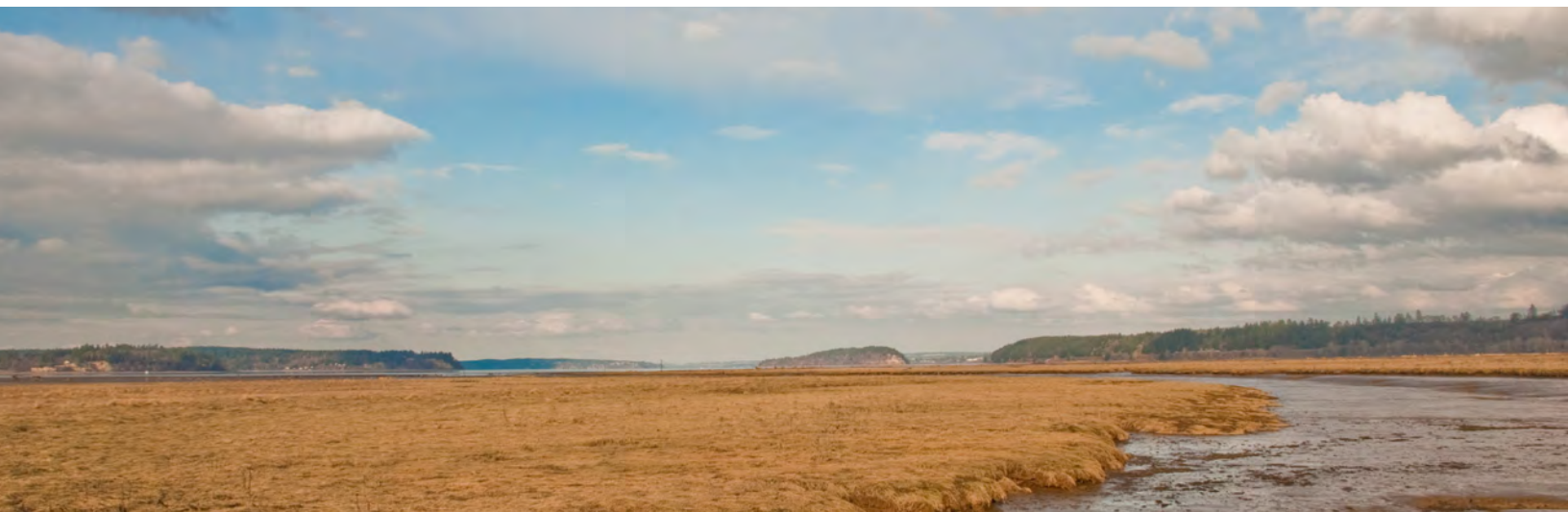


West Coast Regional Land Cover Change Report 1996–2010



About This Report

The *West Coast Regional Land Cover Change Report, 1996–2010*, is one in a series of regional reports that summarize the land cover status of the coastal United States in 2010 and land cover changes over the previous decade and a half. This report provides an overview of key findings using reader-friendly maps and graphics.

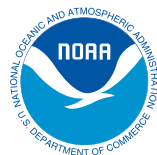
About the Coastal Change Analysis Program

Satellite imagery is a great way to get a big-picture view of the cumulative impacts of changes along our nation's coasts. The Coastal Change Analysis Program (C-CAP) within the National Oceanic and Atmospheric Administration (NOAA) Office for Coastal Management produces nationally standardized land cover and land cover change information for coastal regions of the United States, including the West Coast, using multiple dates of satellite imagery. C-CAP's data products provide inventories of coastal intertidal areas, wetlands, and adjacent uplands at approximately five-year intervals. This information helps to support decision-making about coastal resources and communities. The raster-based maps generated by C-CAP serve as a baseline for studies of coastal changes and evaluations of past or future management actions.

To learn more about the C-CAP data products used in this report and to access the data sets, please visit www.coast.noaa.gov/digitalcoast/data/ccapregional.

About the NOAA Office for Coastal Management

NOAA's Office for Coastal Management works at the center of the nation's coastal management efforts. From implementing the National Coastal Zone Management Program to providing technical assistance to coastal communities through the Digital Coast, the organization strives to help the nation's coastal communities prosper in the face of numerous natural and man-made challenges. To learn more, visit the website at www.coast.noaa.gov.





Location of the West Coast region (red) within the Coastal Change Analysis Program's mapping coverage area (dark gray) in the contiguous United States.

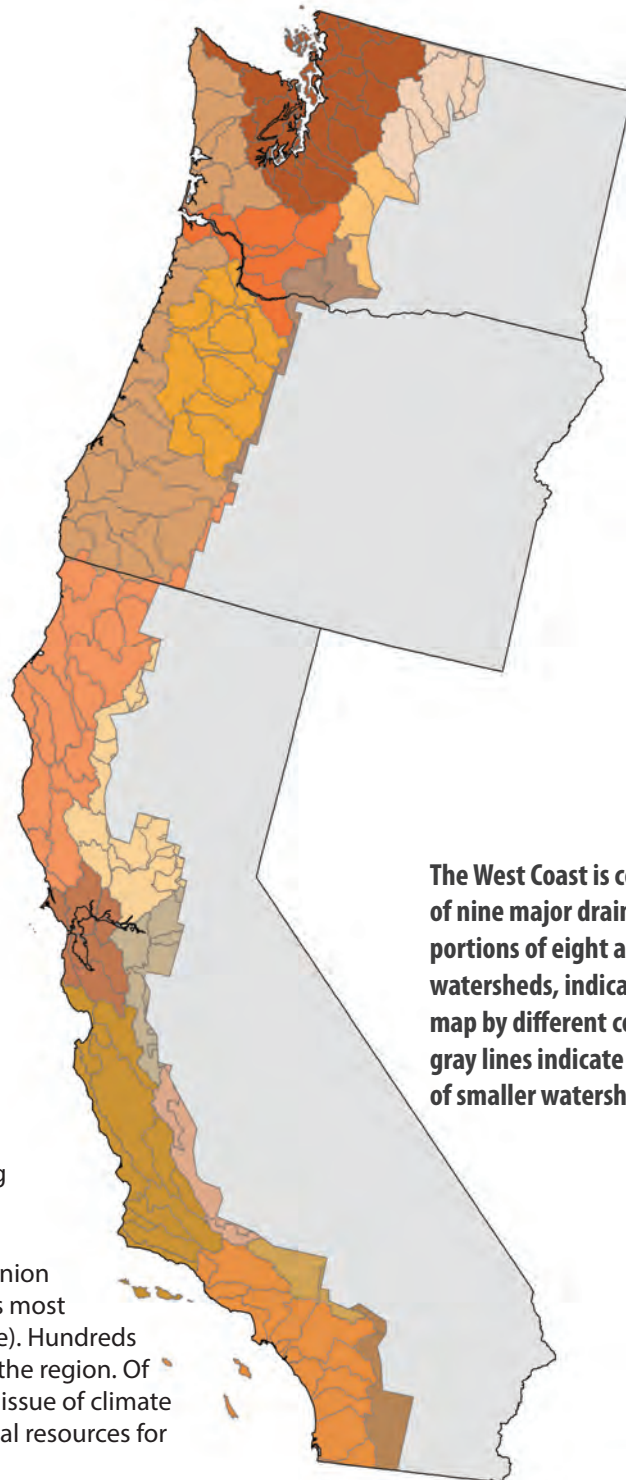
THE WEST COAST REGION covers over 152,500 square miles and extends from the border with Canada in the north to Mexico in the south. The region includes parts of Washington, Oregon, and California. The Pacific coastline is 7,863 miles long and is shaped by the California Current—a highly productive large marine ecosystem comprising over 400 estuaries and bays, including Puget Sound, the Columbia River, and San Francisco Bay. Floodplain habitats, including side channels and backwater sloughs, are common features of the region, as are kelp forests, seagrasses, and rocky reefs. Upland transition zones, or riparian habitat, are also important parts of the landscape.

The social, cultural, historical, political, and economic contexts of the West Coast region have always been, and continue to be, closely tied to the natural environment. Traditional resource sectors include forestry, fishing, mining, and agriculture. Coastal- and ocean-dependent activities such as tourism and recreation, commercial and recreational fishing, offshore oil and gas production, and shipping contribute significantly to the region's economy.

The region includes the most populous state in the union (California), which claims three of ten of the country's most populous cities (Los Angeles, San Diego, and San Jose). Hundreds of federally recognized tribal entities are also part of the region. Of particular concern to many tribal communities is the issue of climate change because of their heavy dependence on natural resources for economic and cultural identity.

Other important regional drivers on the West Coast include drought and wildfires, marine debris, ocean acidification, and sustainable fisheries. One of the most economically important listed fisheries is Pacific salmon. Water operations and long-term planning for water operations, especially in California, continue to be challenging issues for the region.

Many types of land cover, such as forest, grassland, and shrub/scrub, occur in the West Coast, and the amount of each land cover type changes over time. Using images and data collected by satellites, NOAA's Coastal Change Analysis Program (C-CAP) measured the area of each land cover type gained or lost from 1996 to 2010. In this report, 22 land cover classes are grouped into eight general categories: developed, agriculture, grass, shrub, upland forest, wetland, barren, and water.



The West Coast is composed of nine major drainages and portions of eight additional watersheds, indicated on the map by different colors. Thin gray lines indicate boundaries of smaller watersheds.

INTRODUCTION

LAND COVER

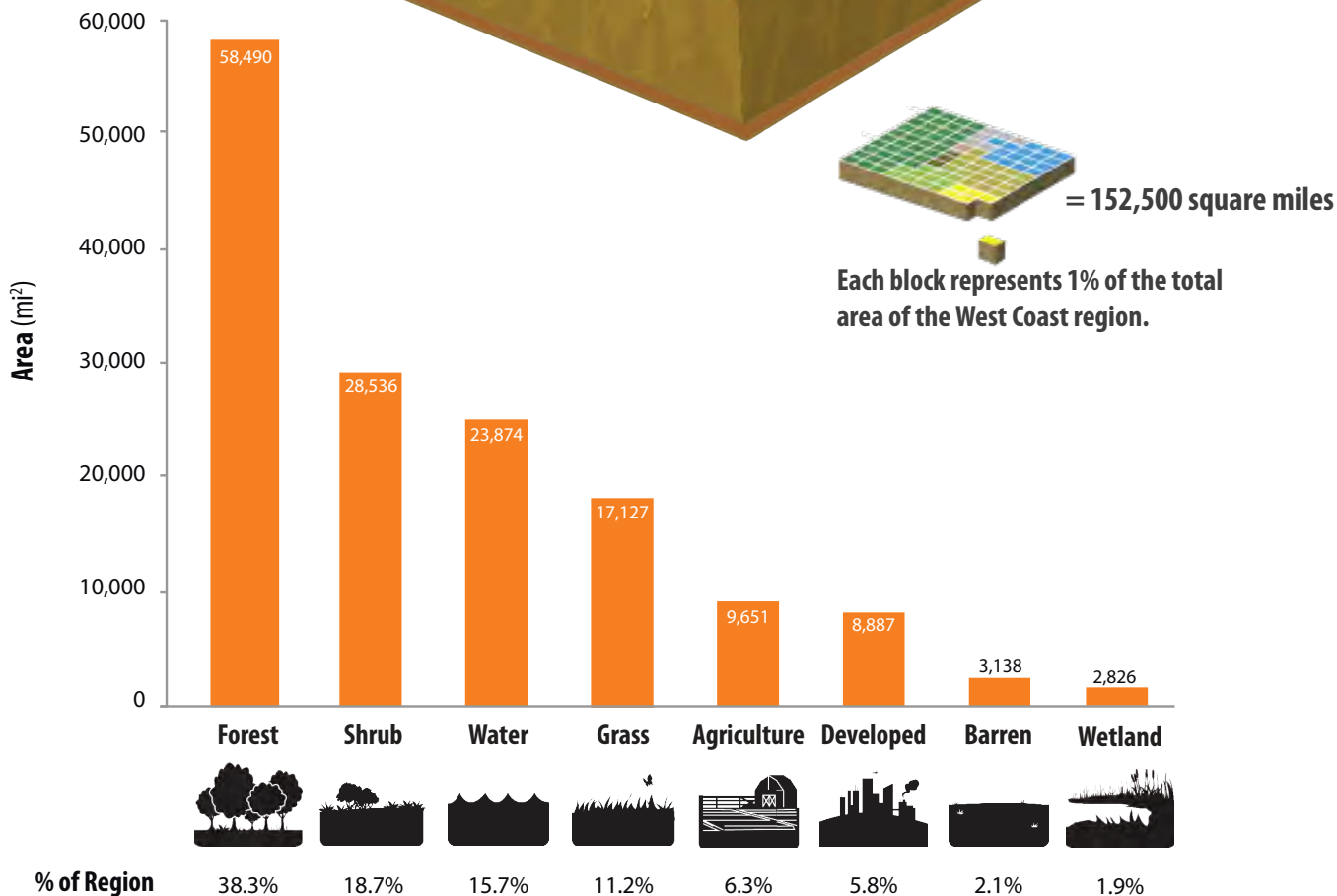
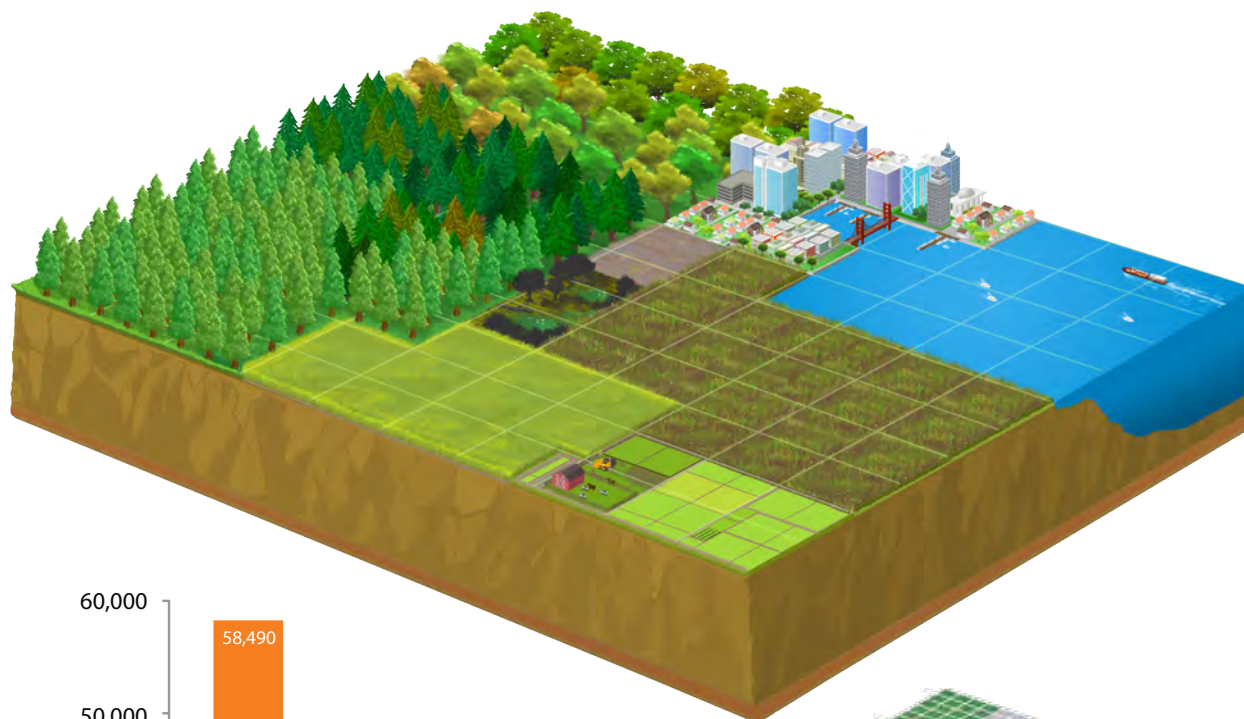


This map shows the distribution of land cover types in the West Coast region in 2010.

- Developed, High Intensity
- Developed, Medium Intensity
- Developed, Low Intensity
- Developed, Open Space
- Cultivated Crops
- Pasture/Hay
- Grassland/Herbaceous
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub/Scrub
- Palustrine Forested Wetland
- Palustrine Shrub/Scrub Wetland
- Palustrine Emergent Wetland
- Estuarine Forested Wetland
- Estuarine Shrub/Shrub Wetland
- Estuarine Emergent Wetland
- Unconsolidated Shore
- Bare Land
- Open Water
- Palustrine Aquatic Bed
- Estuarine Aquatic Bed



IN 2010, UPLAND FOREST (38%), SHRUB (19%), AND WATER (16%) were the most common categories of land cover in the region, accounting for approximately 72% of the area. The next most common cover types were grassland (11%), agriculture (6%), and development (6%). Less than 5% of the area was classified as either barren or wetland.

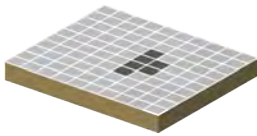


The 22 land cover classes in the West Coast region have been grouped into eight major categories that are displayed in the map graphic to highlight their relative distribution in 2010. More detailed information about these eight categories is displayed in the bar chart.

TOTAL CHANGE IN LAND COVER

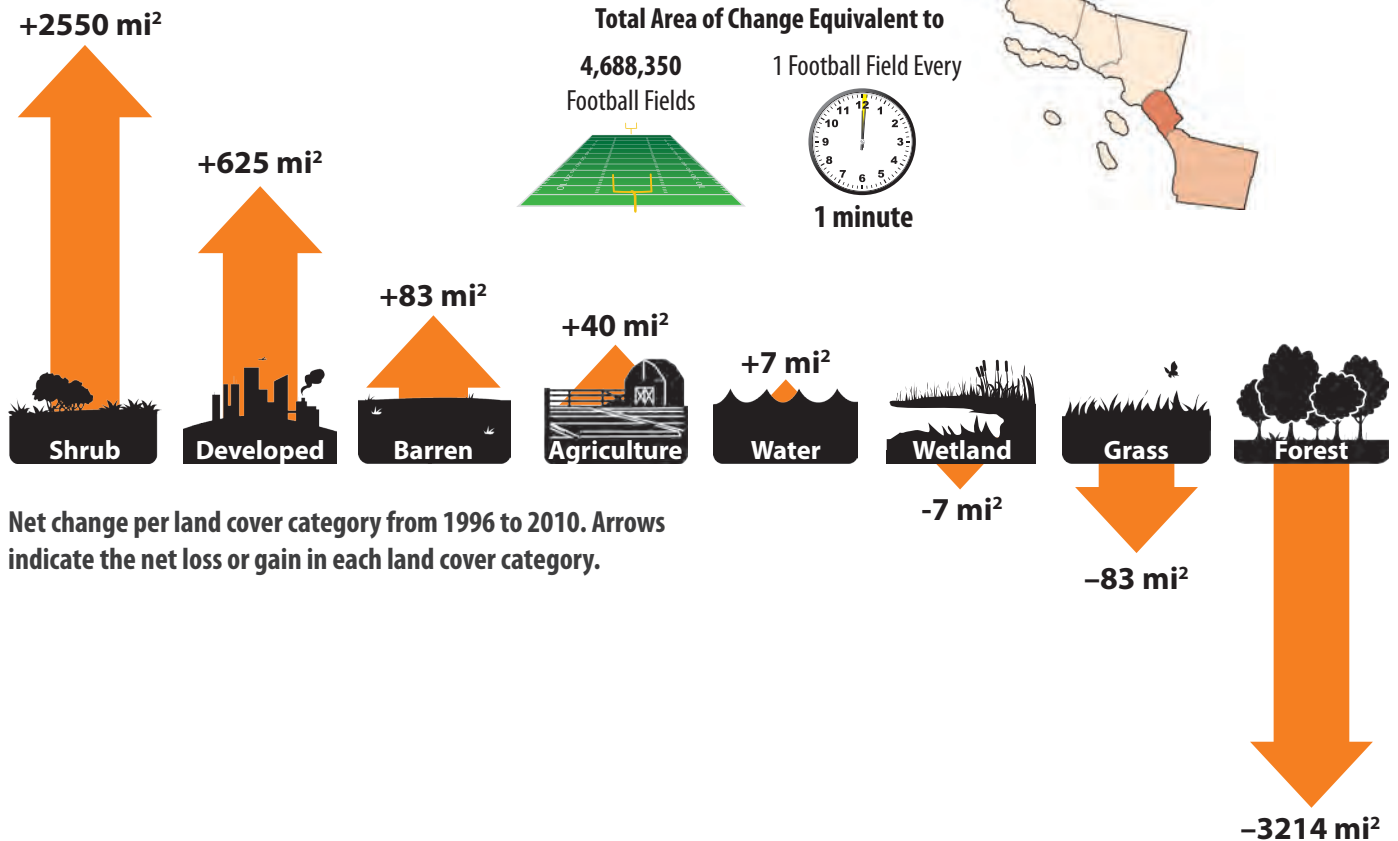
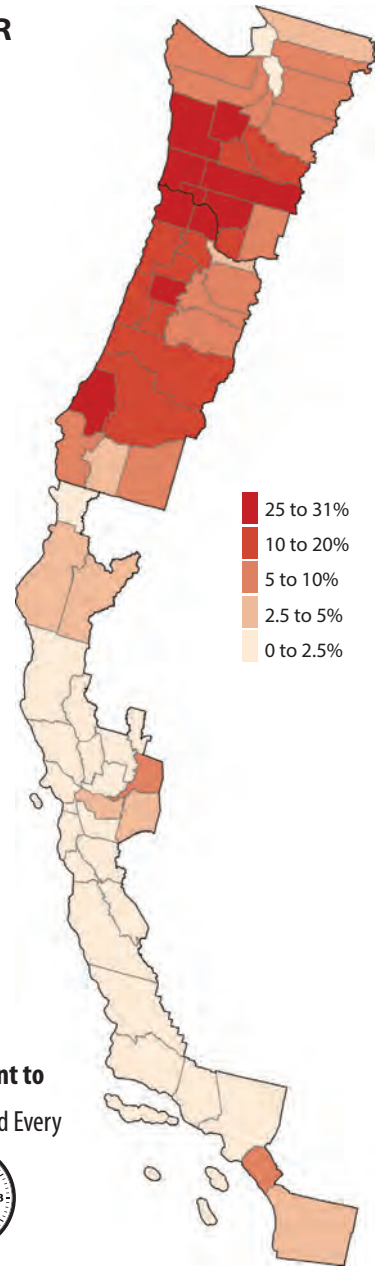
AREA OF CHANGE
9,687 square miles

6% OF REGION



FROM 1996 TO 2010, LAND COVER changed on 9,687 square miles, or just more than 6%, of the region. Areas of change were most common in southern Washington, in the counties along the coast, and between Tacoma, Washington, and Portland, Oregon. There were also significant amounts of change directly south of Portland along Interstate 5, and in the area around Coos Bay. Much of this change is associated with timber management activities in the Pacific Northwest.

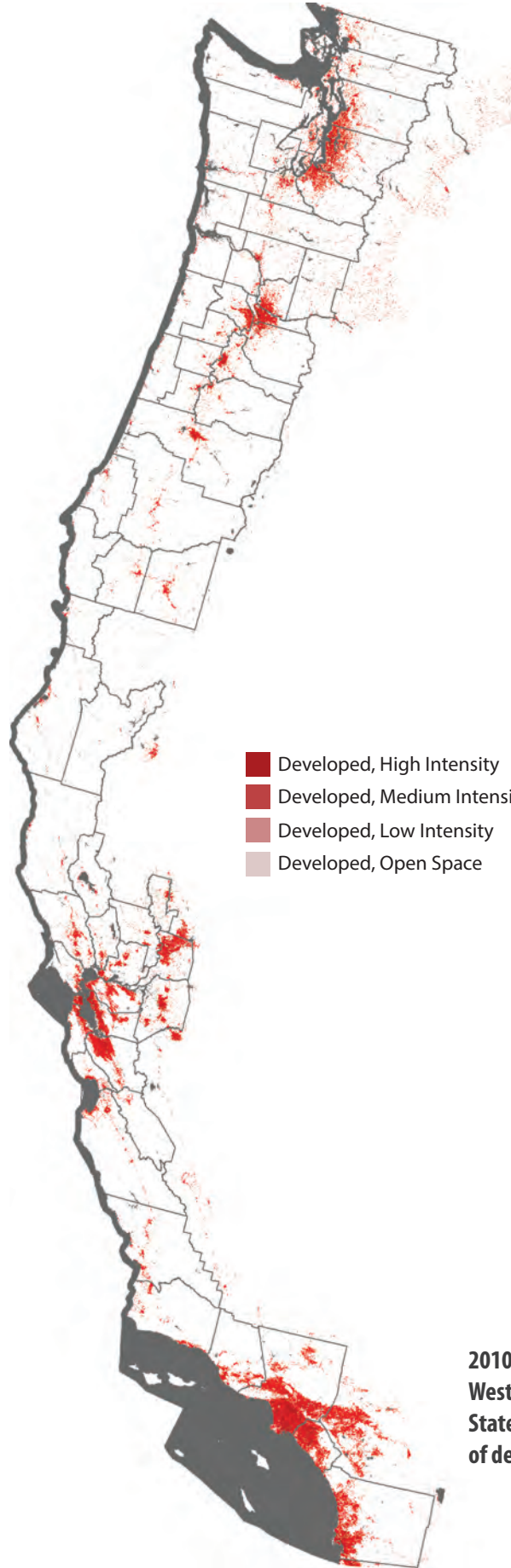
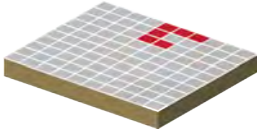
With a loss of 3,214 square miles, upland forest was the land cover with the greatest net decrease in area. Shrub (2,550 square miles) and development (625 square miles) had the largest net increases.



DEVELOPED AREA

8,887 square miles

6% OF REGION



- Developed, High Intensity
- Developed, Medium Intensity
- Developed, Low Intensity
- Developed, Open Space

DEVELOPED



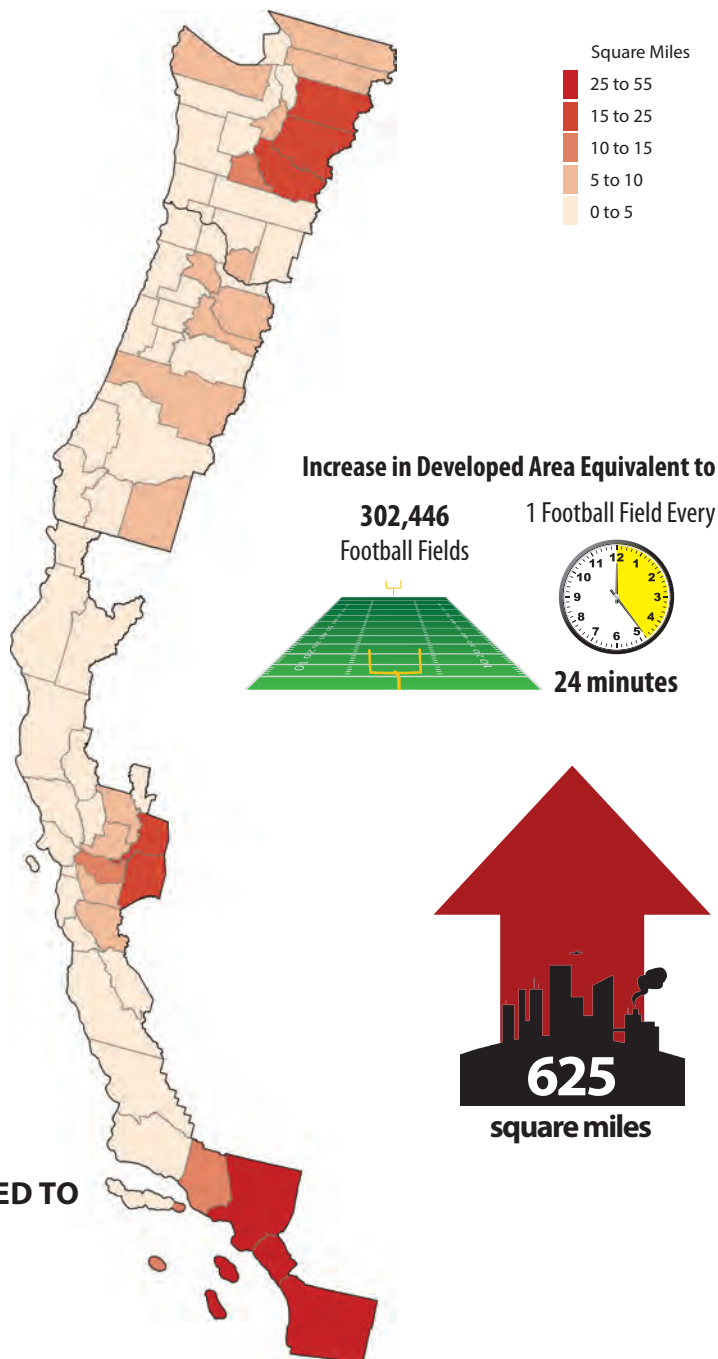
IN 2010, DEVELOPED AREAS accounted for 6% of the West Coast. This development was concentrated in areas surrounding the large metropolitan areas of Seattle and Tacoma, Washington; Portland, Oregon; and San Francisco, Sacramento, Los Angeles, and San Diego, California.

2010 development map for the West Coast region of the United States. This map depicts intensity of development.

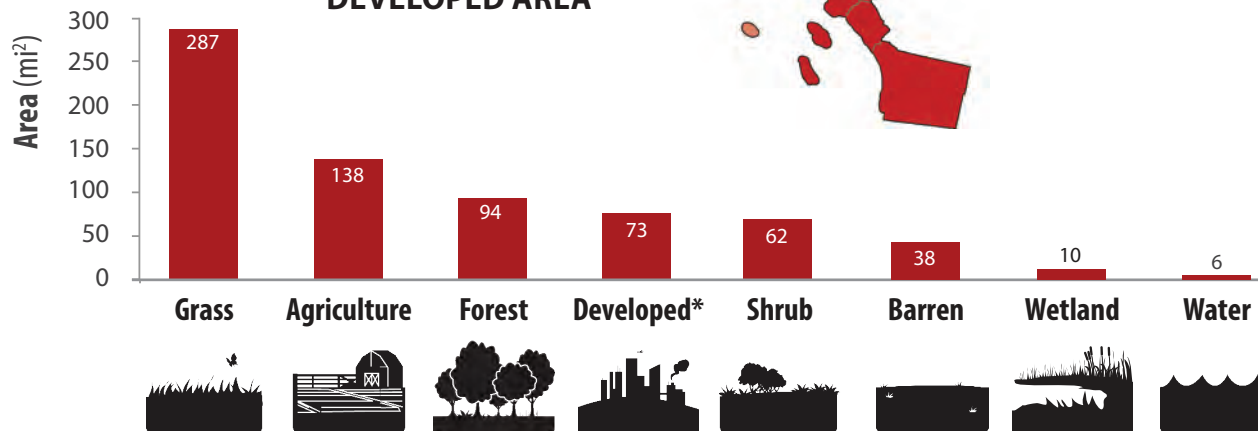
INCREASE IN DEVELOPED AREA

FROM 1996 TO 2010, THE AMOUNT OF DEVELOPED AREA increased by 625 square miles, a 7.6% rate of growth. More than three-quarters of this new development was classified as medium or low intensity developed, which typically includes the denser neighborhoods surrounding metropolitan areas, as well as more suburban and rural features such as parks, golf courses, and housing with large lawns. The largest amounts of new development appeared in the counties that make up Seattle and its eastern suburbs, the Sacramento area, and the cities of Los Angeles and San Diego. Very few other areas are prominent in the map of developed change seen here.

New development across the West Coast during the 14-year period came from lands previously categorized as grassland (45%) and agriculture (22%). An additional 25% was from formerly forested (15%) or shrub/scrub (10%) cover types. Development intensity increased on 73 square miles of already developed land; this type of change is commonly associated with increasing density of housing or infill development within city limits.



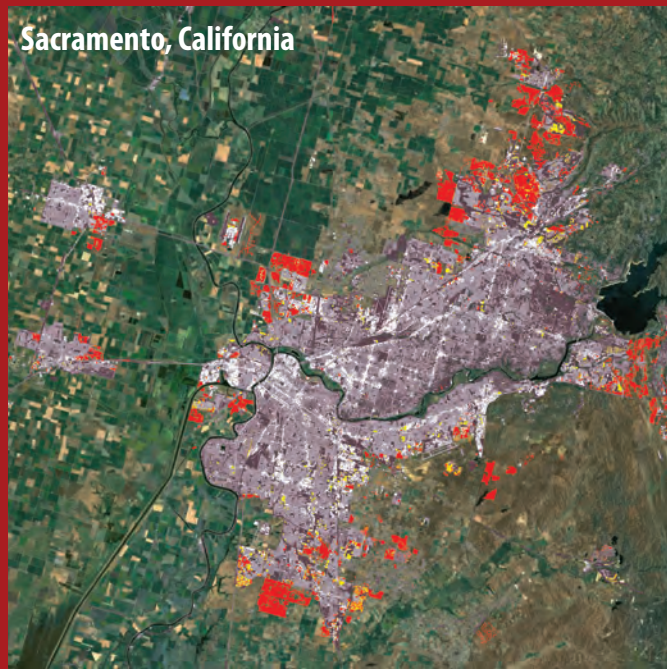
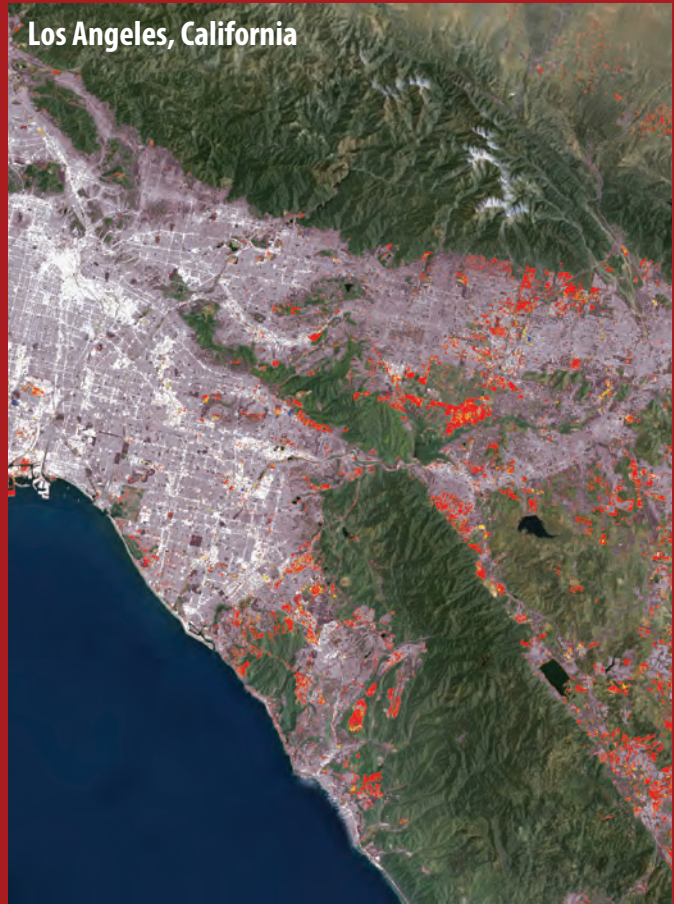
LAND COVER CONVERTED TO DEVELOPED AREA



This bar graph shows the area of each land cover that was converted to development between 1996 and 2010.

* Increases in development intensity

HIGHLIGHT: METROPOLITAN DEVELOPMENT TRENDS



■ Pre-1996 High Intensity ■ Pre-1996 Moderate Intensity ■ Increased Intensity ■ New Development

These images of large metropolitan areas within the West Coast region show patterns of new development (red) and increased density or infill development (yellow). This development often forms a halo pattern around a preexisting city core, reflecting the expansion of major roads and population growth away from the downtown. Background images: Esri

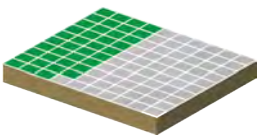
FOREST



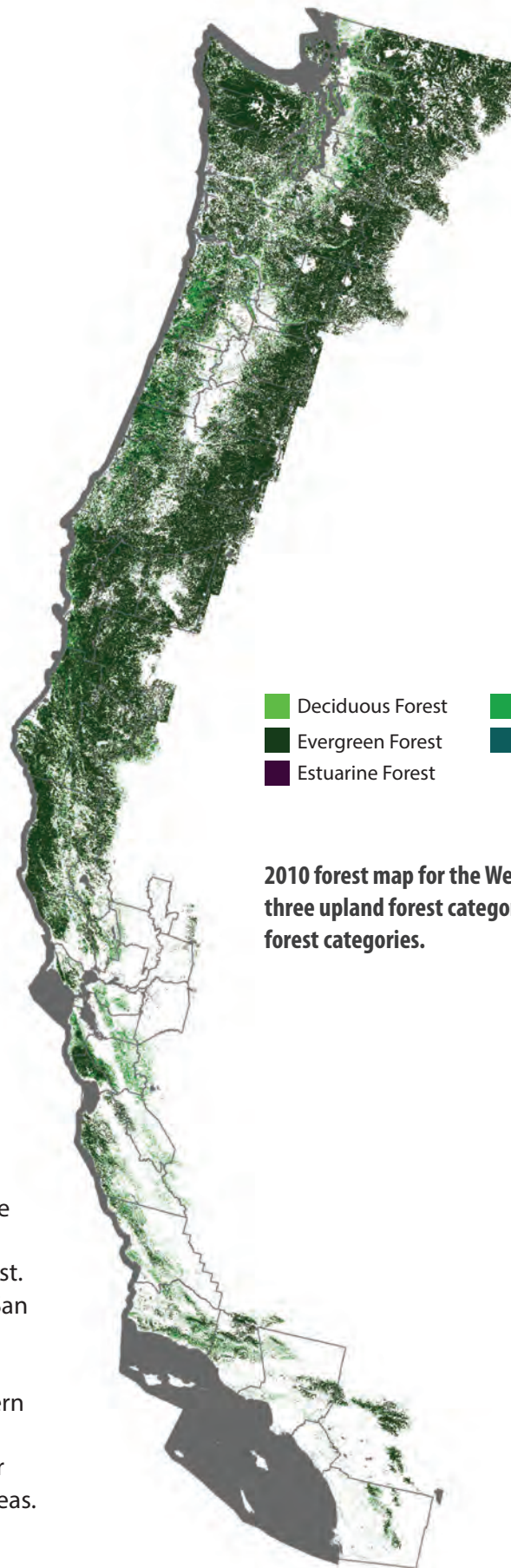
FORESTED AREA

59,352 square miles

39% OF REGION



IN 2010, FOREST covered 39% of the West Coast, including 38% upland forest and less than 1% wetland forest. The West Coast region north of the San Francisco Bay area was significantly more forested than the drier, shrub-dominated landscapes in the southern part of California. Evergreen was the dominant forest type, accounting for approximately 82% of all forested areas.



- Deciduous Forest
- Evergreen Forest
- Estuarine Forest
- Mixed Forest
- Palustrine Forested Wetland

2010 forest map for the West Coast. This map depicts three upland forest categories and two wetland forest categories.



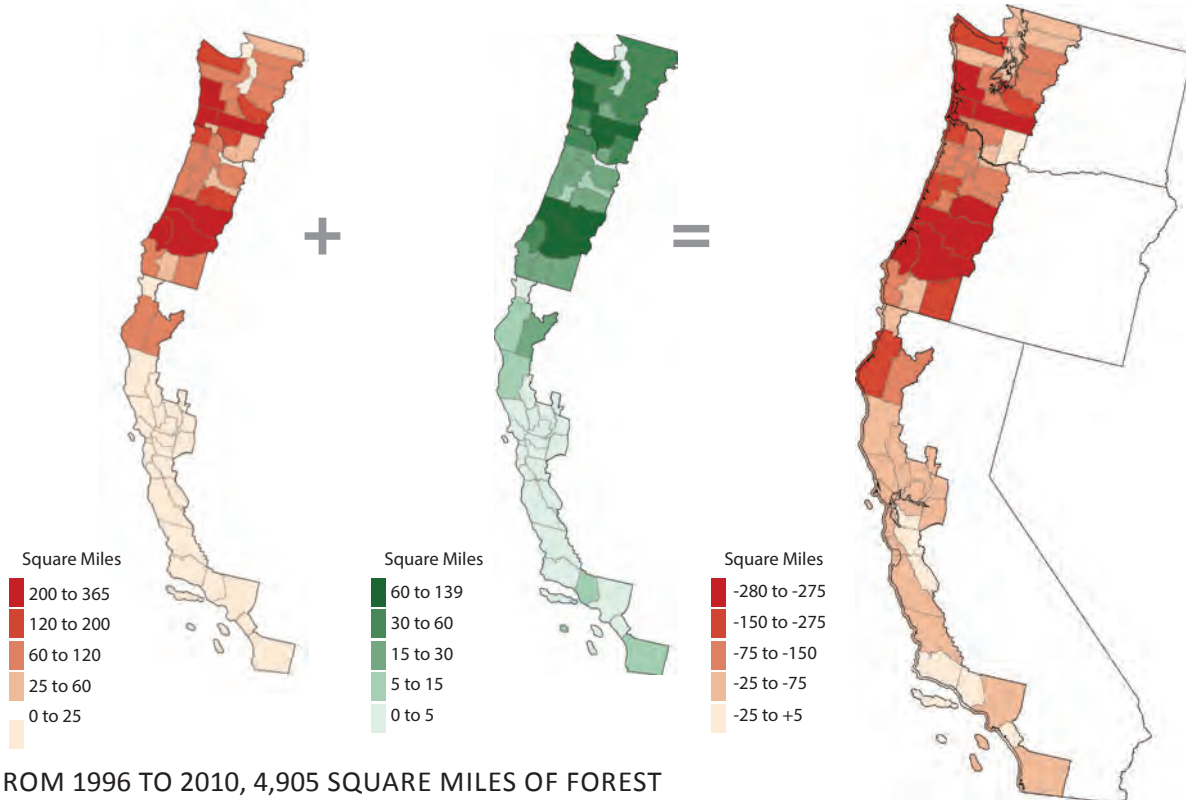
FOREST AREA LOST

4,905 square miles

FOREST AREA GAINED

1,667 square miles

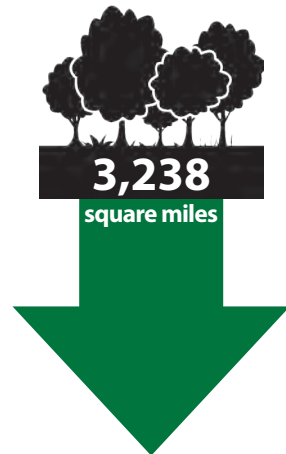
**NET CHANGE
IN FOREST AREA**



FROM 1996 TO 2010, 4,905 SQUARE MILES OF FOREST changed to other types of land cover (above left), and 1,667 square miles of other land cover changed to forest (above center). The result was a net loss of over 3,238 square miles of forest. Most of these changes occurred in central Oregon, in Lane and Douglas Counties (which contain Eugene and Roseburg), and in the Washington counties of Pacific, Lewis, and Grays Harbor (between the major metro areas of Tacoma and Portland).

Silviculture Activities Surrounding Protected Lands

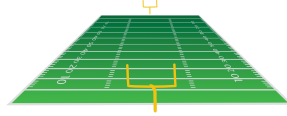
Timber activities (i.e., silviculture) in the western U.S. often result in a “checkerboard” appearance in the landscape. This effect is caused by the tracts of land that alternate between private ownership and public stewardship by the Bureau of Land Management. Areas of recent cuts (red) and subsequent regrowth (light green) are highlighted in the imagery below in the area surrounding Eugene, Oregon.



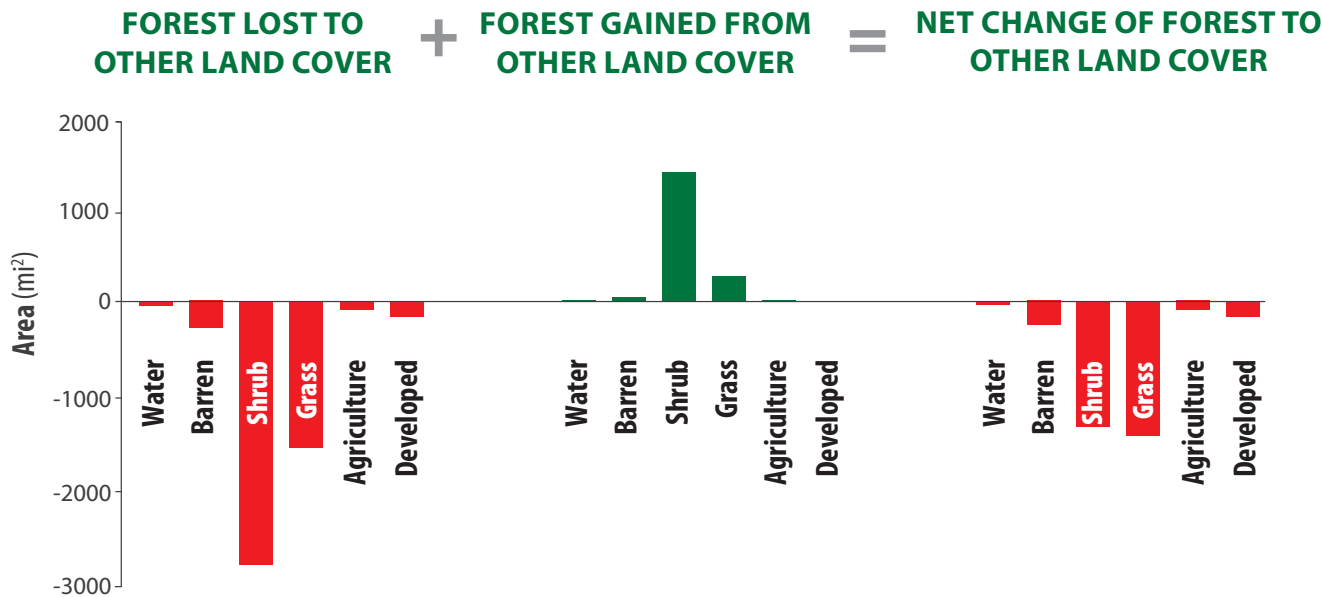
Decrease in Forest Area Equivalent to

1,567,192
Football Fields

1 Football Field Every



5 minutes



These graphs show the categories of land cover that forests were lost to or gained from, along with the resulting net change between each of these categories and forests between 1996 and 2010.

MOST OF THE LOSSES IN FOREST LAND COVER consisted of changes from forest to grass or shrub (90% of all forest losses, combined). At the same time, most gains came from areas that were formerly grass or shrub and changed to forest (97% of all gains, combined). This pattern suggests that many of the region’s forested areas were undergoing transitions

that did not result in permanent loss. However, losses of forest to development are more likely to be permanent. Approximately 95 square miles of forest were lost to development during the study period, accounting for 2% of the net losses. Of these losses, 94 square miles were upland forests, with almost no wetland forest losses to development.

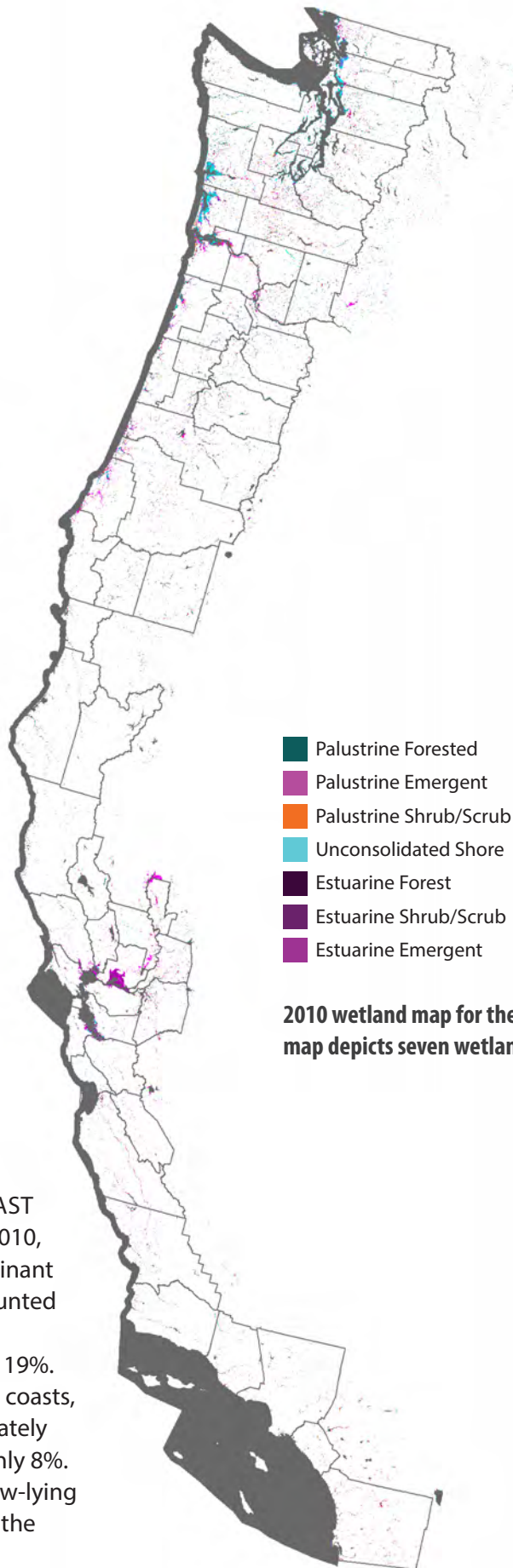
HIGHLIGHT: IMPACTS TO FOREST LAND COVER

National forests and other protected lands often restrict timber activities. The map of Tillamook State Forest (left) shows that timber losses and other significant forest changes occurred outside, and often right up to, the state forest boundaries.

Forest fires can also dramatically alter the landscape. The Charlton Burn of 1996 can be seen on the map (right) north of Lake Waldo, Oregon. The fire was started by lightning and produced a forest mortality rate of more than 95% in the 14.6 square miles (9,300 acres) mapped. The forest here has still not recovered 14 years later.



WETLAND



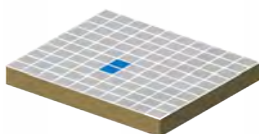
- Palustrine Forested
- Palustrine Emergent
- Palustrine Shrub/Scrub
- Unconsolidated Shore
- Estuarine Forest
- Estuarine Shrub/Scrub
- Estuarine Emergent

2010 wetland map for the West Coast. This map depicts seven wetland categories.

WETLAND AREA

2,826 square miles

2% OF REGION



JUST LESS THAN 2% OF THE WEST COAST REGION was covered by wetlands in 2010, with freshwater wetlands being the dominant type. Freshwater forested wetlands accounted for 30% of all wetlands, while emergent wetlands made up 26% and shrub/scrub 19%. Unconsolidated shore features along the coasts, lakes, and rivers accounted for approximately 17%, and estuarine wetlands made up only 8%. Most wetland types are isolated to the low-lying areas along the immediate coasts and in the narrow river valleys.



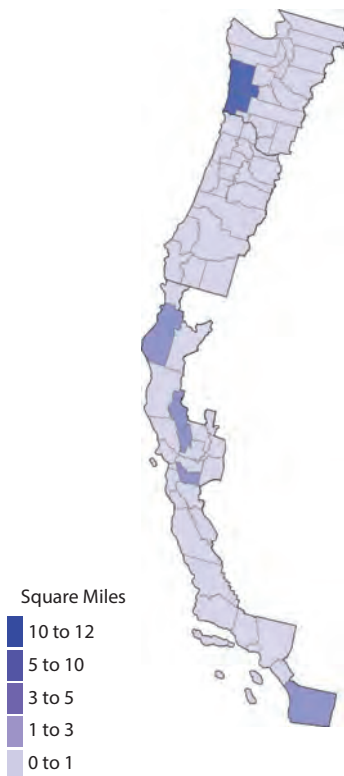
WETLAND AREA LOST

80 square miles

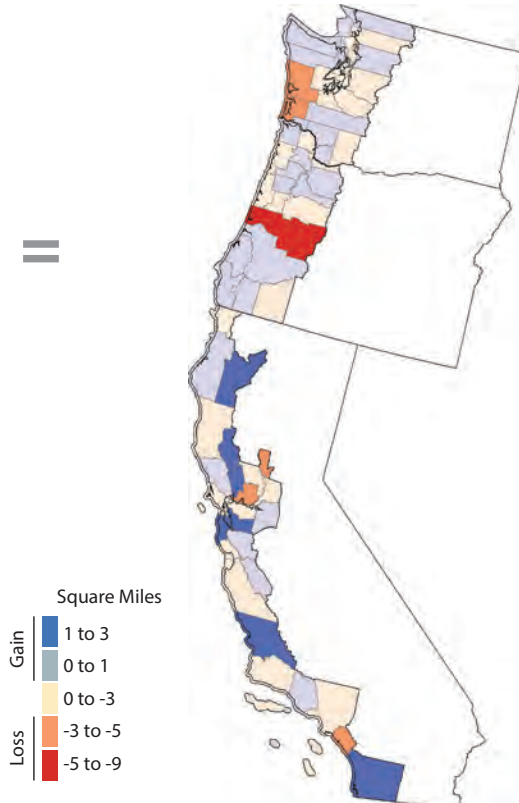


WETLAND AREA GAINED

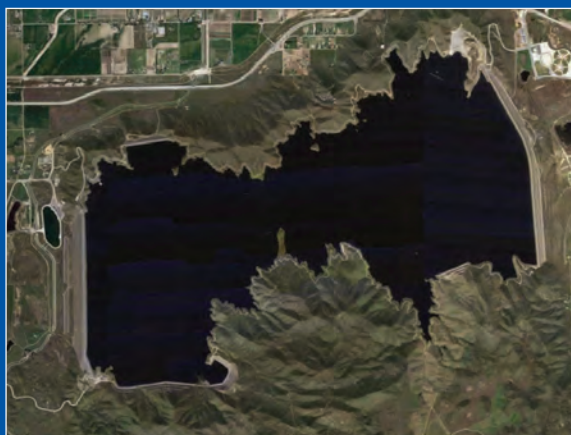
73 square miles

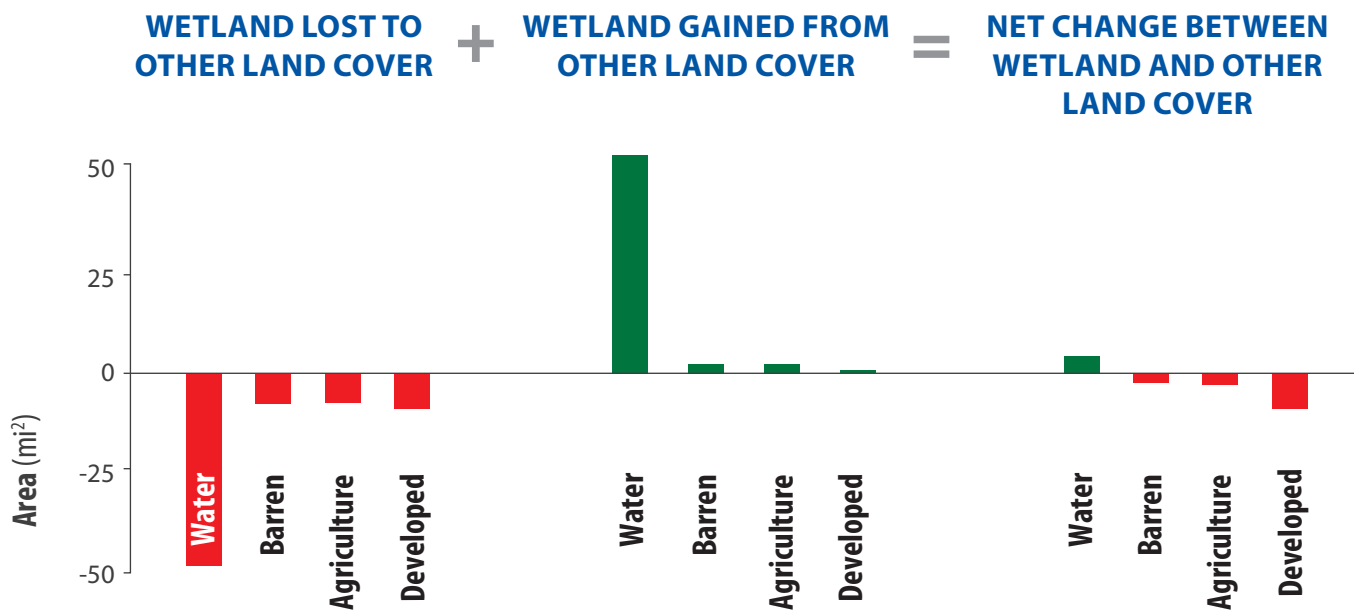


NET CHANGE IN WETLAND AREA



TOTAL WETLAND AREA ACROSS THE REGION remained stable from 1996 to 2010, with a loss of only 80 square miles (above left) and a gain of 73 square miles (above center). Some areas had a net gain and others had a net loss (above right), though all of these net changes were small in terms of the total wetland area. The overall net change resulted in a decrease of less than 7 square miles for the entire coast, representing less than a 0.5% net loss of total wetlands present in 1996.





These graphs show the categories of land cover that wetlands were lost to or gained from, along with the resulting net change between each of these categories and wetlands between 1996 and 2010.

WETLANDS IN THE WEST COAST REGION were primarily lost to open water (67% of all wetlands lost), while most gains came from former water features (88% of all gains). Most of these were associated with the unconsolidated shore class and were a result of sediment movement along the coastline, changes in lake levels, and shifts in river courses throughout the area.

HIGHLIGHT: IMPACTS OF VARYING LAKE LEVELS AND RESERVOIRS

The Diamond Valley Reservoir was built in 1995 (1996 imagery shown on page 12, left) and filled between 1995 and 2003. It is one of the largest reservoirs in southern California, serving as a source of drinking water during times of drought. In more recent years, the water level in the reservoir remained steady (2009 imagery shown on page 12, right), while drought conditions led to low lake levels in many other area lakes and reservoirs, such as Indian Valley Reservoir (shown in both 2005 and 2013, right). The lower water levels at Indian Valley have exposed previously submerged sediment, which is mapped as new land (though likely not permanent).



