/bearberry woodland association are sensitive vegetation communities. The Port-Orford cedar association is located outside of the area of impact, so no direct impacts would occur to this forest association. Approximately 1.1 acres of permanent impacts would occur to a mix of shore pine/Douglas-fir and shore pine/bearberry forest associations due to construction of the Process Area, which is depicted in area 4 on figure 4.4-2 (table 4.4.1.2-3).

Vegetative Species of Special Concern or Value

Several occurrences of Point Reyes bird's-beak are located in the vicinity of the study area (ORNHIC 2005). The closest known occurrence to Jordan Cove or the slip site is located on the western edge of Jordan Cove. An occurrence of approximately 200 Point Reyes bird's-beak plants was found on the site. The occurrence extends approximately 150 feet in length, varies from 30 to 50 feet in width, and is located within a portion of saltmarsh with frequent tidal influence. Based on the distance of the occurrence to areas affected by the proposed project, the proposed LNG terminal is not expected to result in a direct or indirect impact to this occurrence of Point Reyes bird's-beak. The proposed Pacific Connector Pipeline, however, could impact this species. The effects to Species of Special Concern are discussed in more detail within section 4.6.

Noxious Weeds

Construction of the proposed LNG terminal has the potential to increase the risk of aquatic and terrestrial invasive plant species at the terminal site due to the amount of ground disturbance, heavy equipment use, and potential off-site vectors (i.e., equipment used in other locations). To avoid introducing or spreading invasive species, Jordan Cove would follow the recommendations outlined in Oregon Aquatic Species Management Plan, the Oregon Noxious Weed Strategic Plan, and BLM's multi-state environmental impact statement, Northwest Area Noxious Weed Control Program (1985), and its supplements. These documents focus on detection, containment, and/or reduction of invasive plant infestations with an integrated pest management approach (e.g., chemical, mechanical, manual and/or biological) as well as implementation of measures to avoid the introduction and spread of noxious weeds.

In its comments on an administrative draft of the EIS, the EPA expressed concern about the potential for aquatic invasive plant species to be transported into Coos Bay via the external hulls of transport ships. We have included a recommendation in section 4.3.2 to address this concern.

Surveys would be conducted within construction areas to determine the presence of invasive species. In the event that invasive species are identified, equipment would be cleaned to prevent the export and spread of weed species and seeds. Appropriate native seed mixes would also be used to limit germination of weeds during the stabilization and restoration of the site following construction. Once the Jordon Cove site is stabilized, the area would be checked for weeds and control measures consistent with BLM objectives would be implemented as needed.

Vegetation Pathogens

Surveys for Port-Orford cedar root rot disease were not conducted; however, it is likely present within the Coos Bay area due to the presence of its host. This disease, which is caused by the fungus *Phytophthora lateralis*, is readily spread through contaminated soils and ground water. All federal, state, and local management plans would be followed in order to prevent the spread of Port-Orford cedar root rot disease. Preconstruction surveys would be conducted to determine if Port-Orford cedar root rot disease is present. If it is found, the precise locations would be mapped and all contractors and site construction workers would be informed of its location. All earth-moving equipment would be decontaminated before entering and after leaving a site infected with Port-Orford cedar root rot disease in order to prevent cross contamination.

4.4.1.3 Pacific Connector Pipeline

Existing Vegetation Resources

The proposed Pacific Connector pipeline would cross ecologically diverse vegetation from the southern end of the Oregon Dunes National Recreational Area to the drier eastern slopes and plains located within the rain shadow of the Cascades, near Malin, Oregon. It passes through the wet, marine-influenced evergreen forests in the coastal region, and the highly productive coniferous forests of the Klamath Mountains and Cascades. Below are descriptions of vegetation types crossed by the proposed pipeline:

Forest and Woodland Vegetation Types

Douglas-fir-Western Hemlock-Western Redcedar Forest

Douglas-fir dominates multi-storied canopy, with western hemlock, western redcedar and grand fir (*Abies grandis*) as co-dominants. In addition, Pacific yew (*Taxus brevifolia*) may be present in the subcanopy (Kagan et al. 1999). Port-Orford cedar can also be a dominant tree species within Douglas-fir-Western hemlock-Western redcedar forest types within the proposed pipeline project area (Johnson and O'Neil 2001). Within riparian areas, and non-conifer dominated stands, bigleaf maple (*Acer macrophyllum*) and red alder (*Alnus rubra*) are common. Large stature shrubs are frequently present, such as vine maple (*Acer circinatum*), Pacific rhododendron, and fool's and red huckleberry (*Menziesia ferruginea* and *Vaccinium parvifolium*). Ferns dominate the rich and diverse herbaceous layer. This forest type is found low to mid elevations (Kagan et al. 1999) and is located in Coos and Douglas Counties within the proposed pipeline project area.

Mixed Conifer/Mixed Deciduous Forest

This forest type contains early successional (old clear-cut) generally composed of co-dominant conifer (Douglas-fir) and deciduous (red alder and/or bigleaf maple) trees in a single-layered canopy forest (Kagan et al. 1999). Port-Orford cedar may also be dominant tree species within this forest type (Johnson and O'Neil 2001). This forest type is found in low- to mid-elevations (Kagan et al. 1999), and is located in all counties crossed by the proposed pipeline project area.

True Fir-Hemlock Montane Forest

This forest type contains multi-story closed canopy forests. It also has canopy co-dominance of Pacific silver fir (*Abies amabilis*) and/or noble fir (*Abies procera*) along with both western and mountain hemlock. Other tree species present may include Douglas-fir, western white pine (*Pinus monticola*), subalpine fir (*Abies lasiocarpa*), Alaska yellow cedar (*Chamaecyparis nootkatensis*), and grand fir. The shrub layer is dense and diverse with a number of deciduous and evergreen shrubs. This forest type is found in middle to higher elevations (Kagan et al. 1999) and is located in Jackson County within the pipeline project area.

Douglas-fir-White Fir/Tanoak-Madrone Mixed Forest

Multi-layered forest of mixed conifer and mixed deciduous forest makes up this forest type. It always contains Douglas-fir, with other co-dominants (i.e., white fir, incense cedar, sugar pine [*Pinus lambertiana*] and western white pine). Subcanopy layers contain shade-tolerant trees, including tanoak (*Lithocarpus densiflorus*), madrone, chinquapin (*Chrysolepis hjelmquist*), Pacific dogwood (*Cornus nuttallii*), and California laurel (*Umbellularia californica*). Shrub and herb layers are generally well represented. This forest type if found at low to mid elevations

(Kagan et al. 1999) and is located in Douglas and Jackson Counties within the proposed pipeline project area.

Douglas-fir Dominant-Mixed Conifer Forest

Single-layer forest canopy is typical within this forest type, although stand structure can be diverse in undisturbed late seral stands. There is a wide range of canopy closure based on management practice, disturbance history, and microsite. Douglas-fir is dominant, with a variety of coniferous trees including, white fir, incense cedar, western white pine, ponderosa pine, and sugar pine. Understory vegetation is usually diverse and rich in species. This forest type is found at mid elevations (Kagan et al. 1999) and is located in Coos, Douglas and Jackson Counties.

Ponderosa Pine/White Oak Forest and Woodland

Ponderosa pine is exclusively the overstory tree at low elevations within this forest type. White fir, grand fir, western larch (*Larix occidentalis*), incense cedar, Douglas-fir, subalpine fir, and Engelmann spruce (*Picea engelmannii*) dominate at higher elevations. Understory and regeneration layers reflect similar composition as overstory. Lower elevations have fewer shrubs, increasing in diversity and abundance with elevation and improved soil moisture conditions. This forest type is found at low- to mid-elevations (Kagan et al. 1999) and is located in Jackson County.

Oregon White Oak Forest

This forest type contains deciduous woodland/forest dominated by Oregon white oak (*Quercus garryana*). Other canopy trees can be Douglas-fir and ponderosa pine in upland settings, and Oregon ash (*Fraxinus latifolia*), cottonwood (*Populus* spp.), and bigleaf maple on valley floors. The subcanopy often consists of California black oak (*Quercus velutina*). Understory typically contains tall deciduous shrubs and smaller stature deciduous trees. This forest type is a highly desirable wildlife habitat that has been decreasing as a result of fire suppression. It is found at low elevations (Kagan et al. 1999) and is located in Douglas and Jackson Counties.

Ponderosa Pine Forest and Woodland

Ponderosa pine is exclusively the overstory tree at low elevations within this forest type. White fir, grand fir, western larch, incense cedar, Douglas-fir, subalpine fir, and Engelmann spruce are dominant at higher elevations. Understory and regeneration layers reflect similar composition as overstory. Lower elevations have fewer shrubs, increasing in diversity and abundance with elevation and improved soil moisture conditions. This forest type is found at low- to mid-elevations (Kagan et al. 1999) and is located in Klamath County.

Western Juniper Woodland

This forest type contains woodlands dominated by western juniper with open canopy (less than 30 percent crown closure) and single story, short stature (6 to 20 feet tall) trees. Understory vegetation is dominated by sagebrush species, such as big sagebrush, rigid sagebrush (*Artemisia rigida*), and low sagebrush, as well as mountain mahogany, bitterbrush, and rabbitbrush (*Chrysothamnus* spp.). Grasses characterize the herbaceous layer. This forest type is found at a wide range of elevations (Kagan et al. 1999) and is located in Klamath County.

Ponderosa Pine/Western Juniper and Woodland
This forest type is typically found in the foothill margins bordering upland conifer types and sagebrush dominant lowlands. This forest type has a two-story canopy with widely spaced overstory ponderosa pine and a subcanopy of western juniper. Canopy cover is generally between 10 and 50 percent. The undertory is dominated by a shrub layer, including big sagebrush, low sagebrush, rabbitbrush, mountain mahogany, and bitterbrush, and is interspersed with annual bunch grasses (Kagan et al. 1999). This forest type is located within Klamath County.

Grass-shrub-sapling or Regenerating Young Forest
This forest type is characteristic of successional conditions following timber harvest, which can include ground scarification and slash/large woody debris, a variety of shrubs and forbs typical of the area, and then conifer saplings which form a continuous canopy above the shrub layer (Kagan et al. 1999). This forest type is located within all counties crossed by the pipeline.

Grassland and Shrubland Vegetation Types

Sagebrush Steppe
This vegetation type is a mosaic of grasses (mostly introduced) and shrubs that include big sagebrush subspecies, such as Wyoming, basin, and mountain. Other shrubs include low, silver, and three-tip sage brush, and rabbitbrush. A variety of bunchgrasses are scattered with the shrubs, although overgrazing has limited their presence (Kagan et al. 1999). This vegetation type is within Klamath County.

Shrublands
This vegetation type consists of a mosaic of grasses and shrubs, It may include sagebrush, but is not dominated by this species. It typically occur within revegetated utility corridors and transitional areas, such as reclaimed industrial sites. This vegetation type is located within all counties crossed by the pipeline.

Grasslands (west of Cascades)
This habitat contains less than 30 percent tree or shrub cover and is generally used for livestock grazing. Bunchgrasses dominate native-dominated sites, with mosses, lichens, and native forbs occurring throughout. It is found at lower elevations (Johnson and O'Neil 2001) and is located within Coos, Douglas, and Jackson Counties.

Grasslands (east of Cascades)/Forest-Grassland Mosaic
This vegetation type is a mosaic of bunchgrass grasses and conifer forest in the east Cascades. Ponderosa pine, Douglas-fir, white fir, and incense cedar are common conifers, with Idaho fescue generally the dominant grass. Other grasses that can form co-dominances are bluebunch wheatgrass (*Pseudoroegneria spicata*), junegrass (*Koeleria* spp.), Sandberg bluegrass (*Poa secunda*), and western needlegrass (*Achnatherum occidentale*). In stands heavily grazed, cheatgrass (*Bromus tectorum*) and bottlebrush squirreltail (*Elymus elymoides* ssp. *elymoides*) can be dominant. This vegetation type is found at low- to mid-elevations (Kagan et al. 1999) and is located within Klamath County.

Riparian and Wetland Vegetation Types

Palustrine Forest

This vegetation type typically has a multi-storied canopy (trees >18 feet tall). Deciduous trees generally dominate in eastern Oregon, including black cottonwood, white alder (*Alnus rhombifolia*), quaking aspen (*Populus tremuloides*), and peachleaf willow (*Salix amygdaloides*). In western Oregon, conifer trees tend to dominate the canopy: western redcedar, western hemlock, Douglas-fir, and grand fir. This vegetation type is located in narrow strips—riparian zones—along flowing waterbodies (Kagan et al. 1999) and is found within all counties crossed by the pipeline.

Palustrine Shrubland

This vegetation type is dominated by dense, tall shrubs, typically willow species. Other shrubs found could include chokecherry (*Prunus virginiana*), bog birch (*Betula pumila*), bog blueberry (*Vaccinium uliginosum*), snowberry (*Symphoricarpos albus*), wax currant (*Ribes cereum*), and *Douglas spiraea*. This vegetation type is most prominent along low gradient streams in broad valleys and pluvial basins of eastern Oregon (Kagan et al. 1999) and can be found in Coos, Jackson and Klamath Counties.

Estuarine Emergent

This vegetation type consists of herbaceous wetlands that border coastal river mouths, bays, and estuaries. Vegetation composition consists of three plant communities: salt marsh, intermarsh, and transition zone (Kagan et al. 1999). Within the pipeline project area, this category is located in Coos County.

Palustrine Emergent

This vegetation type is made up of freshwater herbaceous wetlands that contain medium tall (2 to 4 feet) to tall (> 4 feet) grass or grass-like plants. Common herbaceous plants include cattails (*Typha* spp.), bulrush species, and burreed (*Sparganium* spp.). Grasses associated with this category are blue wildrye (*Elymus glaucus*), tufted hair grass (*Deschampsia cespitosa*), bluejoint weedgrass (*Calamagrostis canadensis*), reed canarygrass, American sloughgrass (*Beckmannia syzigachne*), and northern mannagrass (*Glyceria borealis*) (Kagan et al. 1999). This vegetation type can be found within all counties crossed by the pipeline.

Agricultural Areas

These areas consists of lands that have been modified for growing crops and/or animal husbandry (Kagan et al. 1999) and are located within all counties crossed by the pipeline.

Vegetative Species of Special Concern or Value

Plant Species of Special Concern that may occur along the pipeline are discussed in section 4.6.

Noxious Weeds

Noxious weeds and other invasive plant species are non-native, undesirable native, or introduced species that are able to exclude and out-compete desirable native species, and thereby decrease overall species diversity. Noxious weeds often invade and persist in areas after the vegetation and ground has been disturbed and their presence can hinder restoration. The ODA Noxious Weed Control Program and the OSWB maintain the State Noxious Weed List for the State of

Oregon. Noxious weeds listed as Class T (target species) that are present in the vicinity or have the potential for being in the area of the proposed pipeline are listed in table 4.4.1.3-1.

TABLE 4.4.1.3-1

Oregon Target Weeds (Class T) within or Near the Proposed Project Area a/

Noxious Weed Common and Scientific Name	Occurrence/Subject to Control			Oregon Weed Class a/
	County	USFS Region 6 b/	BLM Districts b/	
Dalmatian Toadflax (*Linaria dalmatica* (*L. genista*)	Jackson, Klamath	Yes	-	B
Scotch broom (*Cytisus scoparius*)	Coos, Douglas, Jackson	Yes	-	B
Smooth cordgrass (*Spartina alterniflora*)	Coos	-	-	A
Meadow hawkweed (*Hieracium pratense*)	Douglas, Jackson, Klamath	Yes	MD	A
Woolly distaff thistle (*Carthamus lanatus*)	Douglas	-	MD	A
Portuguese broom (*Cytisus striatus*)	Douglas	-	-	B
Gorse (*Ulex europaeus*)	Coos, Douglas, Jackson	-	CB	B
Spotted knapweed (*Centaurea maculosa*)	Coos, Douglas, Jackson, Klamath	Yes, UMP	MD, KF	B
Squarrose knapweed (*Centaurea virgata*)	No Known Presence	-	MD, KF	B
Giant knotweed (*Polygonum sachalinense*)	Coos, Douglas, Jackson	-	MD	B
Himalayan knotweed (*Polygonum polystachyum*)	Coos, Douglas	-	-	B
Japanese knotweed (*Polygonum cuspidatum*)	Coos, Douglas, Jackson	Yes	MD	B
Purple loosestrife (*Lythrum salicaria*)	Coos, Douglas, Jackson, Klamath	-	CB, MD	B
Rush skeletonweed (*Chondrilla juncea*)	Douglas, Jackson	-	MD, KF	B
Leafy spurge (*Euphorbia esula*)	Jackson, Klamath	-	MD, KF	B
Tansy ragwort (*Senecio jacobaea*)	Coos, Douglas, Jackson	Yes	CB, MD, KF	B
Yellow starthistle (*Centaurea solstitialis*)	Coos, Douglas, Jackson, Klamath	Yes, UMP	CB, MD, KF	B

Sources: ODA 2008. USFS 2005

a/ Oregon Noxious Weed List: Class "A" weeds occur in small enough infestations to make eradication or containment possible or is not known to occur in Oregon, but is present in neighboring states making occurrence in Oregon seem imminent. Class "B" weeds are regionally abundant, but may have limited distribution in some counties. Class "T" weeds are selected from the "A" or "B" lists and are designated as a target species.

b/ BLM and USFS Codes: UMP—Umpqua N.F.; CB—Coos Bay District; MD—Medford District; KF—Klamath Falls District. No data available for Roseburg District. "Yes" indicates that it is documented or suspected to occur in USFS Region 6 but not necessarily within forest crossed by the Project.

Vegetation Pathogens

Aerial surveys of all forested land in Oregon are conducted annually by the USFS and ODF to determine insect and disease activity status. The surveys indicated the following insect and/or disease activity within 0.5 mile of the proposed pipeline: Douglas-fir beetle, fir engraver, flatheaded borer, mountain pine beetle (ponderosa and sugar pine), western pine beetle, lodgepole pine needle cast, and Port-Orford cedar root disease. Within the proposed pipeline project area, the western pine beetle and fir engraver are most prevalent. Other diseases that may occur or have potential to occur within the pipeline project area are annosus root rot, laminated root rot, dwarf mistletoe, and sudden oak death. Below are general descriptions of each disease/insect and known information about their potential presence along the proposed pipeline.

Douglas-fir Beetle (ODF 2007)

The Douglas-fir beetle is a medium-sized, brown to black colored beetle that exclusively infects Douglas-fir (standing or down trees with dbh greater than 8 inches). Douglas-fir beetle can be found almost anywhere its host occurs; however, it rarely kills its host tree in the lower elevation of interior southwest Oregon, where the flat-headed borer is usually the cause of Douglas-fir mortality. Two attacks generally occur throughout the year, with an initial attack from April through June, producing piles of reddish or yellowish dust, and then a secondary attack from July through August. The proposed pipeline is adjacent to or intersects documented Douglas-fir beetle infestations on private lands, BLM lands, and lands managed by the USFS.

Fir engraver Beetle (ODF 2005a; USFS 2006a)

Fir engraver beetle occurs in mature and pole-sized true fir (grand, white, red, noble), Douglas-fir, Engleman spruce, and occasionally hemlocks. An attack from fir engraver beetles generally occurs from June through September and can result in dead branches, top kill, or tree mortality. Although outbreaks are often associated with drought events, fir engravers are opportunistic and will invade trees that are stressed during wetter years (i.e., affected by root disease or wounded). The proposed pipeline is adjacent to or intersects documented fir engraver infestations on private lands, BLM lands and lands managed by the USFS; also, proposed roads in the Rogue River-Siskiyou Forest are adjacent to outbreaks.

Flatheaded Borer (ODF 2002; USFS 2006a; Nelson et al. 2004)

Trees that typically serve as the host for this beetle include Douglas-fir, true firs, western larch, spruce, and western hemlock. The flatheaded borer typically attacks weakened, dead, and recently felled trees in the upper crown resulting in topkill; however, it can infest an entire tree. Outbreaks are usually associated with dead or severely damaged trees, especially after disturbance events such as drought, storm damage, or fire. Within southwest Oregon, this beetle is aggressive, often attacking trees on the edge of stands or adjacent to newly created corridors. In 2003, a greater than 50 percent increase of flatheaded borer infestation was observed in southwestern Oregon.

Mountain Pine Beetle (ODF 2005b; USFS 2006a; Nelson et al. 2006)

This destructive beetle can cause landscape-level tree mortality. Attacks occur most often in dense stands of lodgepole, sugar, and western white pine and to a lesser degree in ponderosa pine. Thinning stands of pine is recommended to reduce the severity of mountain pine beetle outbreaks. Within Oregon, mountain pine beetle infestations have increased significantly in the last 5 years. The current outbreak is expected to continue at least another decade. The proposed pipeline is adjacent to or intersects documented mountain pine beetle infestations; therefore, clearing the right-of-way within dense stands of pine may help reduce mountain pine beetle outbreaks.

Western Pine Beetle (USFS 2006a)

The host for this beetle is ponderosa pine in southwest Oregon. Successful attacks will kill the host tree. Characterized by dying old growth trees scattered within a stand or groups of trees in overstocked stands of second growth. Trees weakened by drought or fire damage are especially susceptible. Thinning overstocked ponderosa pine stands and removing infested trees would help reduce the hazard of western pine beetle attacks. The proposed pipeline is adjacent to or intersects documented western pine beetle infestations.

Lodgepole Pine Needle Cast (Hunt 1995; USFS 2006a)

This disease results in a severe and sudden loss of needles in coniferous trees. Although it can be caused by insects, drought, excessive shading, or poor soil, needle loss in lodgepole is usually a result of the fungal disease, *Lophodermella* ssp. Spores released from previously infected year-old needles in early summer affect the current year's new needle growth. Trees infected for several years become more susceptible to other diseases. Other than avoiding plantings with offsite stock, no management is usually warranted.

Port-Orford Cedar Root Disease (Roth et al. 1987; USFS and BLM 2004; Nelson et al. 2006)

This disease is caused by the fungus, *Phytophthora lateralis* that infects approximately 9 to 15 percent of federally administered Port-Orford cedar acreage. The pathogen enters through roots and is usually fatal to old growth or sapling trees it infects. The fungus is spread from soil movement associated with construction and road maintenance, off-road traffic, movement of surface water from infected to uninfected areas, and transfer by hooves of cattle and game animals (Roth et al. 1987; USFS and BLM 2004; Nelson et al. 2006). Port-Orford cedar is geographically limited to southwest Oregon and northwest California and is an ecologically and economically important tree. The root disease is known to occur in Coos and possibly Douglas Counties. The root disease is documented within 0.1 mile of the proposed pipeline area and is known to occur in Coos Bay, Roseburg, and Medford BLM Districts. The USFS (Region 6) and BLM prepared management objectives for affected federal lands in 2004 to help control the spread of the fungus. The objectives focus on maintaining disease-free watersheds, preventing spread through sanitation, seasonal restrictions for activities, and reestablishing Port-Orford cedar using resistant and non-resistant seedlings.

Annosus Root and Butt Rot (Schmitt et al. 2000; Hadfield et al. 2006; USFS 2006a)

This disease is caused by the pathogen *Fomes annosus*, which can infect all conifers. The most susceptible tree species in the Pacific Northwest are western hemlock, mountain hemlock, grand fir, white fir, and Pacific silver fir. Infected trees suffer root and butt decay and root mortality, which result in reduced vigor, windthrow, predisposition to bark beetles, and eventual mortality. It can spread by windblown spores that germinate on freshly exposed wood (i.e., stumps or wounded trees) or underground transfer from diseased roots to uninfected roots. On the west side of the Cascades, stump infection can occur any time of the year, whereas on the east side of the Cascades, stump infection occurs in the spring and autumn. Infected sites are unknown within the proposed pipeline project area; however, annosus root rot is known to be increasing in Oregon. *F. annosus* may occur within the pipeline project area because western and mountain pine beetles and fir engraver infestations exist and they are known to attack trees infected with *F. annosus*.

Laminated Root Rot (USFS 2006b; Nelson et al. 1981)

This disease is caused by a native fungus, *Phellinus weirii* and infects all conifers, but the most susceptible trees are Douglas-fir, mountain hemlock, and grand fir, which are often killed. The infected trees usually show evidence of slow crown decline, including thinning and foliage chlorosis, and in the final stages the tree produces numerous small cones or distressed cones before death. Often the trees are wind-thrown and exhibit root balls where most of the roots have rotted off just below the root crown. The decay of the wood looks reddish-brown to brown in the butts and main roots and in later stages will begin to separate along annual rings (i.e., laminate). The fungus spreads through underground root contact and readily penetrates bark of roots of recently cut (within 12 months) of living susceptible trees. Infected sites are unknown; however, host species are present in the proposed pipeline project area.

Dwarf Mistletoe (Hennon et al. 2001; Hadfield et al. 2000)

Dwarf mistletoe (*Arceuthobium* M. Bieb.) is a damaging parasitic plant that affects conifers including Douglas-fir, grand fir, and mountain hemlock. The first symptom of dwarf mistletoe infection is slight swelling at the infection site which becomes visible 1 to 2 years after infection occurs. The variously shaped masses of abnormal branch and twig growth associated with the disease are indications of old infections and are called "witches' brooms", and can vary in size from small, palm-like structures in young infections to large masses of branches weighing several hundred pounds. Dwarf mistletoe can occur in the main stem of trees creating large burl-like structures on the trunk. The dwarf mistletoe alters tree form, reduces vigor and growth rates, reduces seed production, increases susceptibility to other damaging agents, and results in top-killing and tree death; however, the deformation of trees can provide nesting sites and cover for wildlife. This parasite is spread from tree-to-tree by seed. Infected sites are unknown; however, dwarf mistletoe most likely exists within the proposed pipeline project area.

Sudden Oak Death (USFS 2006a; Nelson et al. 2006)

This disease is caused by a recently introduced water mold, *Phytophthora ramorum*. It has killed large numbers of myrtle and tanoak trees and can also infect many other tree and shrub species. It affects the aboveground plant parts forming sporangia on infected leaves and twigs. In forests,

the sporangia spread from tree-to-tree by wind and rain and usually infect the upper crown first. Infected leaves drop on the ground allowing the sporangia to be transported through a variety of other methods, including boots, vehicles, animals, and streams. Within Oregon, *P. ramorum* has caused bore cankers and death to tanoaks, shoot dieback in Pacific rhododendron and evergreen huckleberry, and leaf blight in cascara and Oregon myrtlewood. Since 2001, state and federal agencies have been trying to eradicate sudden oak death in Oregon by cutting and burning infected host plants and uninfected adjacent plants. It has already killed extensive areas of myrtle and tanoak trees in California and hundreds of acres in Curry County, Oregon, which lies adjacent to two counties (Coos and Douglas) that would be crossed by the proposed pipeline. Infected areas in Curry County are approximately 80 miles from the proposed pipeline's location. ODF and the USFS conduct *P. ramorum* detection surveys in at-risk forests and systematic surveys in tanoak forested areas throughout southwest Oregon. To date, no accounts of sudden oak death have been documented within the proposed pipeline project area.

Wild-Harvesting of Non-Timber Forest Products

Wild-harvesting is the act of harvesting food, decorative, or medicinal products that grow naturally on lands not normally associated with agriculture. Several of the non-timber forest products harvested on public lands and roadsides in the area near the proposed pipeline are of three categories: floral greens, edibles, and medicinals. Some of the more common of these are salal, beargrass, seasonal evergreen boughs and Christmas trees, mushrooms, berries, nettles, prince's pine (*Chimaphila umbellate*), Oregon-grape (*Mahonia nervosa*), and St. Johnswort (*Hypericum perforatum*) (OPB 2006). This harvesting of non-timber forest products is widespread on public lands in the Pacific Northwest and can occur year-round on lands crossed by the proposed pipeline (OPB 2006).

All USFS lands and BLM-administered lands crossed by the pipeline require permits to wild-harvest for both recreational and commercial uses. The permit process provides forest managers with the means to track demand for products, the amount of products removed from the forests, and to protect sensitive resources (USFS 2006c). The USFS divides these permits into two major categories, convertible and non-convertible; the convertible permits are for products, other than timber sales, where the volumes collected can be converted into board feet such as permits to collect fire wood, and non-convertible permits are for other products such as mushrooms or berries were the volumes collected depends on the specific permit applied for. During the 2007 calendar year, 3,300 convertible permits, resulting in an estimated harvest of 7,481 MBF. (Approximately 15.8 MBF are needed to build a 2,000-square foot house; therefore; this represents enough wood to build approximately 475 houses of this size.) Another 5,012 non-convertible permits were filed with the USFS for harvesting on the Umpqua, Rogue River-Siskiyou and Fremont-Winema National Forests (personal communication, Frank Duran). However, the USFS estimates that only 25 to 33 percent of harvests are done through this permitting process in some locations (OPB 2006).

Impacts and Mitigation

General Impacts

During construction, the proposed pipeline facilities would cross 229.5 miles and impact 4,920.4 acres, as shown in tables 4.4.1.3-2 and 4.4.3.3-3, respectively. The primary effects of construction and operation of the proposed pipeline would be the cutting, clearing, and/or

TABLE 4.4.1.3-2

Vegetation Cover Types Crossed by the Proposed Pacific Connector Pipeline

General Vegetation Type	Mapped Vegetation Category Type	Mature Forests Miles	Percent of Total Mature Forests a/	Grass-shrub-sapling or Regenerating Young Forest b/ Miles	Percent of Total Grass-shrub-sapling or Regenerating Young Forest	Total Miles	Percent of Total by Vegetation Type
Forest-Woodland (West of Cascades)	Douglas-fir-W. Hemlock-W. Red Cedar Forest	5.1	7.7	17.0	29.0	22.0	9.6
	Mixed Conifer/Mixed Deciduous Forest	13.0	19.8	9.8	15.8	22.3	9.7
	True Fir-Hemlock Montane Forest	4.0	6.1	5.6	9.6	9.6	4.2
	Douglas-fir-White Fir/Tanoak-Madrone Mixed Forest	4.4	6.8	2.5	4.2	6.9	3.0
	Douglas-fir Dominant-Mixed Conifer Forest	27.3	41.7	23.3	39.8	50.6	22.0
	Ponderosa Pine/White Oak Forest and Woodland	3.8	5.8	0.9	1.6	4.7	2.0
	Oregon White Oak Forest	8.0	12.2	0.0	0.0	8.0	3.5
Subtotal		**65.4**	**100.0**	**58.6**	**100.0**	**124.0**	**54.0**
Percent of Total by Forest Age (West of Cascades)			***52.8***		***47.2***		
Forest-Woodland (East of Cascades)	Ponderosa Pine Forest and Woodland	1.6	14.2	7.0	79.0	8.6	3.7
	Western Juniper Woodland	7.6	66.5	1.4	15.8	9.0	3.9
	Ponderosa Pine/Western Juniper Woodland	2.2	19.3	0.5	5.2	2.7	1.2
Subtotal		**11.5**	**100.0**	**8.8**	**100.0**	**20.3**	**8.8**
Percent of Total by Forest Age (East of Cascades)			***56.6***		***43.4***		
Total for All Forest (by Age)		***76.9***	***33.5***	***67.4***	***29.4***	***144.3***	***62.9***
Grasslands-Shrubland	Sagebrush Steppe					6.9	3.0
	Shrublands	–	–	–	–	3.4	1.5
	Grasslands (West of the Cascades)	–	–	–	–	11.7	5.1
	Grasslands (East of the Cascades)/Forest-Grassland Mosaic	–	–	–	–	1.6	0.7
Subtotal						**23.5**	**10.3**
Riparian	Palustrine Forest	–	–	–	–	0.3	0.1
	Palustrine Shrub	–	–	–	–	0.1	0.0
	Estuarine Emergent	–	–	–	–	0.8	0.3
	Palustrine Emergent	–	–	–	–	6.2	2.7
Subtotal						**7.4**	**3.2**

TABLE 4.4.1.3-2

Vegetation Cover Types Crossed by the Proposed Pacific Connector Pipeline

General Vegetation Type	Mapped Vegetation Category Type	Mature Forests Miles	Percent of Total Mature Forests a/	Grass-shrub-sapling or Regenerating Young Forest b/ Miles	Percent of Total Grass-shrub-sapling or Regenerating Young Forest	Total Miles	Percent of Total by Vegetation Type
	Agriculture	–	–	–	–	32.4	14.1
Subtotal						**32.4**	**14.1**
Developed	Urban	–	–	–	–	1.9	0.8
	Industrial	–	–	–	–	0.7	0.3
Subtotal						**2.6**	**1.1**
Barren	Coastal Dunes	–	–	–	–	< 0.1	< 0.1
	Roads	–	–	–	–	11.7	5.1
Subtotal						**11.7**	**5.1**
Open Water	Rivers and Streams	–	–	–	–	1.2	0.5
	Ditches and Canals	–	–	–	–	0.4	0.2
	Palustrine Unconsolidated Bottom	–	–	–	–	< 0.1	< 0.1
	Bays and Estuaries	–	–	–	–	5.9	2.6
Subtotal						**7.6**	**3.3**
Project Total						**229.5**	**100.0**

Notes:
a/ The "Mature Forest" category describes those forest areas with a majority of trees over 40 years of age.
b/ The "Grass-shrub-sapling or Regenerating Young Forest" category describes those forest areas that are either clear-cut (tree age 0-5 years) or regenerating (tree age 5-40 years). Forest areas in this category are divided into forest vegetation types based on their potential to become those types of mature forests.
-Columns and rows do not necessarily sum correctly due to rounding.
-Acres of impacts to non-vegetated areas are included within this table for consistency in values reported within this EIS.

TABLE 4.4.1.3-3

Summary of Construction-Related Disturbance to Vegetation by the Proposed Pacific Connector Pipeline (acres)

General Vegetation Type	Mapped Vegetation Category Type	Forest Stand by Age	Pipeline Facilities: Construction Right-of-Way	Hydrostatic Discharge Sites c/	Temporary Extra Work Areas	Uncleared Storage Areas	Rock Source/Disposal	Access Roads (TARs/PARs/ Improvements) d/	Subtotal Mature	Subtotal GS or RF	Subtotal by Vegetation Type	Percent of Vegetation Type
Forest-Woodland (West of Cascades)	Douglas-fir-W. Hemlock-W. Red Cedar Forest	Mature a/	58.5		12.2	9.73			80.46		421.8	
		GS or RF b/	198.8		90.6	46.46	5.3	0.2		341.3		8.6
	Mixed Conifer/Mixed Deciduous Forest	Mature a/	147.4		55.2	84.84	6.2	2.2	295.76		457.7	
		GS or RF b/	111.5		37.5	12.95				162.0		9.3
	True Fir-Hemlock Montane Forest	Mature a/	44.2		1.2	22.81			68.18		178.8	
		GS or RF b/	61.7		20.7	28.18				110.6		3.6
	Douglas-fir-White Fir/Tanoak-Madrone Mixed Forest	Mature a/	50.5		23.3	24.71	2.4		100.83		181.2	
		GS or RF b/	30.3		20.0	30.10				80.4		3.7
	Douglas-fir Dominant-Mixed Conifer Forest	Mature a/	321.0		84.8	234.62	1.5	0.3	642.20		1,218.0	
		GS or RF b/	270.9	0.3	126.0	176.45	2.1			575.8		24.8
	Ponderosa Pine/White Oak Forest and Woodland	Mature a/	43.4		16.8	7.52			67.70		84.1	
		GS or RF b/	10.5		5.3	0.61				16.4		1.7
	Oregon White Oak Forest	Mature a/	94.9	0.1	30.1	17.49			142.62		142.6	
		GS or RF b/			0.01					0.01		2.9
Subtotal			**1,443.5**	**0.4**	**523.8**	**696.47**	**17.3**	**2.7**	**1,397.75**	**1,286.5**	**2,684.2**	**54.6**
Forest-Woodland (East of Cascades)	Ponderosa Pine Forest and Woodland	Mature a/	18.3	0.01	1.3	6.58			26.23		133.0	
		GS or RF b/	79.9		10.1	15.59	0.9	0.2		106.8		2.7
	Western Juniper Woodland	Mature a/	83.4		16.2		0.3		99.8		118.6	
		GS or RF b/	16.1		2.6			0.05		18.8		2.4
	Ponderosa Pine/Western Juniper Woodland	Mature a/	26.2	< 0.2	8.9				35.25		41.2	
		GS or RF b/	5.3		0.6					5.9		0.8
Subtotal			**229.2**	**0.2**	**39.7**	**22.17**	**1.2**	**0.3**	**161.28**	**131.4**	**292.7**	**6.0**
Total for All Forest (by Age)			***1,672.7***	***0.6***	***563.5***	***718.64***	***18.5***	***2.9***	***1,559.03***	***1,417.9***	***2,976.9***	
Percent of All Forest			***56.2***	***0.02***	***18.9***	***24.14***	***0.6***	***0.1***	***31.68***	***28.8***	***60.5***	

TABLE 4.4.1.3-3

Summary of Construction-Related Disturbance to Vegetation by the Proposed Pacific Connector Pipeline (acres)

General Vegetation Type	Mapped Vegetation Category Type	Forest Stand by Age	Pipeline Facilities									
			Construction Right-of-Way	Hydrostatic Discharge Sites c/	Temporary Extra Work Areas	Uncleared Storage Areas	Rock Source/Disposal	Access Roads (TARs/PARs/ Improvements) d/	Subtotal Mature	Subtotal GS or RF	Subtotal by Vegetation Type	Percent of Vegetation Type
Grasslands-Shrubland	Sagebrush Steppe		81.4		17.0		0.01				98.5	
	Shrublands		38.6		9.6	7.86		0.6			56.7	
	Grasslands (West of the Cascades)		132.4		101.4	23.02	1.9	0.8			259.6	
	Grasslands (East of the Cascades)/Forest-Grassland Mosaic		19.5		6.6		3.5				29.6	
Subtotal			**272.0**		**134.6**	**30.88**	**5.4**	**1.4**			**444.4**	**9.0**
Riparian	Palustrine Forest		3.7		0.5						4.2	
	Palustrine Shrubland		0.9		0.1						1.1	
	Estuarine Emergent		21.4		0.03						21.5	
	Palustrine Emergent		71.2	0.1	40.8	0.01		0.6			112.8	
Subtotal			**97.3**	**0.1**	**41.5**	**0.01**		**0.6**			**139.5**	**2.8**
	Agriculture		369.5	0.6	216.7	0.87	0.4	1.7			589.7	
Subtotal			**369.5**	**0.6**	**216.7**	**0.87**	**0.4**	**1.7**			**589.7**	**12.0**
Developed	Urban		22.6		46.6	0.16					69.4	
	Industrial		10.8		161.6		27.4	0.2			200.0	
Subtotal			**33.4**		**208.2**	**0.16**	**27.4**	**0.2**			**269.4**	**5.5**
Barren	Coastal Dunes		0.2		0.9						1.1	
	Roads		115.4		76.8	15.92	3.3	18.5			229.9	
Subtotal			**115.6**		**77.7**	**15.92**	**3.3**	**18.5**			**231.0**	**4.7**
	Rivers and Streams		11.4		31.3	0.11	0.1				43.0	
	Ditches and Canals		4.6		2.8			0.01			7.5	
	Palustrine Unconsolidated Bottom		0.1		4	1.43					5.5	

TABLE 4.4.1.3-3

Summary of Construction-Related Disturbance to Vegetation by the Proposed Pacific Connector Pipeline (acres)

General Vegetation Type	Mapped Vegetation Category Type		Pipeline Facilities									
			Construction Right-of-Way	Hydrostatic Discharge Sites c/	Temporary Extra Work Areas	Uncleared Storage Areas	Rock Source/Disposal	Access Roads (TARs/PARs/ Improvements) d/	Subtotal Mature	Subtotal GS or RF	Subtotal by Vegetation Type	Percent of Vegetation Type
	Bays and Estuaries	Forest Stand by Age	186.3		27.5						213.9	
Subtotal			**202.4**		**65.6**	**1.54**	**0.1**	**0.01**			**269.7**	**5.5**
Project Total			**2,762.8**	**1.3**	**1,307.7**	**768.02**	**55.3**	**25.3**			**4,920.4**	
Percent of Pipeline Facilities			**56.2**	**0.03**	**26.9**	**15.61**	**1.12**	**0.5**			**100.0**	**100.0**

a/ The "Mature Forest" category describes those forest areas with a majority of trees over 40 years of age.
b/ The "Grass-shrub-sapling or Regenerating Young Forest" category describes those forest areas that are either clear-cut (tree age 0-5 years) or regenerating (tree age 5-40 years). Forest areas in this category are divided into forest vegetation types based on their potential to become those types of mature forests.
c/ Small brush or trees may be cleared by a rubber-tired rotary or flail motor (brush hog) or by hand with machetes/chainsaws. No soil disturbance would occur. A rubber-tired hoe would be utilized to lay the discharge line and to remove the saturated hay bales or filter bags upon completion of hydrostatic discharge.
d/ Portions of some of the PARs are located within the construction right-of-way and, therefore, there is some duplication in the acreage calculations.
-Columns and rows do not necessarily sum correctly due to rounding.
-Acres of impacts to non-vegetated areas are included within this table for consistency in values reported within this EIS.

removal of existing vegetation within the work areas. All areas except the UCSAs and portions of the hydrostatic test discharge sites would be cleared of vegetation.

Short-term Impacts

Impacts are considered short-term if, after three growing seasons, the revegetated disturbed areas resemble adjacent undisturbed lands. Areas with the vegetation types that have the potential for revegetation after three growing seasons include agricultural lands, grassland-shrubland, and riparian shrub areas. For example, riparian shrubs removed during construction would be replaced by cuttings and sprigs of locally available shrub species during revegetation.

The proposed pipeline is expected to have short-term impacts to approximately 598.7 acres of agricultural lands (12.0 percent of the proposed pipeline project), 444.4 acres of grasslands-shrubland (9.0 percent), and 135.3 acres of riparian shrub area (Palustrine Shrubland, Palustrine Emergent and Estuarine Emergent) (2.8 percent). Additional areas with limited vegetation that would be expected to have short-term impacts include 7.5 acres of ditches and canals and 1.1 acres of coastal dunes. Developed lands (urban and industrial – 269.4 acres), roads (229.9 acres), rivers and streams (43.0 acres), and palustrine unconsolidated bottom (5.5 acres) are non-vegetated areas. The impact upon intertidal, marsh and bay bottom vegetation through the Coos Bay and Marshfield and Cooston Channels (213.8 acres) is discussed in section 4.3.3.

Short-term impacts would also occur on the UCSAs (768.0 acres), which are work areas that would not be cleared of trees during construction. The UCSAs would be used to store forest slash, stumps and dead and downed log materials that would be scattered across the right-way after construction. These areas also may be used to store spoil and park construction equipment and other vehicles. USCAs would be located in mature forests and areas of steep slopes and narrow ridgelines. In forests, these areas are characterized by trees that are sufficiently spaced to allow for storage of cleared right-of-way vegetation. EIs would rope off stands of mature trees and operators would be educated to place and retrieve materials to minimize impacts such as soil compaction and bark damage.

Within UCSAs, some damage to understory vegetation and minor damage to trees would be expected. Trees that are damaged at the time of construction could die over time. Vegetation disturbance would generally depend on the site-specific vegetation characteristics - with younger revegetating forests being potentially more susceptible to damage such as limb breakage. Of the forest-woodland vegetation type, the USCAs would impact 408.3 acres of mature forest (forests with trees over 40 years of age) and 341.2 acres of grass-shrub-sapling (forests with recent clear-cuts age 0 to 5 years) or regenerating young forest (age 5 to 40 years) (see table 4.4.1.3-3).

After construction, Pacific Connector would assess potential tree damage within the UCSAs and would appropriately compensate the landowner for damage. Appropriate restoration measures would be applied as described in Pacific Connector's ECRP (i.e, scarification, seeding, replanting, etc.) where disturbance/damage has occurred. For example, compacted soils would be scarified after use and prior to the rainy season to promote revegetation and ensure that soil disturbance caused by pipeline construction would not permanently impact long-term site productivity. USCAs and their purposes are discussed in more detail within section 2.3.3.1.

For hydrostatic test discharge sites, Pacific Connector has stated that portions of these sites may be cleared of small brush or trees either by mechanical means or by hand in order to position hay

bales or filter bags. The number of growing seasons these areas would take to revegetate would depend on the amount and type of vegetation cleared, which varies from mature Oregon White Oak Forest to agricultural. The seven proposed hydrostatic discharge sites outside of the construction right-of-way would impact approximately 1.3 acres during construction and would be revegetated as necessary following construction.

Medium-Term Impacts

Because the proposed pipeline would impact grass-shrub-sapling areas, which are those areas of clear-cuts with saplings ranging in age from 0 to 5 years, revegetation efforts in these areas could take anywhere from 1 to 5 growing seasons to return to their pre-construction state. This amount of time is slightly longer than what is considered as a short-term impact, but considerably shorter than a long-term impact, which is an impact that can last for the life of a project and beyond. The proposed pipeline would impact approximately 311.7[1] acres of grass-shrub-sapling areas, which is 6.3 percent of the acreage disturbed by the pipeline.

Long-Term Impacts

Long-term impacts would last longer than three growing seasons within the disturbed area and not resemble adjacent undisturbed lands for the life of the proposed project. Areas with trees and shrubs removed from upland coniferous, deciduous and mixed forests would have long-term impacts. Particularly, trees with large basal diameters would not regenerate during the life of the project, so their removal would be a long-term loss for many decades. Likewise, removal of trees within riparian zones would be considered a long-term impact. The proposed pipeline project would cross a total of 144.6 miles of forest-woodlands and riparian woodlands.

Long-term impacts would occur to approximately 54 percent of the area affected by the proposed Pacific Connector pipeline project, or 2,669.4 acres. Of the forest-woodland vegetation, 76.9 miles (1,559.0 acres) of the proposed pipeline would have long-term impacts on mature forests. Regenerating Young Forests, which have trees ranging in age from 5 to 40 years, would also be impacted over the long-term, for 1,106.2 acres. Of all the forest-woodland vegetation types, it is the Douglas-fir Dominant-Mixed Conifer Forest (1,218.0 acres or 24.8 percent) that would be the most impacted.

The proposed pipeline would impact approximately 4.2 acres of riparian (palustrine) forest. This impact would be considered long-term because the trees would not return and the riparian area would be converted to either emergent or shrubland during revegetation.

Additional long-term impacts include the cutting of danger trees – trees outside approved construction areas that are at risk of falling on workers or vehicles and thus would need to be removed. The removal of these trees would result in an additional long-term impact to adjacent vegetation that cannot be quantified prior to construction. Danger trees are discussed in section 4.4.1.

[1] On September 4, 2007 Pacific Connector filed with the FERC Table 8.4-1 in Resource Report 8 breaking out clear-cut forest verses regenerating forest areas. An additional 8.98 acres of clear cut located in transportation corridors that must be maintained in at a seral age in included in the total.

TABLE 4.4.1.3-4

Summary of Operation-Related Disturbance to Vegetation by the Proposed Pacific Connector Pipeline (acres a/)

General Vegetation Type	Mapped Vegetation Category Type	Forest Stand by Age	Pipeline Facilities: Permanent Easement	Permanent Access Roads	Subtotal Mature	Subtotal GS or RF	Subtotal of Forest-Woodland by Vegetation Type	*30-foot Maintenance Corridor*	Aboveground Facilities: Jordan Cover MS & MLV #1 & CT d/	MLV #2	MLV #3	MLV #4	MLV #5	MLV #6	Clarks Branch MS & MLV #7 &CT	MLV #8	MLV #9	Shady Cove MS & CT	Butte Falls CS & MLV #10 & CT	MLV #11	MLV #12	MLV #13	MLV #14	MLV #15	Tule Lake/Russell Canyon/Buck Butte MS & MLV #16 & CT	Subtotal by All Vegetation Type
Forest-Woodland (West of Cascades)	Douglas-fir-W. Hemlock-W. Red Cedar Forest	Mature b/	35.4		35.4		158.34	*18.6*																		158.4
		GS or RF c/	122.8	0.2		122.9		*61.6*				<0.1														
	Mixed Conifer/Mixed Deciduous Forest	Mature b/	105.3	0.3	105.5		178.77	*47.1*											6.0							184.8
		GS or RF c/	73.2			73.2		*34.2*			<0.1															
	True Fir-Hemlock Montane Forest	Mature b/	25.6		25.6		61.33	*14.5*																		61.3
		GS or RF c/	35.8			35.8		*20.4*																		
	Douglas-fir-White Fir/Tanoak-Madrone Mixed Forest	Mature b/	33.6		33.6		52.76	*16.1*																		52.8
		GS or RF c/	19.2			19.2		*9.0*																		
	Douglas-fir Dominant-Mixed Conifer Forest	Mature b/	189.6		189.6		358.91	*99.6*	0.7																	359.6
		GS or RF c/	169.4			169.4		*85.1*									<0.1									
	Ponderosa Pine/White Oak Forest and Woodland	Mature b/	26.5		26.5		32.91	*13.7*																		32.9
		GS or RF c/	6.4			6.4		*3.4*																		
	Oregon White Oak Forest	Mature b/	66.9		66.9		66.90	*30.8*										0.6								67.5
		GS or RF c/				0.0																				
Subtotal			**909.5**	**0.4**	**483.0**	**426.9**	**909.92**	***454.2***	**0.7**		**<0.1**	**<0.1**					**<0.1**	**0.6**	**6.0**							**917.3**
Forest-Woodland (East of Cascades)	Ponderosa Pine Forest and Woodland	Mature b/	10.5		10.5		59.39	*5.9*																		59.5
		GS or RF c/	48.7	0.2		48.9		*25.3*													<0.1					
	Western Juniper Woodland	Mature b/	59.3		59.3		69.41	*27.0*																		69.9
		GS or RF c/	10.1	0.05		10.2		*5.1*														0.5				
	Ponderosa Pine/Western Juniper Woodland	Mature b/	18.3		18.3		21.68	*8.1*																		21.7
		GS or RF c/	3.4			3.4		*1.7*																		
Subtotal			**150.2**	**0.3**	**88.1**	**62.4**	**150.48**	***73.1***													**<0.1**	**0.5**				**151.0**
Total for All Forest			***1059.7***	***0.7***	***571.1***	***489.3***	***1060.40***	***527.3***	***0.7***		***<0.1***	***<0.1***					***<0.1***	***0.6***	***6.0***		***<0.1***	***0.5***				***1068.3***
Percent of All Forest of Total Project			***58.9***	***< 0.1***	***31.7***	***27.2***	***58.89***	***29.3***																		
Grasslands-Shrubland	Sagebrush Steppe		59.7					*24.9*																		59.7
	Shrublands		28.0					*12.4*																		28.0
	Grasslands (West of the Cascades)		96.7	< 0.1				*42.2*								<0.1		2.4	1.3							100.5
	Grasslands (East of the Cascades)/Forest-Grassland Mosaic		14.0					*5.7*																		14.0
Subtotal			**198.4**	**< 0.1**				***85.1***								**<0.1**		**2.4**	**1.3**							**202.2**
Riparian	Palustrine Forest		2.7					*1.2*																		2.7
	Palustrine Shrubland		0.7					*0.4*																		0.7
	Estuarine Emergent		7.1					*2.8*																		7.1
	Palustrine Emergent		52.6					*22.5*							0.1											52.7

TABLE 4.4.1.3-4

Summary of Operation-Related Disturbance to Vegetation by the Proposed Pacific Connector Pipeline (acres a/)

General Vegetation Type	Mapped Vegetation Category Type		Pipeline Facilities: Permanent Easement	Permanent Access Roads	Subtotal Mature	Subtotal GS or RF	Subtotal of Forest-Woodland by Vegetation Type	*30-foot Maintenance Corridor*	Aboveground Facilities: Jordan Cover MS & MLV #1 & CT d/	MLV #2	MLV #3	MLV #4	MLV #5	MLV #6	Clarks Branch MS & MLV #7 &CT	MLV #8	MLV #9	Shady Cove MS & CT	Butte Falls CS & MLV #10 & CT	MLV #11	MLV #12	MLV #13	MLV #14	MLV #15	Tule Lake/Russell Canyon/Buck Butte MS & MLV #16 & CT	Subtotal by All Vegetation Type
Subtotal		**Forest Stand by Age**	**63.1**					***26.9***																		**63.1**
	Agriculture		287.5	0.6				*118.0*		0.06			<0.1	<0.1	0.9				0.01	0.06			<0.1	<0.1	6.6	296.0
Subtotal			**287.5**	**0.6**				***118.0***		**0.06**			**<0.1**	**<0.1**	**0.9**				**0.01**	**0.06**			**<0.1**	**<0.1**	**6.6**	**296.0**
Developed	Urban		15.8					*6.9*											< 0.1							15.9
	Industrial		5.2					*2.7*	1.1																	6.4
Subtotal			**21.1**					***9.5***	**1.1**																	**22.2**
Barren	Coastal Dunes		0.1					*< 0.1*	0.5																	0.6
	Roads		78.9	1.4				*41.4*							<0.1											80.4
Subtotal			**79.0**	**1.4**				***41.5***	**0.5**						**<0.1**											**81.0**
Open Water	Rivers and Streams		10.6					*3.2*										0.1								10.7
	Ditches and Canals		3.5					*1.3*											< 0.1							3.6
	Palustrine Unconsolidated Bottom		0.1					*< 0.1*																		0.1
	Bays and Estuaries		53.5					*21.6*																		53.5
Subtotal			**67.7**					***26.1***										**0.1**	**< 0.1**							**67.9**
Project Total			**1776.5**	**2.8**				***834.5***	**2.2**	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**0.9**	**<0.1**	**<0.1**	**3.1**	**7.3**	**<0.1**	**<0.1**	**0.5**	**<0.1**	**<0.1**	**6.6**	**1800.6**
Percent of Operations Facilities			**98.7**	**0.2**				***46.3***	**0.1**						**<0.1**			**0.2**	**0.4**			**<0.1**			**0.4**	**100.0**

a/ Acres disturbed were evaluated using GIS; footprints for each component (aboveground facilities, permanent easement, and 30-foot maintenance corridor) were overlaid on the digitized vegetation coverage.

b/ The "Mature Forest" category describes those forest areas with a majority of trees over 40 years of age.

c/ GS or RF = Grass-shrub-sapling or Regenerating Young Forest. This category describes those forest areas that are either clear-cut (tree age 0-5 years) or regenerating (tree age 5-40 years). Forest areas in this category are divided into forest vegetation types based on their potential to become those types of mature forests.

d/ CT = Communications tower

General: If percentages were less than 1/100ths, they were not included in the table.

-Columns and rows do not necessarily sum correctly due to rounding.

-Acres of impacts to non-vegetated areas are included within this table for consistency in values reported within this EIS.

During operation, the proposed pipeline would have a permanent easement (right-of-way corridor), permanent access roads, and aboveground facilities that would impact approximately 1,800.6 acres of various vegetation types (table 4.4.1.3-4). The impact resulting from the permanent right-of-way would be approximately 1,776.5 acres; however, Pacific Connector has proposed to limit vegetation maintenance in forested areas to a 30-foot maintenance corridor, which would reduce the impact from 1,776.5 acres to 834.5 acres (a reduction of 942 acres of impacts). The total long-term operational impact of the proposed pipeline would be 858.6 acres (i.e. 1,800.6 acres to 942 acres). Out of the total construction impact of 4,920.4 acres, 4,061.9 acres would be revegetated (or 82.6 percent of the proposed pipeline).

During construction and restoration, Pacific Connector would implement measures to minimize long-term impact on vegetation and ensure successful revegetation of disturbed areas, including measures from its ECRP, agency recommended revegetation plans, and landowner requests. These measures would be applied to all lands – private, state and federal. Measures specific to federal lands are addressed below under Environmental Consequences on Federal Lands. Measures that would be implemented to minimize impacts to vegetation and ensure successful revegetation of disturbed areas include:

- The construction right-of-way would be limited to 75 feet based at stream crossings and TEWAs would be located 50 feet back from streams, except where site-specific conditions would not allow (see table I-1 in Appendix I);
- The construction right-of-way would be graded to restore preconstruction contours and leave the soil in proper condition for seeding or planting;
- Damage to drain tiles or irrigation systems resulting from construction in active agricultural areas would be corrected and monitored until restoration is successful;
- Landscaped areas would be restored in accordance with the landowner's request, or the landowner would be compensated (e.g., where mature trees are removed and can't be replaced in kind). On private lands, compensation would be negotiated on a case-by-case basis or decided in the courts during an eminent domain hearing;
- Restoration plans would include measures for re-establishing herbaceous or woody vegetation, controlling the establishment or spread of invasive species, weed control, and monitoring;
- Disturbed areas would be seeded in accordance with written recommendations for seed mixes, rates and dates obtained from the local conservation authority or as requested by the landowner. The NRCS, BLM, and USFS were consulted regarding seeding dates and mixtures;
- Pacific Connector would use weed-free straw for any mulch used during seeding. In addition, certified weed-free straw would be used for mulch and sediment barriers, dewatering structures, or other uses along the right-of-way. The EI or Pacific Connector's authorized representative would be responsible for ensuring that all straw hauled to the construction yards would be certified weed-free;
- All disturbed areas would be monitored for revegetation success after the first and second growing seasons;
- Slash from timber clearing would be scattered across the right-of-way in order to return organic material to the soil and serve as erosion control;

- Revegetation in non-agricultural areas would be considered successful if upon visual survey the density and cover of non-nuisance vegetation are similar in density and cover to adjacent undisturbed lands (not including landscaped areas). In agricultural areas, revegetation would be considered successful if crop yields are similar to adjacent undisturbed portions of the same field;
- Approximately 1,800 acres would be replanted with conifer species in forested areas outside of the 30-foot maintenance right-of-way, and 30 acres of hardwoods would be replanted within forested, shrub and riverine wetlands. Replanting of trees within forested areas would comply with both state and federal guidelines;
- Vegetation within the upland portion of the 30-foot maintenance corridor, centered over the pipeline, would be maintained in an herbaceous/shrub state of less than 6 feet in height (figure 2.7-1). For waterbody crossings, Pacific Connector would limit vegetation maintenance to maintain a 25 foot buffer from the streambank
  - The 30-foot maintenance corridor would be periodically maintained using mowing, cutting and trimming either through mechanical methods or by hand. Maintenance activities are expected to occur approximately every 3 to 5 years depending on the vegetation's growth rate.
  - Routine vegetation maintenance clearing would not occur more frequently than every 3 years, except as necessary for the 10-foot-wide corridor centered over the pipeline that could be maintained annually if necessary.
  - Route vegetation maintenance clearing would not occur during the principal portion of the growing season from April to August.
  - Compaction of soils would be prevented through the implementation of the ECRP.
- Prior to construction or disturbance, areas of known noxious weeds may be pretreated with herbicides.
- During operation, no herbicides would be used in the 30-foot maintenance corridor unless invasive species infestations were to occur, in which case only landowner approved herbicides would be used for eradication.
- Boulders and other large rocks generated by construction activities would be used to block access to the cleared right-of-way by recreational and off-road vehicles, which have the potential to spread noxious weeds, insects or vegetation diseases.

Effects of Forest Fragmentation

In addition to the direct effects of removing vegetation, there would be indirect effects resulting from the fragmentation of connected vegetation types. Fragmentation refers to breaking up contiguous areas of vegetation or habitat into smaller patches, which results in the creation of forest edges along the right-of-way. The conditions within these fragments are further altered due to edge effects. Forest edges play a crucial role in ecosystem interactions and landscape function, including the distribution of plants and animals, fire spread, vegetation structure, and wildlife habitat. Creation of forest edge adjacent to dense canopy would impact microclimate factors such as wind, humidity, and light, and can lead to a change in species composition within the adjacent forest or increase invasion by invasive species. Compared to the forest interior, areas near edges receive more direct solar radiation during the day, lose more long-wave radiation at night, have lower humidity, and receive less short-wave radiation. Increased solar radiation and wind can desiccate vegetation by increasing evapotranspiration, can affect which

species survive along the edge (typically favoring shade intolerant species), and can impact soil characteristics. Fragmentation and a loss of habitat connectivity can also impact wildlife (see section 4.5).

Other physical factors affecting edge includes edge orientation (Chen et al. 1995). For example, the general orientation of the Pacific Connector pipeline is from northwest to southeast; therefore, edge effects would be most pronounced on the southwest-facing edges and weakest along the northeast-facing edges.

The amount of solar radiation falling on a newly created edge would depend on the direction it faces, its latitude, time of year and time of day (solar azimuth and solar altitude), and height of trees that would cast shadows on the new edge. Because these values constantly change temporally and spatially, the edge effects would also constantly change along the pipeline, as tree shadows would extend different distances across the right-of-way depending on the time of year. This would result as some areas would be in shade at one point in the year (reducing edge effects) and in sunlight during another portion of the year (increasing edge effects). For example, assume the 95-foot wide pipeline corridor is oriented northwest to southeast at 135º from north. At a location in the vicinity of the pipeline (longitude=123.0º West, latitude=42.5º North) on June 21, the sun would be shining from the east (azimuth ≈91.5º) at 0815 (PST) with solar altitude of ≈ 37.6º. A tree 100 feet tall on the southwest-facing edge of the right-of-way would cast a shadow 130 feet which, given the angle and width of the right-of-way, would fall short of reaching the opposite side (northeast-facing edge) by about 5 feet. On May 21, however, the sun in the same position would have cast a shadow of about 170 feet at 0745 (PST) and on July 21 at 0800 (PST) the shadow would extend about 160 feet. In both instances, the edge opposite the eastern sun would be in shadow. Such changing amounts of solar radiation – due to tree shadows - would occur along the entire route although the shortest shadows (and most solar radiation) would always occur on the summer solstice when the solar altitude is at its maximum.

The area crossed by the proposed pipeline has already experienced fragmentation in the form of existing roads, other rights-of-way, clear cuts, residential developments, and agricultural developments (table 4.4.1.3-5); however, the proposed pipeline would create approximately 98.1 miles of new edge, or 196.2 miles when both sides of the right-of-way are taken into account. This estimate does not include clearcut or regenerating forest. The majority of this edge (76.4 miles or 152.8 miles for both sides of right-of-way) would be created through contiguous forest and woodland vegetation types. Additionally, edges would be created through contiguous sagebrush steppe (9.3 miles or 18.6 for both sides of right-of-way), grasslands (11.2 miles west of Cascades or 22.4 for both sides of right-of-way, 1.2 miles east of Cascades or 2.4 for both sides of right-of-way), and palustrine forested and/or shrub wetlands (0.5 mile or 1 mile for both sides of right-of-way). The right-of-way would create some patches less that 1 acre in size. Riparian vegetation would have the smallest average patch size resulting from pipeline-associated fragmentation (average patch size would be 0.26 acres in palustrine forest and 0.16 acres in palustrine shrub communities). A total of 1,063 new isolated patches of vegetation would be created within various vegetation types. Douglas-fir dominant-mixed conifer forest would be the most impacted vegetation type, with approximately 222 patches created. The average size of new patches within Douglas-fir dominant-mixed conifer forest would be 1.4 acres per patch, with a range of 8.6 acres to less than 0.01 acre.

TABLE 4.4.1.3-5

Estimated Fragmentation within Forested, Woodland, Shrub, and Grassland Vegetation Due to the Proposed Pipeline Facilities Construction Right-of-Way

General Vegetation Type	Mapped Vegetation Category Type a/	Total ROW Patches b/ in Category	Total Area (acres)	Mean Area per ROW Patch (acres)	Total Length (miles)
Forest-Woodland (West of Cascades)	Douglas-fir-W. Hemlock-W. Red Cedar Forest	54	57.6	1.1	5.0
	Mixed Conifer/Mixed Deciduous Forest	192	146.5	0.8	12.7
	True Fir-Hemlock Montane Forest	35	44.2	1.3	4.0
	Douglas-fir-White Fir/Tanoak-Madrone Mixed Forest	222	310.8	1.4	26.4
	Douglas-fir Dominant-Mixed Conifer Forest	38	49.6	1.3	4.4
	Ponderosa Pine/White Oak Forest and Woodland	37	43.3	1.2	3.7
	Oregon White Oak Forest	73	99.1	1.4	8.3
Subtotal		**651**	**751.1**		**64.4**
Forest-Woodland (East of Cascades)	Ponderosa Pine Forest and Woodland	50	52.5	1.1	4.6
	Western Juniper Woodland	17	10.9	0.6	1.2
	Ponderosa Pine/Western Juniper Woodland	49	68.2	1.4	6.3
Subtotal		**116**	**131.6**		**12.0**
Forest/Woodland Total		**767**	**882.7**		**76.4**
Grasslands-Shrubland	Sagebrush Steppe	87	110.3	1.3	9.3
	Grasslands (West of the Cascades)	181	127.8	0.7	11.2
	Grasslands (East of the Cascades)/Forest-Grassland Mosaic	28	14.4	0.5	1.2
Subtotal		**296**	**252.5**		**21.7**
Riparian	Palustrine Forest	16	4.2	0.3	0.4
	Palustrine Shrub	10	1.6	0.2	0.2
Subtotal		**26**	**5.8**		**0.5**
Grand Total:		**1,063**	**1,135.3**		**98.1**

a/. TEWAs, UCSAs, and clear cut and regenerating forests are not included.
b/ Patch: a contiguous clump of similar vegetation of varying acreage size.
-Columns and rows do not necessarily sum correctly due to rounding.

In addition to the construction right-of-way, TEWAs would also contribute to fragmentation by creating patches within contiguous habitats. Because most of the proposed TEWAs are adjacent to the construction right-of-way, clearing would mostly add to the patch size created on the right-of-way rather than create additional cleared patches.

Vegetative Species of Special Concern or Value

The proposed pipeline May Impact Individuals or Habitat (MIIH) of ten plant species of special concern, but would not likely contribute to a trend towards federal listing or cause a loss of viability to the populations or species. These ten plant species of special concern are: *Fabronia pusilla*, *Clavariadelphus sachalinensis, Ramaria thiersii, Leptogium teretiusculum, Cheilanthes intertexta, Cypripedium fasciculatum, Limnanthes gracilis* ssp. *gracilis, Microseris laciniata* spp. *detlingii, Navarretia heterandra, and Navarretia subuligera.* The status of and effects to Species of Special Concern are discussed in section 4.6.

Noxious Weeds

Short- or long-term impact to any vegetation community could result from establishment and spread of noxious weeds following construction. Noxious weeds can adversely affect an area either when invasive plants become established or when an existing species' population size increases. Invasive or noxious plants can negatively affect habitat by competing for resources such as water and light, changing the community composition, eliminating or reducing native plants, or by changing the vegetation structure. The changes in community composition or vegetation structure can reduce native plant populations and can also negatively affect habitat for wildlife. Soil disturbance and/or removal of existing vegetation for pipeline or road construction can provide openings for invasive or noxious plants to establish or spread. Movement of equipment can also provide opportunities for seed transport into new areas. Direct effects of invasions can include the establishment or spread of invasive or noxious plants through the use of new roads after construction, maintenance activities, or by providing a corridor for the establishment and spread of invasive or noxious plants to adjoining lands. In general, habitats with more bare ground, such as grasslands, riparian areas, and relatively dry or open forests are more susceptible to invasion than are dense, moist forests, high montane areas and serpentine areas that have relatively closed canopy cover or have extreme climate or soils that are tolerated by fewer invasive plant species. Due to the connectivity of lands by roads and their use, the potential effects of invasive or noxious plants are not limited to the area of disturbance.

Multiple noxious weeds were documented along the pipeline route during botanical surveys conducted in 2007 (table 4.4.1.3-6). All weeds found are ODA class B species but 5 species observed were also Class "T" weeds, including yellow starthistle, rush skeletonweed, purple loosestrife, Japanese knotweed, and tansy ragwort. Of the Class "T" species, yellow starthistle and tansy ragwort were the most prevalent (table 4.4.1.3-6). Occurrences of these species increase the potential for new or expanded growth of noxious weeds as direct consequence of pipeline construction.

TABLE 4.4.1.3-6

Summary of Noxious Weeds found Along the Pacific Connector Pipeline Route during 2007

Common Name *Scientific Name*	Oregon DOA Class	Oregon DOA Target "T" Weed	Number of Incidences on ROW
Meadow knapweed *Centaurea pratensis*	B	No	7
Yellow starthistle *Centaurea solstitialis*	B	Yes	17
Canada thistle *Cirsium arvense*	B	No	11
Rush skeletonweed *Chondrilla juncea*	B	Yes	10
Scotch broom *Cytisus scoparius*	B	No	11
English ivy *Hedera helix*	B	No	1
Dalmation toadflax *Linaria dalmatica (L. genista)*	B	No	1
Purple loosestrife *Lythrum salicaria*	B	Yes	1
Japanese knotweed *Polygonum cuspidatum*	B	Yes	1
Himalyan blackberry *Rubus discolor*	B	No	39
Tansy ragwort *Senecio jacobaea*	B	Yes	14

The ODA, BLM and USFS were consulted for recommendations to prevent the introduction or spread of noxious weeds and soil pests. Before construction, Pacific Connector would develop a Noxious Weed Control Plan as part of the ECRP that would incorporate the recommendations of these agencies. The plan would provide procedures to minimize the potential introduction or spread of weeds along the construction right-of-way. The plan would include reconnaissance surveys to determine the presence of noxious weeds, cleaning of construction equipment and vehicles prior to moving them onto the construction right-of-way, and requirements for vegetation clearing and grading in areas of noxious weeds. All construction equipment would be inspected to ensure that it is clean and free of potential weed seed, prior to transporting equipment to the construction right-of-way. Construction equipment would be power washed, if necessary, as determined by the EI. In addition, initial inspections of all project inspector vehicles and construction contractor vehicles would be performed prior to being allowed on the construction right-of-way. The EI or Pacific Connector's authorized representative would be responsible for performing inspections and registering or tagging the equipment prior to being transported or moved to the right-of-way. Any equipment used for clearing of areas with noxious weeds present which are classified as priority A and T as well as selected B listed weeds would be cleaned by hand, blown down with air, or pressure washed prior to leaving the site. Equipment cleaning on the right-of-way would occur in a cleaning station approved by the EI. Infested areas and cleaning stations would be mapped to ensure that these areas are monitored during construction and to ensure that these weeds are controlled and not spread.

After construction, Pacific Connector would monitor the right-of-way for infestations of noxious weeds. Monitoring would occur in the areas where noxious weeds were identified prior to construction and were previously mapped to ensure that potential infestations do not reestablish and/or spread. Monitoring would also occur in areas along the right-of-way where equipment cleaning stations and hydrostatic dewatering sites were located to ensure that infestation at these locations do not occur. Pacific Connector's operational staff or their contractors would be responsible for these monitoring efforts. If infestations occur along the right-of-way, Pacific Connector would make an assessment of the source of the infestation, the potential for the infestation to spread, and develop a treatment plan to control the infestation. The treatment plan would be developed using integrated weed management principles, and if herbicides are used, all applicable approvals would be obtained prior to their use including landowner approvals. Only herbicides which are approved for use within treated lands (private, state, or federal) would be used. Treatments would not be conducted during precipitation events or when precipitation is expected within 24 hours. If weeds targeted for herbicide treatments are in the vicinity of sensitive sites, proper buffers would be used in order to prevent the spread of herbicides to these areas. Pacific Connector would consult with the Oregon Department of Agriculture Noxious Weed Control Program or local County Weed Programs for additional support regarding noxious weed control issues that may occur during the pipeline operations. Pacific Connector would conduct follow-up inspections of all disturbed areas after the first and second growing season to determine the success of revegetation.

Vegetation Pathogens

Insects and diseases can adversely affect a forest if pipeline associated activities introduce new or spread existing infestations. Trees may be more susceptible to infestation that are damaged during clearing activities and/or have soil compacted over their roots, including those within UCSAs. Equipment can transport insects or disease in or out of an area. The pipeline's

right-of-way and the use of roads can spread or introduce insects or disease to new areas. The spread of insects or disease within the proposed pipeline Project area would result in both short- and long-term effects, such as reduced species diversity due to invasion or infestation and a loss of habitat function for wildlife.

Multiple infestations of insect parasites and tree pathogens already exist along the pipeline's route (table 4.4.1.3-7). Those occurrences increase the potential for new or expanded infestations or infections as direct result of pipeline construction. Port-Orford-Cedar root disease has been documented on the proposed route. Though no current records exist, sites infected with annosus root and butt rot would be documented during timber cruising prior to vegetation clearing in 2010. Known infestations of insect tree parasites include several associated with fir engraver and western pine beetles and one each of flatheaded borer and mountain pine beetle (table 4.4.1.3-7). True firs that are damaged during clearing activities and have compacted soil may be more susceptible to fir engravers. Likewise, thinning overstocked ponderosa pine stands and removing trees infested with western pine beetles would help reduce the hazard of additional attacks. Flatheaded borer outbreaks are usually associated with dead or severely damaged trees, especially after disturbance events such as drought, storm damage or fire. Dwarf mistletoe most likely exists on the Pacific Connector proposed pipeline route, although specific sites have not been identified. Potential impacts to stands within the proposed project area that may increase the spread of the parasite, especially in Douglas-fir stands, would likely evolve as forested openings are created that provide more direct sunlight to existing infestations that cause the disease to become more vigorous.

TABLE 4.4.1.3-7

Summary of Known Infestations of Insect Parasites and Tree Diseases Along the Pacific Connector Pipeline Route

Tree Insect or Disease	Land Ownership	Number of Incidences on ROW	Approximate Length (miles) of ROW Affected
Port-Orford-Cedar Root Disease	Private	1	0.2
Fir Engraver	Private	1	0.1
	Private - FS	1	0.3
	FS	4	1.0
	BLM	4	0.9
Flatheaded Borer	BLM	1	< 0.1
Mountain Pine Beetle	FS	1	< 0.1
Western Pine Beetle	Private	3	0.3
	Private-BLM	1	< 0.1
	BLM	2	0.3

Listed below are mitigations for specific insect or diseases that would be implemented within infected areas.

- Douglas-fir beetle – Within areas where Douglas-fir beetle infestations have been documented, methylcychexenone capsules (a natural beetle repellant) would be applied to trees along the edge of the construction right-of-way. This treatment would occur before beetle flight in April to protect remaining stands of Douglas-fir and to prevent the spread of Douglas-fir beetle. No Douglas-fir down wood, 12 inches or larger in diameter, would be left in areas on USFS lands where there are known infestations of Douglas-fir beetle.

- Fir engraver – When clearing the construction right-of-way within true fir stands, Pacific Connector would utilize logging practices that directionally fall timber into the right-of-way, as well as store logs away from trees adjacent to the right-of-way to minimize or prevent damage to standing trees. Additionally, fresh slash greater than 4 inches provides breeding material for the beetles and can contribute to outbreaks. Pacific Connector would use the BLM and USFS fuel loading specifications to minimize slash accumulations.
- Flatheaded borer – Pacific Connector would minimize damage to adjacent trees when clearing and maintaining the right-of-way, including felling trees within the right-of-way away from adjacent, standing trees.
- Western pine beetle – In overstocked, infested stands, Pacific Connector would remove infested trees before beetle emergence in early June to reduce potential for infestation, if feasible. Also, if a mature ponderosa pine tree is identified with western pine beetle infestation within, but on the immediate edge of the construction right-of-way and would not pose a safety or construction hazards, it would be retained for future snag recruitment to benefit wildlife.
- Port-Orford cedar root disease – To minimize or prevent the spread of *P. lateralis* within the proposed Project area, Pacific Connector would implement the following in areas with Port-Orford cedar, whether stands are infested or not (adapted from BLM 1994a): 1) pressure wash equipment and vehicles prior to entering uninfected areas and prior to departure of infested areas with water, 2) limit ground-disturbing construction and maintenance activities to the dry season, if feasible, and 3) prevent use of right-of-way in Port-Orford cedar areas from off-road recreationists by blocking access. All equipment entering USFS lands would comply with all USFS *P. lateralis* mitigation requirements. Pacific Connector would revegetate Port-Orford cedar areas using disease-resistant strains of seedlings if recommended and available for the seed zone affected by the proposed pipeline.
- Laminated root rot – Infected stands would be documented and revegetated with resistant conifer species (native cedars, pines, and spruces).
- Dwarf mistletoe – In the event that dwarf mistletoe is found within the proposed Project area, Pacific Connector would consult with the agencies to determine the appropriate plan to minimize its spread.
- Annosus root and butt rot – During timber cruises in 2009, sites infected with annosus root and butt rot would be documented. Management to reduce tree loss from *F. annosus* varies depending on tree species affected. To reduce the spread of annosus root rot in the proposed Project area overall, dry borax would be applied to freshly cut stumps and wounds inflicted on trees adjacent to the construction right-of-way in areas identified with infestations of annosus root rot, especially when true firs and pine are the tree species present Unless the specific strain of Annosus root disease is known (p-type strain or s-type strain), cut surfaces of all susceptible species would be treated in areas where the disease may be occurring to prevent spread. P-type strain occurs mainly on pines and incense cedar, but also on hardwoods and brush; the s-type strain infects spruces, firs, Douglas-fir, western redcedar, and hemlocks.

Fire Regimes

During public scoping we received comments about the potential for herbaceous vegetation maintained along the pipeline right-of-way or slash (wood debris created during construction) scattered within the right-of-way to increase the local fire regime. In addition, there was concern that vehicles traveling along new access roads would ignite wildfires within these herbaceous communities and slash piles, which could then subsequently trigger forest fires within adjacent vegetation. This would result as the low intensity herbaceous ground fires utilize the more dense vegetation located near forest edges as a ladder, allowing access to the forest's canopy, which would trigger a high intensity crown fire. If fire frequencies were to increase within either herbaceous or forested areas, communities could shift to a species composition more adapted to higher fire frequencies and the increased disturbance rates could increase the rate of establishment by invasive species.

The exact risk of fires (either natural, or caused by human and/or pipeline construction or operation activities) occurring along the pipeline would be dependent on local conditions; as the pipeline crosses a broad range of vegetation types and ecoregion, the mean fire return intervals experienced along the pipeline's route varies considerably, with mean fire return intervals from as frequent as 10 to 15 years in the dryer eastern regions to some moister regions with intervals greater than 500 (USGS 2008).

Once construction is completed, vehicular traffic along the new access roads would be intermittent due to the reduced need for access following construction; therefore, the likelihood and frequency of vehicular ignited fires along these new access roads contributing to the local fire regime would be small. In addition, the western portion of the pipeline is in an area with a moist climate, where fire ignitions from vehicle are infrequent. Also, herbaceous vegetation is common in the eastern portion of the pipeline's right-of-way; therefore, additional herbaceous communities within these eastern areas would not likely alter the areas fire regime.

Land management units (i.e., BLM District, National Forest, State Forest, private forest ownership) generally have specific fuel management standards for its lands, depending on location and management objectives. These may include the periodic use of prescribed fire to reduce fuel loads, and therefore fire hazard, to recommended levels. Pacific Connector would comply with land owner/land management agency standards for each ownership/management unit crossed by the pipeline and would coordinate fuel reduction activities with land owners/managers. In addition, Pacific Connector would coordinate with appropriate land owners, land management agencies, state agencies, and local fire districts to ensure that fire prevention and suppression activities consider pipeline safety.

Wild-Harvest of Non-Timber Forest Products

Some legal (i.e. permitted) recreational and commercial harvesters could be temporarily displaced during pipeline construction. Additionally, some of the forest products which are typically harvested would be removed during land clearing phases of pipeline construction. However, much of the wild harvesting which occurs within this area is illegal (i.e. not permitted) and the proposed pipeline right-of-way and roads would create new access into forested areas, therefore wild harvesting could increase as a result of the proposed construction and operation. In order to limit this unauthorized use of the pipeline's right-of-way by illegal harvesters, debris

and boulders, generated during construction, would be used to block these potential points of access.

4.4.1.4 Environmental Consequences on Federal Lands

BLM – Forest Operations Inventory

The BLM tracks vegetation, land management treatments, and disturbance within each district during operations inventories. This data and/or attributes are then transferred to a GIS coverage called the Forest Operations Inventory (FOI). The FOI describes and classifies forest cover (vegetation), site class, denudation cause, dominant species, understory species, treatments, age class, and stand condition (BLM 2006). The FOI classification for all BLM districts that would be crossed by the proposed Project are listed within Table 3C-1 in Appendix 3C of Resource Report 3, filled with Pacific Connector's application to the FERC.

USFS– Plant Association Groups

The USFS classifies potential vegetation based on plant association groups (PAGs). PAGs are described primarily by the presence or absence, and abundance of plant species based on environmental variables, including soil, aspect, slope, slope position, and moisture. PAGs are also divided into plant series based on the climax dominant trees of a stand. PAGs have been defined for the three USFS lands that would be crossed by the proposed Project; not all three USFS managed lands, however, have had PAGs identified and are noted as "not currently in model" (USFS 1996). The following describes seven plant series that would be crossed by the proposed Pacific Connector pipeline, based on GIS coverage:

Douglas-Fir Series

Douglas-fir occurs in all PAG series within elevations ranging from sea level to 5,600 feet. Usually overstory presence of Douglas-fir indicates recent ground disturbance while presence and dominance in the understory can indicate hot, dry conditions, which is characteristic of the Douglas-fir Series. Many other tree species may be present that are also tolerant of drought-like conditions, such as ponderosa pine, incense cedar and canyon live oak (*Quercus chrysolepis*). Within Umpqua National Forest, the following shrubs/plant associations may occur within the Douglas-fir Series: poison oak (*Toxicodendron diversilobum*), canyon live oak, chinquapin, salal, and species associated with ultramafic parent materials. Potentially canyon live oak and Douglas-fir may occur on the Rogue River-Siskiyou National Forest.

Mountain Hemlock Series

In Southwest Oregon, mountain hemlock occurs at high elevations, ranging from approximately 3,950 feet to 6,690 feet in the Cascades, with cold temperatures and moderate precipitation. Associated parent material is highly variable, although pumice, andesite, and basalt are the most common. Mountain hemlock and Shasta red fir are dominant tree species in the overstory, with western white pine and Douglas-fir occasionally occurring. Within the Rogue River-Siskiyou National Forest, the Mountain Hemlock Series may be associated with grouse huckleberry in deep soils at higher elevations, Pacific rhododendron at lower elevations and warmer conditions, and/or with the wildflower sidebells pyrola (*Pyrola secunda*).

Shasta Red Fir Series

The Shasta Red Fir Series is representative of a variety of California red fir found in southwest Oregon and northern California generally at higher elevations (4,000 to 6,900 feet) where the climate is cool and moist. Shasta red fir is typically the dominant tree in the overstory, although on warmer sites, white fir is present and on cooler sites, mountain hemlock is present. Within the Rogue River-Siskiyou National Forest, the mountain sweet-root/Shasta Red Fir Series association may potentially be found which is typically located at sites with lower precipitation. In the Fremont-Winema National Forest, the Shasta Red Fir series is found within the Cascade Province of Southwest Oregon.

White Fir Series

This species is most abundant in Southwest Oregon and will occur on a variety of sites and therefore is not specific to slope, aspect, soil type, or elevation. White Fir Series generally occurs on cool sites, with an average rainfall varying between 45 inches in drier areas of the Cascades to 102 inches near the coast. As a result of frequent disturbances, other early seral species become the dominant overstory tree in the White Fir Series, such as Douglas-fir and Shasta red fir, which are potentially present within the Rogue River Siskiyou National Forest. Also, dwarf Oregon grape is common and widespread within the Series and may occur within the Project area. Based on GIS coverage, white fir-shasta red fir is crossed on the Fremont-Winema National Forest.

Grand Fir Series

No specific description has been created for this series. However, based on GIS coverage, grand fir trees may be dominant within stands located in the Umpqua National Forest, with a canyon live oak association.

Jeffrey Pine Series

This species is scattered throughout Jackson and Douglas Counties and usually occurs on dry, ultramafic parent material, mainly serpentine and peridotite with high exposed gravel, surface rock, and bedrock components. As a result of the serpentine/periodotite parent material this series is associated with, many unique and rare species can be found. This series is found within a wide elevational range, from 1,200 feet to 6,000 feet; however, most occurrences are concentrated near 2,000 feet. It can occur on all aspects and slope positions although it is most common on the southerly aspect and mid-slope position. Often Douglas-fir and incense cedar are associated with the Jeffrey Pine Series, which has an open canopy characteristic. Within the Umpqua National Forest, Jeffrey Pine (*Pinus jeffreyi*) has the potential to occur with high grass understory coverage.

Western Hemlock Series

This plant series is known to occur in drier conditions on Umpqua National Forest, and the associations crossed by the proposed pipeline are salal, Oregon grape, and rhododendron. The series is associated with low to moderate elevations. Because of the frequent disturbances in southwest Oregon, the overstory of this series is generally dominated by Douglas-fir with the understory predominately western hemlock; however, within the western hemlock/salal-dwarf Oregon grape association, both western hemlock and Douglas-fir are present in the overstory.

Noxious Weeds

The BLM objective for weeds is to contain and/or reduce noxious weed infestations with an integrated pest management approach (e.g., chemical, mechanical, manual, and/or biological) and avoid introducing or spreading noxious weed infestations in areas, as outlined in the BLM's multi-state environmental impact statement, Northwest Area Noxious Weed Control Program (BLM 1985) and its supplements. The BLM is specifically concerned with the impacts of weeds on LSRs and seeks to eliminate or control weeds that adversely affect those areas. Elsewhere, the BLM surveys for noxious weed infestations, reports them to the ODA, and coordinates with them to reduce infestations, using methods that do not conflict with Northwest Forest Plan ACS objectives.

Control of noxious weeds by USFS is coordinated with state, county, and private organizations through weed control districts or coordinated resource management agreements. On USFS lands, preventive management is critical to an effective control program. The agency utilizes management direction provided in the Pacific Northwest Region Invasive Plant Program: Preventing and Managing Invasive Plants Final Environmental Impact Statement (2005). Noxious weeds classified as target species, which occur on federal lands are listed within table 4.4.1.3-6.

Impacts and Mitigation

The proposed pipeline would cross the Umpqua, Rogue River-Siskiyou and Fremont-Winema National Forests, as well as through the checkerboard landownership pattern of the BLM-administered lands within the Coos, Roseburg, Medford, and Lakeview BLM Districts.

Areas crossed on federally managed lands include both Riparian Reserves and LSRs. Riparian Reserves are areas along streams and other waterbodies where the conservation of aquatic- and riparian-dependent terrestrial resources receives emphasis. The main purpose of Riparian Reserves is to protect the health of the aquatic system and its dependent species. The riparian vegetation is important because it provides shade and a source of large woody debris, which can affect the stream temperature and contribute to the overall quality of habitat. Lands considered within Riparian Reserves are determined through watershed analysis. If watershed analysis has not been conducted for a particular waterbody, interim widths are assigned. Section 4.3.3 discusses the widths for Riparian Reserves within BLM and USFS lands. LSRs were established in order to protect and enhance the conditions of old growth forest ecosystems; however, not all forests within LSRs consist of old growth. LSRs contain a diverse assemblage of tree species in moderate to high densities, and provide essential habitat for a variety of wildlife species such as the northern spotted owl (USFS and BLM 1994b).

The proposed pipeline would cross approximately 8.1 miles of riparian zones, 3.5 of which are on lands managed by the Oregon Department of Forestry under the Forest Practices Act, and 4.6 of which are Riparian Reserves on federal lands; 3.7 miles on BLM-administrated lands and 0.9 mile on USFS lands (table 4.4.1.4-1). Medium-term impact to Riparian Reserves on federal lands would include clearing 28.7 acres of clearcut and regenerating forest. Short-term impacts to Riparian Reserves on federal lands would include clearing 10.3 acres of unaltered non-forested vegetation, 1.6 acres of agriculture, 6.9 acres of altered vegetation/developed areas, and 0.5 acres of wetlands within federal Riparian Reserves. Long-term impacts to Riparian Reserves on federal lands would include the clearing of 37.4 acres of forested vegetation.

TABLE 4.4.1.4-1

Riparian Area Vegetation Types Crossed by the Proposed Pipeline

Property Jurisdiction	Total Distance Crossed (miles)	Total (acres) in Riparian Areas Affected by Construction						
		Forested Habitat	Clearcut or Regenerating Habitat	Wetland Habitat	Unaltered Nonforested Habitat	Agriculture	Altered Habitat	Total Habitat Affected
Private	3.3	18.5	15.5	2.9	8.9	6.6	4.3	56.6
State	0.1	< 0.1	0.0	2.4	0.0	0.6	0.1	3.1
Unknown	0.1	0.0	0.0	< 0.1	< 0.1	1.9	0.6	2.5
Non-Federal Total	3.5	18.5	15.5	5.3	8.9	9.1	4.9	62.3
BLM Coos Bay	0.9	5.8	5.3	0.0	0.0	1.4	0.7	13.2
BLM Roseburg	0.7	8.6	5.6	0.0	0.4	0.0	2.0	16.6
BLM Medford	2.0	14.5	8.2	0.2	9.9	0.1	1.2	34.1
BLM Lakeview	0.1	0.1	1.3	0.0	0.0	0.0	0.2	1.5
BLM Total	3.7	28.9	20.3	0.2	10.3	1.6	4.1	65.5
Umpqua NF	0.6	7.5	2.6	0.0	0.0	0.0	2.7	12.8
Rogue River-Siskiyou NF	0.3	0.5	3.6	0.0	0.0	0.0	0.1	4.2
Fremont-Winema NF	0.1	0.5	2.3	0.3	0.0	0.0	0.0	3.1
USFS Total	0.9	8.5	8.4	0.3	0.0	0.0	2.8	20.0
TOTAL	**8.1**	**56.0**	**44.2**	**5.8**	**19.2**	**10.7**	**11.8**	**147.8**

Columns do not necessarily sum correctly due to rounding.

Table 4.4.1.4-2 summarizes the effects of the proposed pipeline on PAGs and LSRs within USFS lands. A total of 394.6 acres of land would be impacted within LSRs on USFS lands, most of which occurs within the Rogue River-Siskiyou National Forest (277.5 acres), while a total of 560.8 acres of land would be impacted outside of LSRs on USFS lands (table 4.4.1.4-2). Table 4.4.1.4-3 summarizes impacts to forested stands within the affected BLM districts, including LSRs. A total of 133.8 acres of land would be impacted within LSR on BLM-administered lands, while a total of 874.2 acres of land would be impacted outside of LSRs on BLM-administered lands (table 4.4.1.4-3). Of these 874.2 acres of impacts, over 527 acres would occur to forests over 80 years in age (see wildlife section 4.5).

TABLE 4.4.1.4-2

Summary of Construction Impact to Plant Association Groups (PAGs) on Three National Forests Affected by the Pacific Connector Pipeline

National Forest	PAG Series a/	Impacted Area (acres) in LSR	Construction Impact (acres): Construction Right-of-Way	Temporary Extra Work Areas	Uncleared Storage Area	Rock Source/ Disposal	Total b/
Umpqua NF	Douglas-fir	66.5	60.8	15.1	24.0	0.4	100.3
	Grand fir	16.4	8.1	1.7	8.3	0	18.0
	Jeffrey pine	0.4	11.6	2.3	5.4	0	19.4
	Western hemlock	3.8	4.7	1.0	2.5	0	8.2
	White fir	10.8	35.5	28.8	6.3	1.2	71.8
	Not in series	9.1	7.9	3.3	0	0.7	11.8
Umpqua NF Total		106.7	128.5	52.2	46.4	2.3	229.5
Rogue River-Siskiyou NF	Douglas-fir	37.8	20.1	8.1	9.5		37.8
	Mountain hemlock	10.0	6.3	0.5	3.2	0	10.0
	Shasta red fir	35.5	22.3	4.5	8.7	0	35.5
	White fir	193.7	106.6	36.6	50.5	0	193.7
	Not in series	0.6	0.5	0	0.1	0	0.6
Rogue River-Siskiyou NF Total		277.5	155.8	49.7	72.0	0	277.6
Fremont-Winema NF	Shasta red fir	2.7	1.7	0	1.0	0	2.7
	White fir	0.5	0.3	0	0.2	0	0.5
	Not in series	7.0	35.9	6.2	8.5	0	50.6
Fremont-Winema NF Total		**10.2**	**37.9**	**6.2**	**9.7**	**0**	**53.8 c/**
Overall Total		**394.6**	**322.3**	**108.1**	**128.1**	**2.3**	**560.8**

a/ PAGs as defined by USFS.

b/ Total excludes Impacted Area in LSR which is already included in the Construction Impacts.

c/ The Fremont-Winema PAG data is not complete, and, therefore only 53.78 of the 96.58 acres impacted by the Pacific Connector pipeline within the Fremont-Winema National Forest are represented in this table.

Columns do not necessarily sum correctly due to rounding.

TABLE 4.4.1.4-3

Summary of Construction Impact to Forested Stands within Four BLM Districts Affected by the Pacific Connector Pipeline

BLM District and Forest Stand Type	Age Category (years)	Impacted Area (acres) in LSR	Construction Impact (acres): Construction Right-of-Way	Hydrostatic or TARs/PARs	Rock Source/ Disposal	Temporary Extra Work Areas	Uncleared Storage Areas	Total a/
Coos Bay District								
Conifers	<80	11.1	87.4	< 0.1	1.8	24.6	10.5	124.3
	80-150	0	27.4	0	0	4.0	5.2	36.7
	151-300	0	5.0	0	0.4	0	0.6	6.0
	>300	0	0.9	0	0.9	0	0	1.8
Hardwoods	80-150	0	0.6	0	0	0.4	0	1.0
Mixed	<80	0.1	6.5	0	0.1	3.2	0	9.8
Non-Forest	N/A	2.4	1.3	0	2.4	2.0	0	5.7
Coos Bay District Total		**13.5**	**129.1**	**< 0.1**	**5.6**	**34.2**	**16.3**	**185.2**
Roseburg District								
Conifers	<80	60.5	52.3	0.2	2.1	28.4	34.3	117.3
	80-150	9.0	42.8	< 0.1	0	13.4	44.9	101.2
	151-300	47.7	49.8	0.2	0.9	27.9	55.0	133.8
Hardwoods	<80	0	0.6	0	0	< 0.1	0.4	1.0
Mixed	80-150	0	4.7	0	0	2.1	5.6	12.4
	151-300	3.1	6.4	0	0	3.8	3.2	13.4
Non-Forest	N/A	0	5.2	0	0	1.1	3.7	10.0
Roseburg District Total		**120.3**	**161.8**	**0.4**	**3.0**	**76.8**	**147.1**	**389.1**
Medford District								
Conifers	<80	0	22.0	0	< 0.1	13.4	1.3	36.7
	80-150	0	13.2	0.1	0	4.6	4.7	22.7
	151-300	0	32.1	0	< 0.1	8.5	14.5	55.1
	>300	0	3.1	0	0	1.2	1.1	5.4
Hardwoods	80-150	0	20.0	0	0	7.9	1.3	29.2
	151-300	0	10.4	0	0	2.6	4.8	17.7
Mixed	<80	0	3.2	0	0	1.3	0.6	5.1
	80-150	0	40.4	0	0	14.5	10.8	65.8
	151-300	0	3.3	0	0	1.2	0.6	5.7
Non-Forest	N/A	0	23.8	0	0	12.7	0.7	37.2
Medford District Total		**0**	**171.6**	**0.1**	**< 0.1**	**67.9**	**40.3**	**279.9**
Lakeview District								
Conifers	80-150	0	6.2	0	0	0.6	0.8	7.5
	151-300	0	9.3	0	0	2.6	0.5	12.4
Lakeview District Total		**0**	**15.4**	**0**	**0**	**3.2**	**1.3**	**19.9**
Overall Total		**133.8**	**478.0**	**0.5**	**8.7**	**182.0**	**205.0**	**874.2**

a/ Total excludes Impacted Area in LSR which is already included in the Construction Impacts.
Columns do not necessarily sum correctly due to rounding.

The pipeline would also fragment LSR and Riparian Reserves on federal lands. The Pacific Connector pipeline would cross three LSRs. These include: RO 261 in Coos Bay and Roseburg BLM Districts, RO 223 in Roseburg BLM District and Umpqua National Forest, and RO 227 in Rogue River-Siskiyou National Forest, resulting in 24.1 miles of new edge. This value does not take into account both sides of the proposed construction right-of-way. When both sides of the

right-of-way are considered, this value becomes 48.2 miles of new edge. Much of this habitat type is comprised of mature forest types, which may be more prone than younger regenerating forests types to the adverse effects of fragmentation and edge effects, due to an abundance of species adapted to a contiguous dense habitat with an infrequent disturbance regime. The Pacific Connector pipeline would cross approximately 4.6 miles of federally managed Riparian Reserves, resulting in 4.6 miles of new edge or 9.2 miles when both sides of the right-of-way are considered.

Listed below are the mitigation measures which would be implemented on federal lands, in addition to those described above.

- On state and federal lands, compensation would be negotiated on a case-by-case basis.
- Disturbed areas would be replanted with appropriate seed mixes identified by the BLM and USFS for pastures, range lands, the right-of-way, wetlands, and other federal designated lands (based on NRCS recommendations) to prevent noxious weed germination.
- For straw used on federal lands, the authorized officer for BLM or USFS may inspect and approve straw material to verify that it is weed free. Gravel/rock used on USFS lands would be from weed-free sources as well, and approved by the USFS' authorized representative.
- Pacific Connector has agreed to plant the permanent easement with native shrubs extending 100 feet from the streambanks with federally-designated Riparian Reserves on BLM-administered and USFS-managed lands. All plantings proposed for federally administered lands must be approved by each agency's silviculturist. Agency silviculturist would determine when sites have been successfully revegetated.
- Replanting of USFS lands would be in accordance with agency silviculture requirements, which may include planting native hardwood and shrubs in addition to conifers to ensure species diversity.

In addition, the Northwest Forest Plan requires that new developments within proposed LSR are neutral or beneficial to the creation and maintenance of late-succession habitat. The proposed Pacific Connector pipeline as designed cannot be constructed without affecting LSRs. In order to comply with the Objectives, Standards and Guidelines of the Northwest Forest Plan a mitigation fund would be developed. How this mitigation fund would be set up, including whether the funds would be transferred to the BLM and USFS prior to construction or held on paper as a trust by Pacific Connector, and how the fund would be administered, would be determined through consultation with the BLM and USFS. The details for administering the mitigation fund would be specified as a condition of the BLM's Right-of-Way Grant. Pacific Connector's mitigation fund would mitigate for the loss of LSR habitat by funding various projects, such as:

- The decommissioning of roads within LSRs that the USFS and BLM have determined are no longer required.
  - Roads which the USFS has identified as "surplus" or unneeded would be decommissioned and these roadbeds would be tilled to a depth of 18 inches. Tillage on federal lands would be directed by a Soil Scientist, and would use equipment designed to promote rooting depths needed to facilitate native vegetation recovery and proper water infiltration.

- The process of decommissioning roads could result in short term impacts, including a temporary increase in erosion during road treatments, temporary disturbance to wildlife during treatments, temporary loss of vegetation if roads need to be cleared in order to remove culverts or side-cast materials, and an increased risk of invasive species as a result of soil disturbance. In addition, the creation of snags could result in short term impacts to vegetation during their installation within stream or terrestrial habitat.

- Establishing easements or purchasing titles on lands which could be preserved as late successional forest.
  - These lands could either be adjacent to the pipeline or be situated adjacent to existing BLM-administered and USFS-managed lands in order to block up ownership, increase connectivity, and reduce potential future fragmentation.
- Funding silvilcultural projects that would create or accelerate the development of old growth characteristics on federal lands.
- Creating snags to enhance riparian or terrestrial habitat.
- Funding habitat management programs for the Kincaid's lupine/Mardon skipper.
  - Fence or otherwise exclude cattle and off-road vehicles from sensitive areas to protect habitat.

Vegetation Infestations – Insects and Pathogens

The effects and mitigation measure implemented for the prevention of infestation by insects or pathogens would be similar to those discussed above; however, directional tree falling would be required on all USFS lands, including areas with no known insect/disease occurrence, in order to prevent residual tree damage/injury and disease infection.

Noxious Weeds

In order to prevent or limit the spread of invasive species and noxious weeds, all construction equipment would be inspected to ensure that it is clean and free of potential weed seed, prior to transporting equipment to the construction right-of-way. Because of the contiguous pattern of USFS lands crossed by the pipeline, equipment would be inspected and cleaned at cleaning stations located at the borders of each National Forest, prior to clearing and grading activities, in addition to being cleaned at cleaning stations associated with any mapped areas infested with noxious weeds of priority A and T and selected B listed weeds within each National Forest. Because the BLM managed lands crossed by the pipeline are not contiguous, but are instead spread out in a checkerboard pattern, it is not practical to set up inspection and cleaning stations at each entry point. Instead, where BLM lands are contiguous to USFS lands, the cleaning stations would be located to include the adjacent BLM lands. The location of any additional cleaning stations required in areas where BLM lands are not contiguous with USFS lands, would be coordinated with the BLM. Monitoring efforts for weed species would be similar to those described above; however, monitoring within federal lands would occur annually for a period of 3 to 5 years.

4.4.2 Timber

Timber harvesting is an important industry within the Pacific Northwest. Most timber operations are commercial, in which a landowner, operator, or timber owner receives payment from a purchaser of forest products. All of the known merchantable tree species in the proposed project area are present within the area to be crossed by the proposed Pacific Connector pipeline facilities. Trees that would be cut within the area of the proposed Jordan Cove LNG Import Terminal are not considered merchantable. Jordan Cove has, however, committed to conduct a timber cruise in the proposed terminal area prior to construction to confirm that assumption. If any merchantable trees are found within the proposed terminal area, they would be salvage logged and sold while the unmerchantable timber, timber slash and brush will be pulverized in a tub grinder and stockpiled as mulch. The mulch would be saved for future erosion control of recontoured sand dunces created post-construction. No facilities are proposed for those land areas within the waterway for LNG marine traffic, thus no tree clearing is necessary.

4.4.2.1 Pacific Connector Pipeline

Existing Timber Resources

The proposed Pacific Connector pipeline would cross approximately 77 miles of mature forested lands and 67 miles of recently harvested forested lands. Land ownership within forested lands includes privately owned timberland as well as state lands, USFS lands, and BLM-administered lands. The USGS defines five forested land types within the pipeline route:

- **Deciduous Forest Lands.** This category includes all forested lands, which consist predominantly of trees that lose their leaves at the end of the frost-free season or at the beginning of the dry season. Within the pipeline route, this forest type consists of hardwoods such as oak, maple, and alder. Deciduous forests found within wetlands are not included within this category.
- **Evergreen Forest Lands**. This category includes areas that consist predominantly of tree species that maintain their leaves year-round (including both coniferous and broadleaved evergreens). Species typically found within this forest type are: Douglas-fir, western red cedar, western hemlock, Sitka spruce, Engelmann spruce, lodgepole pine, and ponderosa pine. Within the pipeline route, lands designated as Evergreen Forested Lands apply to forests that have not been harvested for 80 to 100 years or the majority of trees are over 40 years old.
- **Clearcut Forest Lands.** This category applies to Evergreen Forested Lands that have recently been clearcut. This applies to lands which are markedly different from adjacent stands and were cleared within four years.
- **Regenerating Forest Lands.** This category applies to lands that fall between the Clearcut and the Evergreen Forested Lands. These lands consist of evergreen species that have been replanted after clear-cutting occurred. This classification is also used for areas where selective harvesting has occurred and 20 to 30 percent of the forest consists of older trees (40 years or older) intermixed with younger trees.
- **Mixed Forest Lands.** This category applies to forests where both evergreen and deciduous species are present but neither species dominates.

Table 4.4.2.1-1 lists the log types in the pipeline route (see table 4.4.2.2-1 for log types on federal lands). While timber cruises have not yet been conducted, information available (see table 4.4.2.1-1) indicated that approximately 1,559 acres of the proposed pipeline (approximately 31.7 percent) contain large mature trees over 40 years in age, and approximately 1,418 contain small to medium trees, under 40 years in age, that would be harvested. A portion of these 1,418 acres of small to medium trees would not be merchantable (those less than 25 years in age). The exact number and board feet of these non-merchantable trees would be determined during timber cruises in 2009/2010. Some portion of the trees would be retained for restoration (large woody debris and stream restoration) and the remainder, the majority of the merchantable logs, would be sold.

TABLE 4.4.2.1-1

Merchantable Timber to be Cleared by Class and Age

Type of Timber	Diameter to Breast Height (dbh)	Inside Top Bark Height Diameter	Age
Small conifer sawlog	10”-20”	6-10”	26 – 60 years
Medium conifer sawlog	20-30”	8-12”	61 – 100-125 years
Large conifer sawlog	30” and larger	8-16”	125 – 250 years; with an unquantified population of ancient relic trees 300 to 500 years

Impacts and Mitigation

Logging methods to be used would vary by location and acreage and would not be known until timber contractors evaluate site-specific and then-current acreages. Actual logging methods selected would be based on site-specific information at the time of actual harvest. Minimal log removal by helicopter is anticipated. The logging contractors would be solicited by a request for proposal. These proposals would be evaluated by Pacific Connector and contracts would be awarded to the most qualified bidder(s). Logging methods would be the contractor’s decision (subject to appropriate company and agency approval). The exact timber harvest and decking requirement locations would be determined by the contractor within the access roads and staging areas already approved for the pipeline.

The primary effects of the Pacific Connector pipeline on timber production would result from the cutting, clearing, and/or removal of forested areas as required for clearing of the pipeline construction right-of-way and adjacent TEWAs. The degree of impact would depend on the logging methods used, quantity of lumber removed, and the age of affected stands. The proposed Pacific Connector pipeline would impact approximately 142 acres of Deciduous Forest, 1,059 acres of Evergreen Forest, 303 acres of Clearcut Forest, 1,106 acres of Regenerating Forest, and 346 acres of Mixed Forest Lands. Approximately 238 acres of forest land allocated to timber production (the area within the permanently cleared right-of-way on private forest land, state forest land, and matrix land on USFS and BLM-administered land) would be removed from the timber base. Future timber production would be lost on these acres for at least the life of the Pacific Connector pipeline. This would be a long-term adverse effect. In addition, approximately 1,106 acres of young stands would be cleared. These stands have not yet reached merchantable size; therefore, current timber production would be lost on private forest land, state forest land, and matrix land on USFS and BLM-administered land. This would be a long-term adverse effect.

Timber cruises would be conducted in 2009/2010 in order to determine timber volumes, values, and species composition within forested lands. Timber cruises would be conducted in accordance with industry and/or federal agency standards (e.g., they would meet the USFS Pacific Northwest Regional standards for USFS lands). Timber cruises on federal lands would be conducted by the land management agencies or by an approved third party contract or approved by the government, not by Pacific Connector. Pacific Connector would prepare detailed timber extraction plans after timber cruises are completed.

Pacific Connector proposes that any debris entering a waterbody as a result of felling and yarding of timber would be removed as soon as practical after entry into the waterbody and shall be placed outside the 100-year floodplain where practical. Logs and slash would not be yarded across perennial streams unless fully suspended. During logging/clearing operations, the direction of log or slash movement would be conducted to minimize sediment delivery to waterbodies, including intermittent streams. Logs firmly embedded in the bed or bank of waterbodies that are in place prior to felling and yarding of timber would not be disturbed, unless they prevent trenching and fluming operations. Any existing logs that are removed from waterbodies to construct the pipeline crossing would be returned to the waterbody after the pipeline has been installed, backfilling is complete, and during the time the streambanks are being restored. Landings for clearing operations would not be located in wetlands or riparian reserves on federal lands, and, where feasible, logs yarded out of wetlands or riparian zones would be skidded with at least one end suspended from the ground so as to minimize soil disturbance. All timber cleared from the right-of-way would be cut and cleared in accordance with land owner/land management agency requirements, where practical. If, based on site-specific conditions, the land owner/land management agency-recommended timber harvesting method is not feasible, an alternate timber harvesting method would be utilized with approval from the land owner/land-managing agency.

Merchantable timber would be removed and sold according to landowner or land management agency stipulations. In limited areas, TEWAs have been identified for log storage and decking along the pipeline alignment that would be located in existing cleared areas adjacent to existing roads where feasible where log storage could occur for extended periods, if necessary. Pacific Connector has designed the construction right-of-way to minimize additional TEWAs which would reduce overall project disturbance. The construction footprint is not large enough in many areas to accommodate both the logs cleared from the right-of-way and accomplish efficient construction activities simultaneously. Therefore, cut timber would be removed from the right-of-way to avoid project delays due to right-of-way congestion.

Pacific Connector expects that the use of all logging methods may be necessary during right-of-way clearing to efficiently remove timber from the right-of-way depending on the specific location. Ground-based skidding and cable (where feasible) logging methods would likely be the standard method; however in some isolated rugged topographic areas with poor access, helicopter logging may be utilized. The specific logging methods would not be determined until a contractor has been selected through the bidding process for each construction spread. Cable and helicopter logging methods would minimize the potential for soil compaction. Helicopter yarding is currently proposed for the following locations but would not be finalized until a contractor is selected for project construction:

MP 37.3 – 38.3

MP 78 – 83

MP 88.5 – 105

MP 108.5 – 109.8

MP 134 - 136

Any timber cleared from the right-of-way that would be used for instream or upland wildlife habitat diversity structures would be stored on the edge of the right-of-way or in temporary extra work areas for later use during restoration efforts. Prior to clearing operations, the EI or Pacific Connector's authorized representative would flag existing snags on the edges of the construction right-of-way or TEWAs where feasible to save from clearing. These snags would be saved as mitigation to benefit primary and secondary cavity nesting birds, mammals, reptiles and amphibians. During this process other large diameter trees on the edges of the construction right-of-way and TEWAs would also be flagged to save/protect as green recruitment or habitat/shade trees, where feasible. Some of these trees would be girdled to create snags to augment the number of snags along the right-of-way to benefit cavity nesting birds, mammals, reptiles and amphibians.

Pacific Connector proposes that all operations and tree felling would occur within the certificated construction work area limits, and that trees within the certificated construction work area limits would be felled or sheared so as to prevent damage to adjacent trees, facilities, or structures. This may not be practical in steep areas where trees often must be felled on the contour to reduce breakage. Much of the forested portion of the proposed route crosses steep mountainous land. Failure to fall trees properly would result in a loss of timber available to local industries and loss of value to the land owners and land management agencies. Also, logging roads in some areas crossed by the proposed pipeline have not been used in many years and are covered with young trees. These roads would require clearing and major reconstruction if needed for hauling logs. Both the BLM and the USFS have requested that Pacific Connector retain qualified foresters and logging engineers to develop site-specific logging plans for each area to be logged. These plans would identify the size, height, volume, and value of trees in each portion of the construction right-of-way, how the timber would be felled and yarded, where landings and log decks would be placed, the haul routes that would be used to remove the logs, and how logging debris would be disposed of. The FERC requires that all operations be contained within the certificated work area, so it is important to identify methods for falling, yarding, decking, and any additional temporary roads that may be needed for hauling logs prior to the start of operations. **Therefore, we recommend that:**

- **Pacific Connector should file detailed timber extraction plans with the Secretary 120 days prior to construction. Timber extraction plans should be prepared in consultation with the respective land owners and land managing agencies, and separate plans should be prepared for state, BLM, and NFS lands. At a minimum, timber extraction plans should include the following information: Timber volume to be cleared, tree sizes, log grades, dollar value of timber, logging system(s) to be used for each harvest segment, yarding methods and locations, volume of timber that would be yarded at each landing, the location of landings and decks, roads that would be used to haul the logs, and the haul distance for each harvest segment.**

State Lands

Less than one percent of the proposed Pacific Connector pipeline would cross State Forests. The proposed route crosses the Southwest Oregon and the East Oregon Forest Practices Region which contains mature forest. Trees within this portion the right-of-way would be cut and merchantable trees would be sold as directed by ODF. As stipulated within ORS 527.670(3), a written plan must be submitted to the ODF State Forester before extracting timber within:

- 100 feet of a Type F stream (stream with fish or fish and domestic water use) or Type D stream (with domestic water but no fish);
- 300 feet of an area containing state threatened or endangered wildlife, or sensitive nesting, roosting or water sites;
- 300 feet of an area containing federal threatened or endangered wildlife or critical habitat; and
- 300 feet of any area identified in OAR 629-665-0100 (Sensitive Bird Nesting, Roosting, and Watering Resource Site on Forestlands), OAR 629-665-0200 (threatened and endangered species that use Resource Sites on Forestlands), or OAR 629-645-0000 (Significant Wetlands).

Pacific Connector would prepare and submit to the ODF State Forester for approval a written plan, describing how the proposed pipeline would be in compliance with the Forest Practices Act (OAR 629-606-0010), prior to harvesting activates.

4.4.2.2 Federal Lands

Each National Forest and the four BLM Districts crossed by the proposed pipeline would administer its own timber sale contract. Pacific Connector would be the contractor for harvest on federal lands, although logging would likely be done by subcontractor. Table 4.4.2.2-1 summarizes the estimated volume of timber that would be harvested on federally managed lands. The timber volume estimates provided in table 4.4.2.2-1 were derived using professional forestry methodologies and protocols to provide a basic timber volume inventory for the proposed Pipeline Project. A cruise-inventory of stand types (conifer, brush, riparian, roads, rock pits, etc.) was complied along forested areas of the proposed pipeline project route using aerial photography and ground visits. Each stand type was ground visited and inventory-cruise plots were established in each type to result in a 5 to 8 percent level of accuracy for determining Scribner decimal C log rule gross and net volumes. Twenty percent of plots were full measure quarter-acre (58.9 feet circular). To determine Gross MBF timber volumes, "Local" volume tables were developed for each species by stand type to determine gross volume by two inch diameter class total height. Dilworth, MB&G, Atterbury, & FS Cruise timber cruising protocols were used to determine volume, grade, and cruise downfall. No further deductions were taken for harvesting breakage, or local scaling rules-of-thumb factors for hidden defects.

Approximately 8,540 MBF of timber would be harvested on USFS lands and 8,839 MBF on BLM-administered lands (approximately 15.8 MBF are needed to build a 2,000 square foot house; therefore, this is enough timber to build approximately 1,100 houses of this size.) Pacific Connector would submit a reforestation plan to the BLM and the USFS for approval during easement acquisition. Following construction, previously forested areas within the temporary construction right-of-way and TEWAs would be replanted in accordance with Oregon

TABLE 4.4.2.2-1.

Estimated Merchantable Timber Volumes in MBF by Class and County within the Proposed Construction Work Areas on Federal Lands

County	Jurisdiction	Timber Class (MBF)				Total Volume (MBF)
		Small Conifer Sawlog	Medium Conifer Sawlog	Large Conifer Sawlog	Mixed Conifer/Hardwood a/	
Coos b/	BLM	360	270	1,680	24	2,334
Douglas	USFS	360	595	1,764	35	2,754
	BLM	480	702	2,016	40	3,238
Jackson	USFS	600	540	3,192	51	4,383
	BLM	480	486	1,680	22	2,668
Klamath	USFS	240	135	1,008	20	1,403
	BLM	108	54	420	17	599
Total	USFS	1,200	1,270	5,964	106	8,540
	BLM	1,428	1,512	5,796	103	8,839
Total		**2,628**	**2,782**	**11,760**	**209**	**17,379**

a/ Mixed Conifer/Hardwood: Includes some exotics and a variety of hardwoods i.e., oak, madrone, ash, maple, and others.
b/ There are no USFS lands crossed by the Project in Coos County.

reforestation rules (OAR 629-610-0000 through 629-610-0090), BLM Management Directions, and USFS Standards and Guidelines (i.e., National Forest Management Act requirements and Forest stocking standards). Areas within the permanent right-of-way would remain cleared and maintained in an herbaceous state in order to facilitate periodic checks of the pipeline. This would result in a permanent loss of timber production on land allocated for timber production (matrix land) on approximately 134 acres within BLM-administered lands and on approximately 35 acres of USFS lands (refer to the Financial Efficiency Analysis discussion in section 4.8.4.10). The government would be compensated for this lost in productivity by Pacific Connector.

Riparian Reserves and LSRs are not available for programmed timber harvest. While Pacific Connector would be required to pay for all trees cut within the right-of-way, only trees within the Riparian Reserves and LSRs that the government determines would cause adverse impacts if left on the ground would be removed. Prior to any commercial harvest, resource specialists from the applicable resource management agency would evaluate whether felled trees should be removed and which should be retained to meet Riparian Reserve and LSR habitat objectives. If trees must be removed from the construction right-of-way in order for construction of the pipeline to be completed, they would be stored in pre-approved locations (not within uncleared portions of the riparian reserves) that would facilitate later transportation back to the riparian area for placement.

Danger trees are those trees at risk of falling on workers or vehicles and thus would need to be removed for safety reasons. A tree may be at risk of falling for a number of reasons including the tree's location and the presence of defects, insects, disease, work activities, and weather conditions. Such trees would be felled in advance of logging, pipeline construction, road construction/reconstruction, and road maintenance. Additionally, danger trees could be created from trees felled as part of the proposed pipeline project when removal of trees may result in damage to standing trees outside of approved construction areas. While this could result in growth loss, for which Pacific Connector would compensate the landowner for any trees

removed and any loss in timber productivity, the FERC requires that all operations be contained within the certificated work areas. Although compliance monitors in the field could review and approve as appropriate requests to remove danger trees outside the approved construction area, **we recommend that:**

- **Pacific Connector should prepare a danger tree plan that outlines a procedure for removal of trees that present a hazard located outside of approved construction areas. The plan should be filed for review and approval by the Director of OEP at least 120 days prior to construction.**

In addition to the procedures proposed for timber harvest above, the following would apply to federal lands:

- The authority and procedure the USFS would use to dispose of merchantable timber cut for construction of the proposed Project is addressed under Title 36 "CFR 223.12 Permission to cut, damage, or destroy trees without advertisement." This regulation authorizes the USFS, under the issuance of a right-of-way or special use authorization (SUA), to sell the timber directly to Pacific Connector at the current appraised value. Pacific Connector intends to negotiate one contract covering the three National Forests.
- The authority and procedures the BLM would use to dispose of merchantable timber on BLM-administered lands involved in the proposed pipeline are addressed in the Title 43 CFR 5400 regulations. BLM may sell the right-of-way timber by competitive bidding or through negotiated sale where it is impracticable to obtain competition. Right-of-way timber would be sold under lump sum timber sale contract(s) at not less than the appraised value as determined by the BLM. Timber sale contracts would be prepared, offered, and administered by each BLM District involved.

Timber sale boundary designation, volume estimation, appraisal and contract preparation would be accomplished in cooperation with Pacific Connector as negotiated. Pacific Connector would be responsible for logging and marketing of the timber. Any timber sold from federal land must be processed domestically and not exported. Tree marking paint would be agency tracer paint used under the supervision and accountability of the respective agency.

The agencies would use a Tree Measurement Timber Sale Contract with the standard provisions for payment and log accountability. Many of the operational requirements typically detailed in such a timber sale contract such as erosion control, road maintenance and slash disposal are expected to be contained in the right-of-way grant and would be incorporated into the timber sale contract. Performance bonding typically required in such a timber sale, if included in the grant and considered adequate, would be used to cover operations performed under the timber sale contract(s). Agency sale administrators would oversee timber disposal operations to ensure they are carried out following any site-specific requirements as well as to insure proper log accounting for specially-designated revenues.

The logging methods to be used on USFS and BLM lands would be determined through consultations with the USFS and BLM and as required in the Timber Sale Agreement. Pacific Connector proposes that slash from timber clearing be stored on or at the edge of the right-of-way and scattered/redistributed across the right-of-way during final cleanup and reclamation according to BLM and USFS fuel loading specifications to minimize fire hazard risks. This

material would be pulled back onto the right-of-way during final cleanup after seeding. Where it is not feasible to pull the slash back onto the right-of-way after seeding, seeding in these areas (broadcast or hydroseeding) would occur with specifications to ensure adequate seed coverage.

Scattering the slash across the right-of-way will hinder OHV traffic on the right-of-way and will act as a natural mulch to minimize erosion.

Because more than 1 ton per acre of woody material (logs, slash and chips) may be scattered across the right-of-way during final cleanup in many areas, Pacific Connector is proposed a modification to from Section IV.F.3.e. of FERC's Plan. Pacific Connector would utilize the fuel loading standards of the BLM and the USFS as the limit for the quantity of woody debris that would be distributed across the right-of-way to minimize fire hazard risks for this proposed modification. Section IV.F.3.e. of FERC's Plan states that if wood chips are used as mulch to not use more than 1 ton per acre of chips and to add an equivalent of 11 lbs of available nitrogen where chips are used as mulch. The purpose of Section IV.F.3.e. of FERC's Plan is to ensure that revegetation efforts are not hindered due to the decaying process of large amounts of wood chips which can bind up soil nitrogen and impede revegetation. Pacific Connector proposes this modification because it would be impractical and infeasible to remove this material from the right-of-way and it is a typical sivilcultural practice in the proposed project area (i.e., forest slash left in logged areas). Furthermore, it is expected that the woody slash material would not deplete soil nitrogen in the short-term, during revegetation establishment, because the size of the woody material that would be scattered on the right-of-way would be large and would not readily decay in the short-term. However, as proposed in the Section 10.8 of the ECRP, Pacific Connector would apply a standard fertilization rate of 200 pounds per acre bulk triple-16 fertilizer (16:16:16 -nitrogen, potassium and phosphorus) on all disturbed areas to be reseeded, except in wetlands. This fertilization rate would apply 32 pounds per acre of elemental nitrogen, potassium, and phosphorus. The elemental nitrogen rate would also satisfy FERC's requirement to add nitrogen where wood chips are used as mulch (see Section IV.F.3.e.). We find this proposed modification acceptable.

On USFS lands, the maximum amount of slash that would be scattered across the right-of-way would be 12 tons per acre, which would be distributed over the following fuel loading size classes:

Fuel Loading Specification by Size Class	
Size Class (diameter)	**tons/acre**
0-1/4"	< 1
1/4– 3"	4-8
3-8"	7-12
maximum	12

On BLM and private lands, the fuel loading specifications would be:

Fuel Loading Specification by Size Class	
Size Class (diameter)	**tons/acre**
0-1/4"	< 1 1
1/4 -8"	5-8 1
>8"	10-15
Note: Adapted from USFS Fuel Loading Standards	

As provided by the USFS, dead and downed woody debris greater than 16-inches in diameter does not contribute to fire hazard and would be maintained on site. Slash may be chipped and scattered across the right-of-way provided that the average depth of wood chips covering the area does not exceed 1 inch following application. This chip depth would be sufficient to stabilize the soil surface from erosion while allowing grass seed to germinate and seedlings to develop. It is not expected to significantly increase fuel hazards as long as the maximum tonnage for fuel loading does not exceed 12 tons per acre.

In areas where the fuel loading exceeds these standards, Pacific Connector would machine or hand pile and burn the excess material depending on the site location. Burning would occur during the appropriate burning season and according to the conditions permitted by the BLM, the USFS, and the ODF (OAR 629-615300). A prescribed burning plan would be developed for these activities which would be included in the POD.

On BLM and USFS lands, larger slash pieces (more than 8 inches in diameter), may be removed from the project area and decked in designated storage sites, as stipulated by these agencies, or on the right-of-way at road crossings. This material would be made available to the public through the agencies' firewood programs.

Pacific Connector believes that the slash materials that may be generated during periodic right-of-way maintenance activities, which are likely to occur about every 3 to 5 years along the permanent easement, would not exceed BLM or USFS fuel loading standards.

Design Criteria and Mitigation Measures

Pacific Connector would implement the following measures to reduce impacts on timber production:

- Pacific Connector would be responsible for logging and marketing of the harvested timber. Any timber cut on federal lands that is sold must be processed domestically.
- The USFS and BLM would designate (i.e., flag, tag, and paint) all cutting unit boundaries and trees to be cut on federal land. Trees marked for cutting on federal land would be marked with agency tracer paint by representatives of the respective land management agency.
- Logging methods would be ground based or skyline methods, currently used within each unique logging area. Methods used would minimize disturbance to the soil at the time of actual harvest. Logging methods would be proposed by the contractor and subject to appropriate company and agency approval.
- Performance bonding would be adequate to cover operations performed under timber sale contract.
- The logging system analysis/logging plan would include a transportation plan specific to BLM-administered lands and USFS lands.
- All tree felling and vegetation clearing would occur within the certificated construction work areas, except for danger trees adjacent to the right-of-way, additional work areas, and travel corridors. Trees within the certificated construction work areas would be directionally sheared or felled so as to prevent damage to adjacent trees, facilities, or structures.

- Danger trees would be designated by qualified federal representatives and felled in advance of logging, pipeline construction, road construction/reconstruction, and road maintenance. Danger trees would be directionally felled, using chainsaws, away from the permanent right-of-way if trees are to be left and towards to right-of-way if trees are to be removed.
- Logs would not be stored next to conifer trees bordering the sides of the right-of-way in order to avoid damage to live trees. Logs planned for removal from the site would be hauled off the site as soon as practical following yarding in order to prevent disease problems, as well as potential theft problems. Slash pieces larger than 8 inches in diameter, may be decked for short periods in agency or landowner designated and approved storage areas or in places where roads cross the right-of-way and made available for removal by firewood permits or for habitat improvement projects.
- Landings would not be located in wetlands.
- Logs and slash would not be yarded across perennial streams unless fully suspended over the stream and adjacent banks. Where yarding across intermittent streams is necessary, log movement would be designed to minimize sediment delivery to streams.
- Logs firmly embedded in the bed or bank of waterbodies that are in place prior to felling timber would not be disturbed during logging and yarding operations unless they prevent trenching and fluming operations.
- All timber cleared from the right-of-way would be in accordance with the land owner/land management agency. Merchantable timber would be removed and sold according to land owner/land management agency direction except for trees agency representatives require be left to meet resource objectives.
- In limited areas, logs would be decked and stored in TEWAs located outside the right-of-way. TEWAs would be in currently cleared areas next to roads.
- Most timber removal would be accomplished through ground skidding and cable yarding; helicopter yarding may be used in some areas that are difficult to access. Where ground skidding is used, the following measures would be employed to minimize significant detrimental soil disturbance (compaction and displacement):
  - low ground weight (pressure) vehicles would be used;
  - Logging machinery would be restricted to the 30-foot permanent right-of-way wherever possible to prevent soil compaction;
  - the removal of soil duff layers would be avoided in order to maintain a cushion between the soil and the logs and the logging equipment; and
  - designed skid trails would be used to restrict detrimental soil disturbance (compaction and displacement) to a smaller area of the right-of-way over the pipeline trenching area.
- Logging slash would be treated immediately. Material designated to remain on site to meet resource concerns would be placed in designated UCSAs along the edge of the right-of-way and then scattered/redistributed across the right-of-way during final cleanup and reclamation (following seeding), in accordance with BLM and USFS fuel loading specifications in order to minimize fire hazard risks. No Douglas-fir down wood, 12 inches or larger in diameter, would be left in areas on USFS lands where there are known infestations of Douglas-fir beetle.
- Logging would be minimized viable to yarding where appropriate, especially within a 30-foot permanent easement. Slash concentrations on federal lands would be chipped in

areas where yarding out is not feasible; slash on federal lands would not be stored in UCSAs in order to maintain forest productivity in these areas.

- In upland areas, stump removal would be limited to the trenchline and areas where grading is necessary to construct a safe, level working plane.
- Off-site slash disposal and/or burning may occur in areas where slash is concentrated, such as landings. Slash would be machine or hand piled and burned according to state burning requirements and landowner, BLM, and USFS stipulations. Burns would occur during the wet season.
- Each construction spread would have one lead EI and several assistant EIs. The inspectors would ensure compliance with federal, state, and local regulations and permit requirements.
- EIs would have the authority to stop activities that violate the measures set forth in the timber harvest contracts with the various land owners and land managers and in other permits and authorizations, and would have the authority to order corrective actions.
- The Chief EI would advise the contractor on when wet weather or other conditions make it advisable to restrict activities to avoid excessive rutting in sensitive areas.
- Forestlands disturbed by the proposed Pacific Connector pipeline would be replanted according to state and federal (BLM and USFS) requirements. Planting would occur on all forestlands disturbed by the proposed project that are greater than 15 feet from the centerline of the permanent right-of-way of the pipeline.
- An integrated pest management plan would be developed that meets landowner/agency approval.