Geothermal

The potential for the occurrence of geothermal energy is moderate to high across the planning area. Available information on existing geothermal resources comes from 8 natural hot springs and 18 exploratory geothermal wells in the planning area. Data from other wells adjacent to the planning area were used to interpolate the geothermal energy potential to the planning area boundaries.

All of the hot springs are scattered throughout the southeast part of the planning area. Each hot spring is a surface indication of geothermal energy. All but 2 of the hot springs have temperatures exceeding 40° C (104° F).

The geothermal exploratory wells are somewhat evenly distributed across the planning area. Temperatures encountered in the wells range from 20° C (68° F) to 45° C (113° F). Only four of these wells have temperatures exceeding 30° C (86° F); all of the other wells have temperatures of 23° C (73° F) or less.

Soils

Soils are defined by the processes that form them including climate, topography, parent material, and organisms living in the soil. Through time, these processes form unique soil types and influence what plants grow.

Climatic Factors

Climatic influences are reflected by soil temperature and moisture. In the planning area, we have two soil moisture regimes: dry and moist. Common soil temperature regimes in the planning area include warm and cool.

Soils play an integral part in vegetation community development. Plant communities are most noticeably influenced with extremes in soil texture and thickness of soil horizons, depth to restrictive layers including abrupt soil horizon boundaries, and by soil drainage or depth to water table.

Topographic Factors

Deep to very deep soils occur in alluvial drainages, floodplains and river terraces of the John Day River, and on North and Northeast facing slopes influenced by leeward soil deposition from the prevailing winds, and on colluvial (rockfall) foot slopes from water and gravity deposition. Shallow and very shallow soils occur on flat basalt table lands, and on upland ridge top and shoulder slopes.

Parent Materials Factor

The soils in the Columbia Plateau are derived from weathered basalt and some wind deposited silt. Silty soil textures occur in the Umatilla Plateau and Pleistocene Lake Basins. At higher elevations, the deep loess soils become thinner. The John Day Canyons have a higher rock fragment content than the surrounding areas. High rock fragment content helps protect the soil from erosion.

The soils in the Blue Mountains are derived from a myriad of surface geology, including: ash, basalt flows, and partially heated and metamorphosed oceanic rocks. The Canyons and Highlands have shifting colluvial soils on steep canyon slopes shallow, cobbly soils occur in the continental zone highlands. The soil of the mesic forest zone has a significant ash layer that is relatively rock free and that also helps to retain moisture during the dry season.

Living Organisms Factor

A functioning soil biological community includes insects, biologic crusts, and in forests large wood in various stages of decay. Small organisms reduce dead plants into tiny pieces so fungus and bacteria can rot them. They help spread bacteria and protozoa through the soil.

Sensitive Soils

Sensitive soils are those soils that are more vulnerable to soil productivity loss with disturbance. Sensitive soils in the planning area have been modeled based on soil properties that make them susceptible to site degradation. These properties include steep slopes, soil texture, water erosion, droughty sites, and depth to bedrock. Map 5 shows planning area soil vulnerability to site degradation. Table 3 correlates the common soil associations with Subecoregions and the percent of those Subecoregions with sensitive soils.

Disturbances

Common soil disturbances in the planning area include timber harvest, wildfire, prescribed fire, off road vehicle use, poorly drained roads, livestock and wildlife grazing and mechanical treatment of vegetation. These and other surface disturbing activities can decrease soil cover and contribute to increased erosion, decreased infiltration, and reduced soil productivity.

Within the planning area, regions of intense off highway vehicle use are exhibiting static to downward trends in soil productivity. Soil productivity trends are static to improving in rangelands with good perennial grass cover, shrub/tree canopy cover less than 10 percent, and grazing systems that allow for vegetation (grass) recovery and rest. With increases in the density of forest and juniper stands the potential for wildfire to damage soil productivity also increases.

Unique Soil Resources

Hydric (wet) soils, prime agriculture land, and unique biological soil crusts are key soil resources in the planning area.

Hydric Soils

Hydric soils constitute only a small portion of the planning area. Hydric soils are associated with riparian areas in poorly drained back waters along flood plains and in small spring seeps through out the planning area. Soil mapping frequently excludes hydric soils because of the limited distribution and aerial extent.

Biologic Soil Crusts

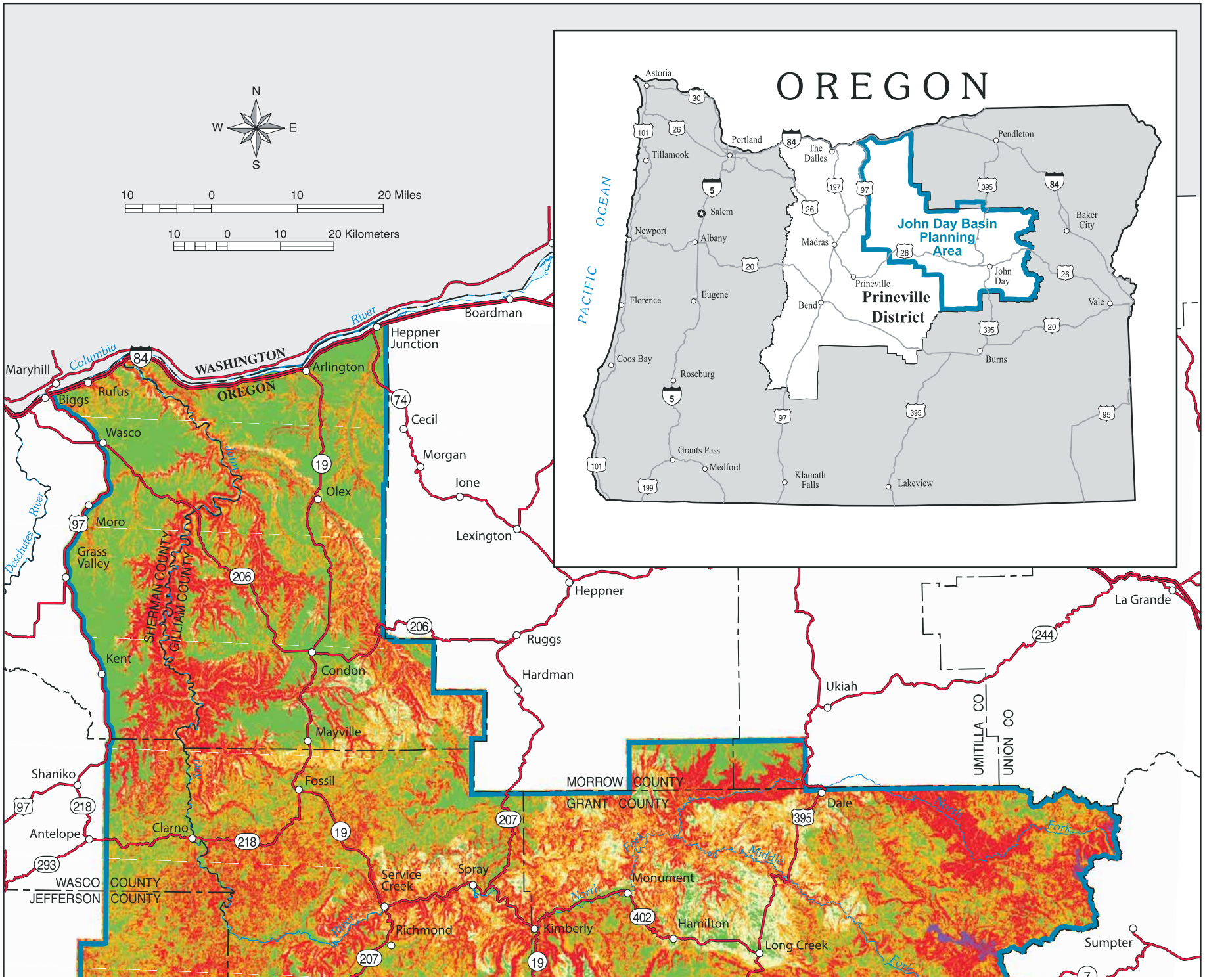
Biologic soil crusts (BSC) are made up of tiny living plants and bacteria that grow together on the soil surface. They help keep the soil from washing or blowing away, make nitrogen, help keep out weeds, and promote the health of plant communities. In areas where BSCs have been lost native vascular plants have been replaced by invasive species such as cheatgrass or medusa head.

The John Day Basin biological soil crust communities are unique. They are often more stable and more diverse than BSC communities in other parts of the west. A combination of relatively stable soils, moderate annual precipitation and many sunny days allow these BSC communities to develop quickly and withstand disturbances. However, sandy or clayey soil conditions promote crusts that are less tolerant of disturbance than the crusts in loamy volcanic soils that dominate the basin.

A globally threatened species in biological soils crusts, *Texosporium sancti-jacobi*, is widespread in the basin. This species has become rare or has been extirpated from most of its Oregon, Washington, Idaho and California range. This species is found in windy locations, such as ridgelines and hill tops. It occurs in both the loamy and sandy portions of the basin.

Table 3: Sensitive Soils by Soil Associations and Subecoregion

Ecoregion	Subecoregion	Common Soil Associations (% of Subecocoregion)	Percent of Subecoregion with Sensitive Soils
Columbia Plateau	Umatilla Plateau	Ritzville-Walla Walla-Condon-Bake-oven (63%)	13%
	Pleistocene Lake Basins	Ritzville-Olex-Walla Walla-Roloff (51%)	13%
	John Day Canyons	Lickskillet-Wrentham-Rock Outcrop-Bakeoven (81%)	61%
	Umatilla Dissected Up-lands	Gwin-Waha-Simas-Gurdane (55%)	17%
Blue Moun-tains	John Day/Clarno Uplands	Simas-Tub-Waterbury-Gwin (51%)	27%
	John Day/ Clarno High-lands	Klicker-Hankins-Tolo-Bocker (63%)	30%
	Maritime-Influenced Zone	Klicker-Tolo-Hall Ranch-Anatone (77%)	14%
	Melange	Tolo-Klicker-Helter-Anatone (50%)	54%
	Continental Zone High-lands	Klicker-Tolo-Hankins-Anatone (65%)	25%
	Continental Zone Foot-hills	Ateron-Menbo-Observation-Westbutte (54%)	24%
	Mesic Forest Zone	Helter-Klicker-Tolo-Ateron (54%)	44%
	Subalpine-Alpine Zone	Helter-Rock Outcrop-Klicker-Ateron (55%)	54%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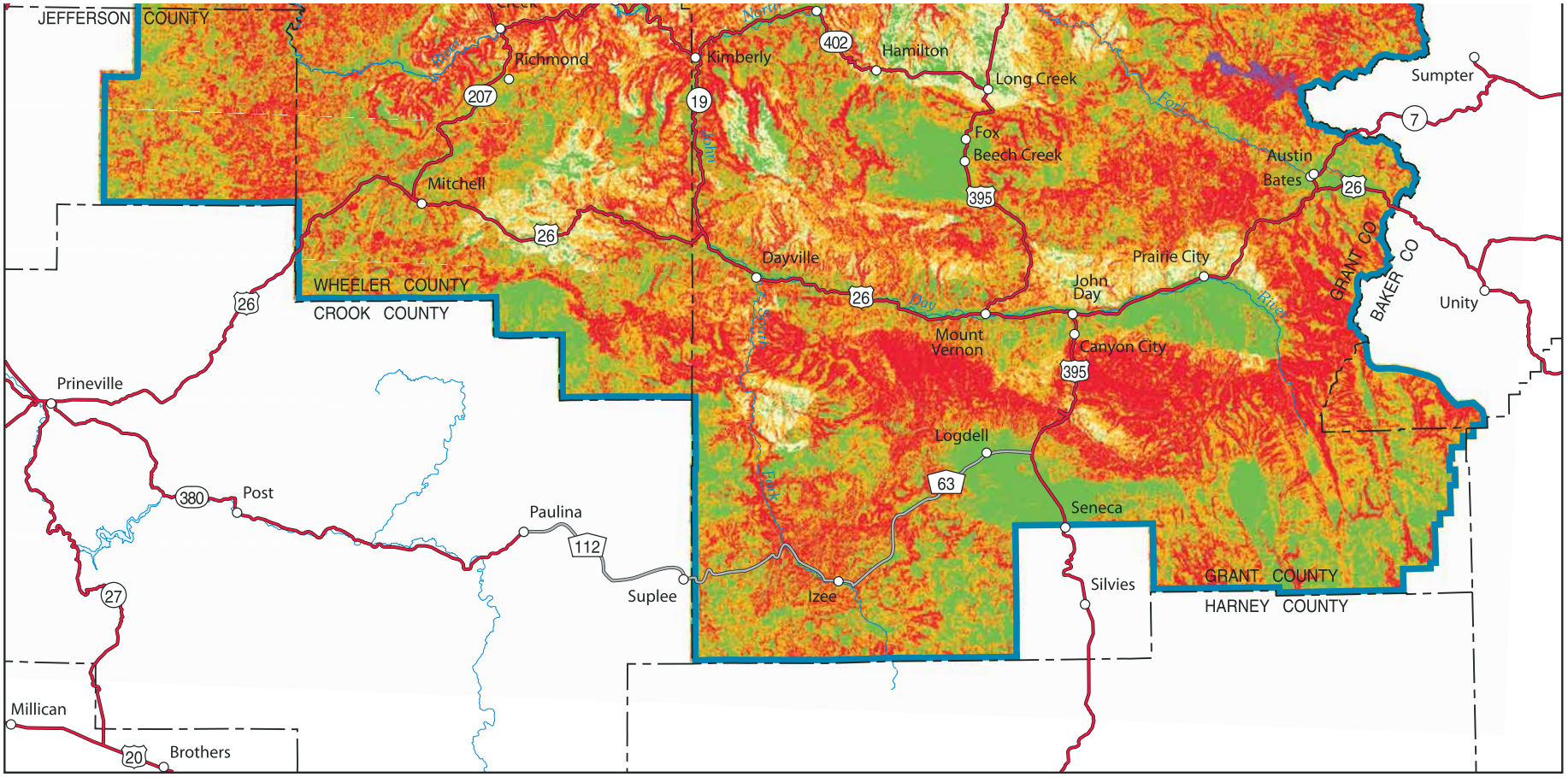
PACIFIC OCEAN
Astoria
Portland
Tillamook
Pendleton
The Dalles
Salem
Newport
Albany
Madras
Baker City
John Day Basin Planning Area
Prineville
John Day
Prineville District
Florence
Eugene
Bend
Vale
Coos Bay
Roseburg
Burns
Grants Pass
Medford
Klamath Falls
Lakeview
WASHINGTON
OREGON
Columbia River
Maryhill
Biggs
Rufus
Arlington
Boardman
Heppner Junction
Wasco
John Day River
Olex
Cecil
Morgan
Ione
Lexington
Deschutes River
Moro
Grass Valley
SHERMAN COUNTY
GILLIAM COUNTY
Heppner
Ruggs
Hardman
La Grande
Ukiah
Kent
Condon
Mayville
UMATILLA CO
UNION CO
Shaniko
Fossil
MORROW COUNTY
GRANT COUNTY
Dale
Middle Fork John Day River
North Fork John Day River
Antelope
Clarno
Service Creek
Spray
Monument
WASCO COUNTY
JEFFERSON COUNTY
Richmond
Kimberly
Hamilton
Long Creek
Sumpter



LEGEND

- Planning Area Boundary
- 84 Interstate Highway
- 26 U.S. Highway
- 19 218 State Highway
- 63 County Road

Soils Vulnerability to Degradation

- LOW
- HIGH - Water Erosion
- MODERATE - Water Erosion
- HIGH - Soil Depth
- MODERATE - Soil Depth

U.S. DEPARTMENT OF THE INTERIOR
Bureau of Land Management

PRINEVILLE DISTRICT

John Day Basin Resource Management Plan

2006

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Map 5: Soil Vulnerability to Site Degradation

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Prime Farmland

For more than two decades, the State of Oregon has maintained a strong policy to protect farmland through "preservation of a maximum amount of the limited supply of agricultural land" (ORS 215.243). Counties inventory agricultural land, designate it in their comprehensive plan, and adopt policies to preserve it. The acres of BLM land zoned as agricultural are shown in Table 4. Lands zoned as Exclusive Farm Use (EFU), have restrictions designed to limit development that would conflict with agriculture. It keeps farmland from being divided into parcels too small for commercial agriculture.

Vegetation

Vegetation within the planning area is a product of the physical and climate properties associated with the Subecoregions and modifications introduced by natural processes, including, fire, insect infestations, disease, and floods as well as human uses such as grazing management, introduction of exotic species, farming, mining, fire suppression, and timber harvest.

The primary disturbance element has been wildfire. Occasional episodes of insect/disease epidemics and wind and moisture driven erosion have also formed the vegetation patterns across the John Day Basin. Climatic variations and associated disturbance elements created a landscape of vegetative conditions that varied within a range referred to as a Historic Range of Variability (HRV) Sagebrush and juniper dot the slopes, grass lines the valleys, and pine forests ring mountain peaks. Lush green vegetation trims the many streams, rivers and springs in the planning area. Along the plateaus swaths of wheat fields alternate with remnant grasslands. Spring wildflowers of lupine, balsamroot and paintbrush created brilliant displays of purple, yellow and red.

Table 4: Acres of BLM Land Zoned as "Agriculture"

County	Zone	Acres
Gilliam		56,029
	Gilliam County AE Zone	56,029
Grant		124,648
	Multiple Use Range MUR40	120,758
	Primary Farm EFU20	3,769
	Primary Farm EFU40	121
	Primary Farm EFU80	0
Jefferson		22,940
	Rangeland Zone RL	22,940
Morrow		438
	EFU Zone	438
Sherman		37,960
	EFU F1 Zone	37,960
Wasco		26,006
	Wasco County A1-80 Zone	26,006
Wheeler		137,437
	EFU Zone	137,437