

Climate and Precipitation

The climate in the North Coast Basin is generally mild and wet. Temperatures along the coast vary from lows of about 36° F to highs around 72° F (Oregon Climate Service, 2003). The higher elevations in the Coast Range on the east have lower winter temperatures. The average annual precipitation ranges from 66 inches at Astoria to 180 inches in the upper headwaters of the coastal streams (Western Region Climate Center, 2003). Figure 4 shows the average annual precipitation distribution in the North Coast Basin. The wide range of rainfall, particularly the large amount in the coastal stream headwaters regions, are due to the orographic effects of mountains near the Pacific Coast. The prevailing winds come from the west, bringing moisture from the Pacific Ocean. When this moisture builds up against the Coast Range mountains where the coastal stream headwaters originate, the moisture condenses and the clouds release the moisture as large amounts of rain and snow.

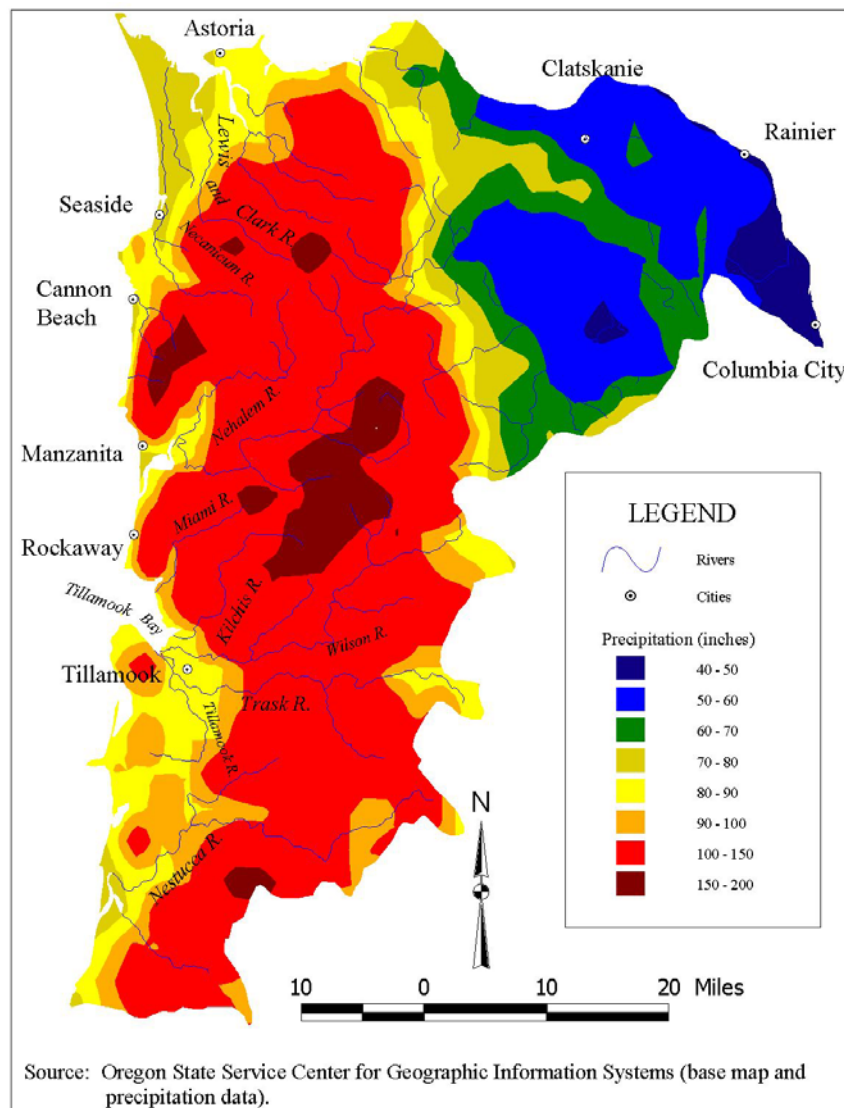


Figure 4. Annual Precipitation, North Coast Basin, Oregon.

Geology

The North Coast Basin geology is composed of volcanic rocks, marine sedimentary rocks, alluvium, and a prominent dunal sand complex (Orr and other, 1992) (Figure 5). The highlands on the basin's eastern border consist mainly of volcanic rocks, including basalt lava flows extruded on land and underwater. Lava extruded under water has a characteristic rounded, pillow-like appearance. Folding and faulting uplifted submarine lavas and other volcanic rocks. These rocks are exposed in the Coast Range, and in the prominent headlands along the basin's western coastline. From north to south these headlands include Tillamook Head, Cape Falcon, Cape Meares, Cape Lookout, and Cascade Head. Some layers of volcanic-derived sediments are associated with these rocks.

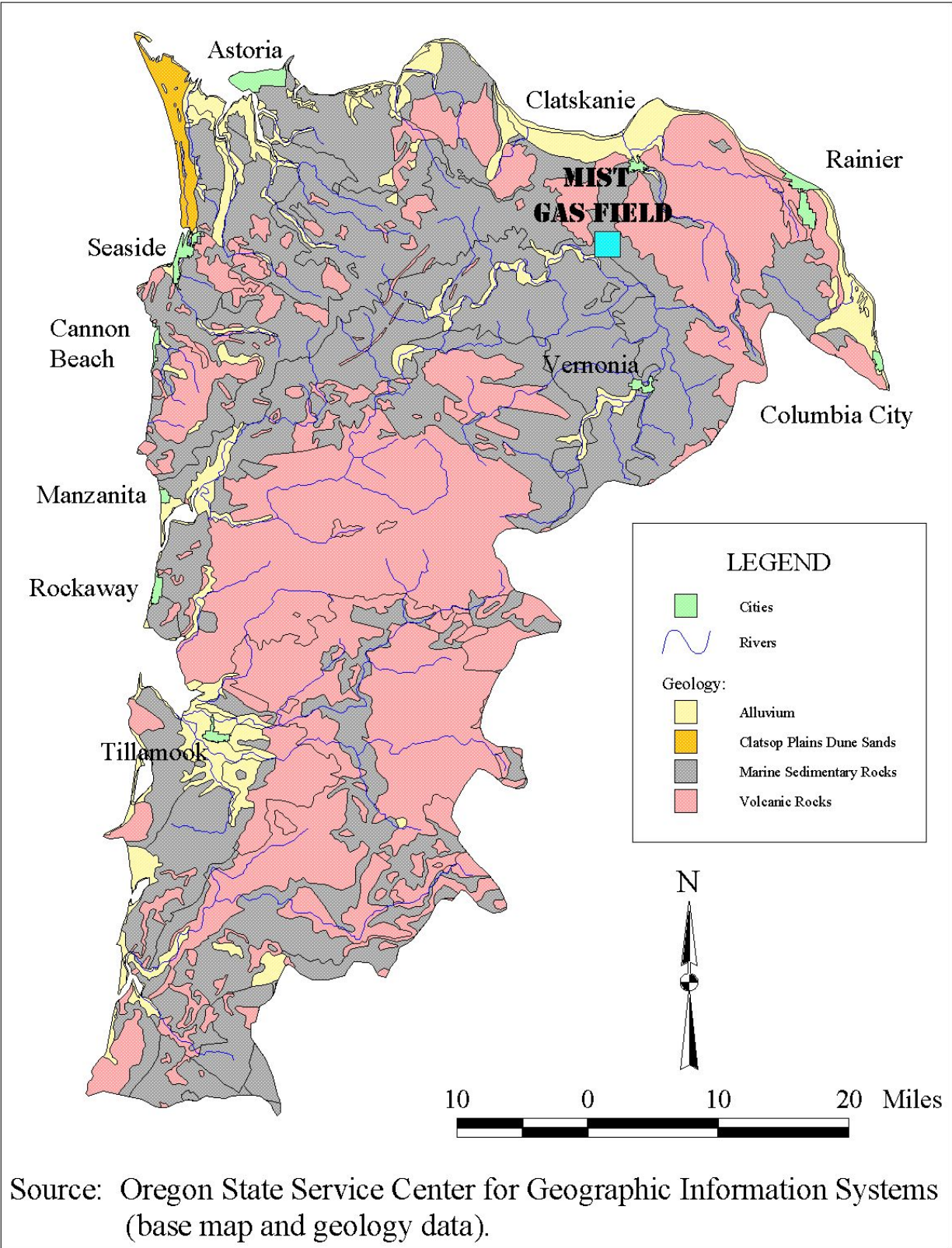
Marine sedimentary rocks including mudstone, siltstone, sandstone, and conglomerate are the second major rock type present in the North Coast Basin. Some of these rocks contain marine fossils. Cape Kiwanda, south of Tillamook, is composed of relatively erosion resistant marine sedimentary rocks.

Unconsolidated alluvial sediments are present as valley fill deposits and along streams in the basin. The Tillamook Valley lowlands contain terrace alluvium up to 120 feet thick. These deposits contain basalt pebbles and cobbles in a sand, silt, and clay matrix (ODEQ, 1997). Along the river flood plain, alluvium consisting of gravel layered with sand, silt, and clay is present in deposits up to 300 feet thick.

Along the basin's northwest margin, between the Columbia River on the north and Seaside on the south, is an area known as the Clatsop Plains. The Clatsop Plains is a complex of unconsolidated dunal sands from 125 to 400 feet thick (Sweet, Edwards, 1981; Pollock and Weick, 1996). Ocean currents and wind have deposited Columbia River sands to form beaches and parallel rows of stabilized dunes. The dunal area varies in width from 1 mile in the south near Seaside, to 3 miles in the basin's northwest corner. The dunes are arranged in a longitudinal manner, oriented parallel to the shoreline, and rise 10 to 100 feet above sea level. Numerous lakes and wetlands are present in the interdunal area. Sedimentary rocks (shale and sandstone) underlie the dunal sand.

Some of the sedimentary rocks are organic rich, and contain hydrocarbon traps. Economic volumes of natural gas were discovered in 1979 near the town of Mist in the basin's northern part (see Figure 5). The Mist gas field has produced about 65 billion cubic feet of gas (Orr and others, 1992).

Active tectonic forces of folding, faulting, and uplift, created the Coast Range's steep and rugged topography. Seasonal storms lead to widespread instability in the basin's mountainous areas. This instability is expressed as landslides occurring annually during periods of heavy rainfall (Orr and others, 1992).



Source: Oregon State Service Center for Geographic Information Systems (base map and geology data).

Figure 5. Generalized Geology of the North Coast Basin, Oregon.

Hydrogeology

Shallow alluvial aquifers are the North Coast Basin's primary aquifers (Pollack and Weick, 1996; ODEQ, 1997). The aquifers are present in unconfined and unconsolidated sedimentary materials, primarily sand and gravel, near the coastline, and adjacent to major rivers and streams. Sweet and others (1980) produced a statewide map of aquifers sensitive to contamination. Figure 6 shows the sensitive aquifers identified in the North Coast Basin. Fractured volcanic and marine sedimentary rocks can yield substantial groundwater volumes. However, these rocks' high salt content produces poor groundwater quality, and these formations provide only minor potable water supply sources.

One of the most important and best known North Coast Basin aquifers is the Clatsop Plains aquifer. F.J. Frank (1970) studied the Clatsop Plains dunal aquifer. Infiltrating precipitation is the primary aquifer recharge mechanism. He estimated about 80 percent of the precipitation infiltrates through the highly permeable sandy soils into the aquifer's dune sand. Minor aquifer recharge comes from irrigation and domestic sources. Sweet's (1981) hydrology model indicated surface water runoff from the Coast Range foothills contributes negligible quantities of water to the Clatsop Plains area water budget. During periods of drought with low or depressed water tables, surface water recharges the aquifer. The permanent groundwater table occurs at 3 to 33 feet below ground surface. In the central dune area, the saturated sand thickness ranges from 95 feet to more than 150 feet.

Frank performed water well pumping tests in the Clatsop Plains aquifer. He calculated an aquifer vertical hydraulic conductivity between 227 to 254 feet per day. Frank estimated a horizontal hydraulic conductivity 35 times greater than the vertical hydraulic conductivity. He said these values may be 50% too low, due to partial penetration effects and well loss in the test wells. Frank estimated up to 2,500 acre-feet of groundwater per year per square mile of area may be available in the 10 square mile area most favorable for development.

Many inter-dunal lakes are present in the Clatsop Plains (Frank, 1970; Sweet, 1981). The lakes fill one to two mile long elongate depressions or basins between the dunal ridges. Groundwater provides base flow to these lakes. Most of the lakes are independent of the local stream and river systems. No perennial surface water flows in or out of these lakes. The groundwater aquifer discharges water to the surface water bodies and the ocean. Despite abundant rainfall, little surface runoff occurs, and local streams lack well defined tributaries. Because of the two-way communication between groundwater and surface water, contaminants introduced into surface water impact the groundwater, and vice versa.

In the Tillamook Valley, the primary aquifers are present in the valley fill deposits (ODEQ, 1997). Groundwater is present in an upper zone of sand to clayey sand at 20 to 60 feet below ground surface. A deeper groundwater zone is present at depths greater than 80 feet below ground surface in permeable sand and gravel. The underlying sedimentary rocks are generally impermeable.

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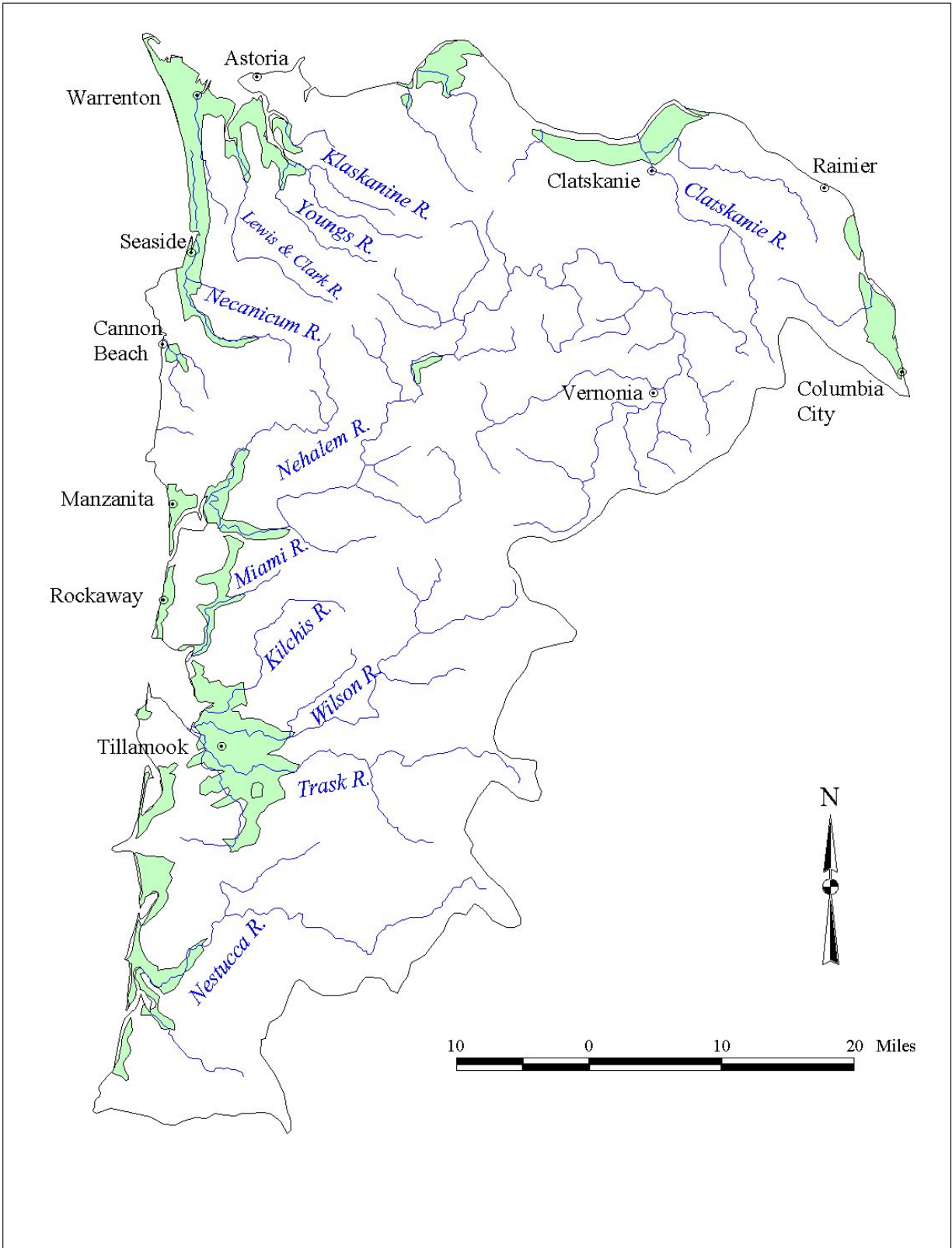


Figure 6. Sensitive Aquifers, North Coast Basin, Oregon.