Pacific Ponderosa Pine—Douglas-Fir

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Definition and composition.—Ponderosa pine and Douglas-fir together comprise a majority of the stocking; the proportion of these two species varies considerably, or even alternates in predominance within short distances. California white fir is only a minor associate, a distinction that helps separate this type from the Sierra Nevada mixed conifer type. Other conifer associates are sugar pine and incense-cedar; hardwoods are Pacific madrone, California black oak, canyon live oak, tanoak, Pacific dogwood, and bigleaf maple.

Stands are rarely even aged, and two-story stands are common. In California, ponderosa pine usually is the older species and dominates the upper canopy (McDonald 1976a). Most old-growth stands of the type are gone and the forest today is primarily less than 120 years old. Plantations are numerous. In Oregon both Douglas-fir and ponderosa pine have been planted, but in California the latter is preferred.

Geographic distribution.—This forest type typically is developed in the Klamath Mountains of southwestern Oregon and northern California at elevations from about 460 to 1,220 m (1,500 to 4,000 ft.). It also occurs on the eastern slope of the Coast Range and the western slope of the Cascades, particularly in the Rogue River drainage. Southward in the Coast Range, the type extends into Mendocino County, California, and in the Sierra Nevada into Tuolumne County.

Although the type seldom is homogeneous, in southern Oregon it is likely to be more uniform, and more extensive, than in California. At low elevations, north and east aspects and canyons and draws favor the type. Higher up, ridges and west aspects are just as likely to support it. In the southern Klamath Mountains in California, ponderosa pine may dominate the type where soils are warmer and better drained. In the California Coast Range and the Sierra Nevada, north and east aspects and canyons and draws are essentially the only locations where the type exists.

Ecological relationships.—The successional status of the type differs from north to south. In the Klamath, Coast, and Cascade mountains, mostly in Oregon but partially in California, Douglas-fir predominates and succession in undisturbed stands is to that species, or perhaps to grand fir. In California, ponderosa pine is the dominant species, but as dense, shady stands develop, this species becomes more sparse and Douglas-fir is increasingly abundant.

Gross disturbance reverses this trend. In the north, hardwoods and shrubs temporarily replace Douglas-fir; in the south, logging and fire favor establishment of ponderosa pine (McDonald 1976b). At the lower elevational margins of the type, disturbance causes loss of area to hardwoods and shrubs; at higher margins, it pushes the type into the Sierra Nevada mixed conifer type. Partial disturbance favors understory and intermediate stand strata and tends to maintain the ponderosa pine—Douglas-fir type. If conifer regeneration fails, however, brushfields will develop. But, they in turn, will be slowly invaded by shade-tolerant conifers.

Variants and associated vegetation.—Although the type is distinct, it nevertheless grades into the Sierra Nevada mixed conifer and the Douglas-fir—tanoak—Pacific madrone types and in some places can be considered a variant of them. Additional types into which the Pacific ponderosa pine—Douglas-fir type merges are Pacific Douglas-fir and Oregon white oak. In the Sierra Nevada, outliers of the California black oak and Pacific ponderosa pine types often mix with the Pacific ponderosa pine—Douglas-fir type. With time and without disturbance, they eventually convert to the latter type. White fir is an adjoining type, especially in the northern Sierra Nevada.

The mixture of intolerant ponderosa pine and tolerant Douglas-fir practically guarantees that on good sites little growing space will remain unfilled. Beneath dense stands, there are found only a few species, such as tanoak, Pacific madrone, and incense-cedar seedlings, and wood rose, pine violet, western starflower, and California hazel. Once the overstory is removed and the soil bared, however, myriad shrubs, forbs, and grasses appear. On a high site in the north central Sierra Nevada, 115 vegetative species were present within three years after clearcutting. Other than hardwood tree seedlings, prominent pioneers from propagules in the soil are whiteleaf and hoary manzanita, deerbrush, oceanspray, spreading snowberry, and bracken. Common invaders from widely disseminated seeds are bull thistle, forest clarkia, *Epilobium*, blue wildrye, prickly lettuce, Spanish-clover, and gumweed madia.

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Definition and composition.—This forest cover type is defined by species composition. Ponderosa

pine must be pure or nearly so, although other conifer and hardwood species may be present in small amounts. In Oregon, Douglas-fir, Oregon white oak, bigleaf maple, California black oak, and Pacific madrone are common associates. Southward into California, on the westerly slopes of the southern Cascade and northern Sierra Nevada ranges, Digger pine and knobcone pine appear. In the north central Sierra Nevada, tanoak becomes an associate along with scattered incense-cedar and California white fir. Canyon live oak is an occasional associate, especially in the Klamath Mountains and the Sierra Nevada. Most stands are even-aged, and most are less than 125 years old.

Geographic distribution. —The Pacific ponderosa pine type is most extensive and best developed in the Sierra Nevada from Shasta southward through El Dorado County. It lies in a narrow elevational band that varies with latitude. In the Klamath Mountains of Oregon and California, the type ranges from about 300 to 600 m (1,000 to 2,000 ft.), rising with distance southward to 450 to 760 m (1,500 to 2,500 ft.) in the northern Sierra Nevada, and increasing thereafter to about 1,065 m (3,500 ft.) in the central Sierra Nevada.

Within this elevational range, the type can be found where soil, elevation, or physiography interact to create the necessary environment (Griffin and Critchfield 1972). In Oregon the type is present in more open, warmer, and drier portions of the Douglas-fir and mixed hardwood forest. In the Sierra Nevada, extension of the type can be found as low as 240 m (800 ft.), well within the natural ranges of California black oak, blue oak, and Digger pine. Here, along watercourses, on north and east aspects, or on deep, well-drained soils, ponderosa pine flourishes.

Ecological relationships. —Ponderosa pine is ideally adapted to a climate characterized by long, hot, dry summers and cool, moist winters. At the end of the first growing season, seedling height growth aboveground is only 3 to 5 cm (1 to 2 in.), but below-ground growth is much greater. The root system must reach and stay in a zone of adequate soil moisture or perish; consequently a 30-inch (76 cm) taproot on a one-year-old seedling is not uncommon. This attribute, plus rapid early height growth beginning the second growing season, enables seedlings to withstand drought and generally to compete on sites that would be inadequate for most other conifers. Consequently, ponderosa pine in this type extends its range to lower elevations on good sites in the chaparral and hardwood zones, and to higher elevations on hotter, drier, rocky sites in the forest zones above it.

Ponderosa pine, a frequent and heavy seed producer, is resilient and long lived. Seedlings require only top light to survive and compete well with aggressive shrubs. Rapid height growth continues through the sapling and pole stages well into maturity. As the tree grows, its bark continues to thicken until the species becomes fire resistant at a relatively young age.

The type is climax. By being the lowest true coniferous forest, close to the heavily populated valleys and the often-decimated chaparral zone, this type bears the brunt of human actions. Disturbance from fire, cutting, recreation, grazing, road construction, and dumping are chronic. Thus within the type shifts to subclimax oak woodland or chaparral are commonplace.

Variants and associated vegetation. —In general, this type lies between the Pacific ponderosa pine —Douglas-fir and Sierra Nevada mixed conifer types above, and the California black oak and blue oak—Digger pine types below. To the north, Oregon white oak, and Douglas-fir—tanoak—Pacific madrone types are neighbors. Throughout, the knobcone pine and canyon live oak types can be found.

Young-growth stands of ponderosa pine generally are quite dense. Not until age 200 or so do these stands open up. Beneath 110-year-old stands on high sites in north central California, lesser vegetation consists of seedlings of hardwoods (tanoak and California black oak), and tolerant conifers (incense-cedar and Douglas-fir). Also present are shade-tolerant woody shrubs such as western poison-oak, wood rose, and spreading snowberry, plus such perennial forbs as Sierra iris, milkwort, trailplant, western starflower, and princes-pine. Grasses and annual species are virtually absent.

When small openings are created, the species mentioned above appear, plus shrubs such as bearclover, deerbrush, and whiteleaf manzanita. Several more perennial forbs, six annual forbs, and four species of grass also become established.

In large openings or clearcuttings, where intensive site preparation and slash disposal bare the ground, a host of pioneer and invader species become established shortly after clearing. Woody shrubs from long-dormant seeds are particularly prevalent immediately after fire; they are a serious threat to ponderosa pine regeneration.

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