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Average Dry-Season Precipitation in Southwest Oregon, May Through September

Oregon State University
Extension Service

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During the hot, dry summer, a major factor affecting the reforestation potential of forest sites in southwest Oregon is the availability of soil moisture. Soil moisture will be least available in areas of low precipitation. Therefore, the amount of precipitation a site receives during the summer (when evapotranspiration demands are the greatest) is extremely important to seedling survival. This precipitation periodically replenishes the soil moisture supply in the vicinity of the roots of newly planted seedlings.

Thus, a map of the average dry-season precipitation for southwest Oregon should aid in the planning of reforestation activities and assessing reforestation risk. Dry-season precipitation is defined as that occurring between May 1 and September 30. During this period, potential evapotranspiration exceeds precipitation throughout the interior valleys of southwest Oregon (Johnsgard, 1963).

Source of data

We collected data from 62 precipitation stations with monthly precipitation records in and adjoining the five southwest Oregon counties of Coos, Curry, Douglas, Jackson, and Josephine (figure 1). The National Weather Service (NOAA) has published most of these data, but we obtained data for a few sites from the USDA Forest Service.

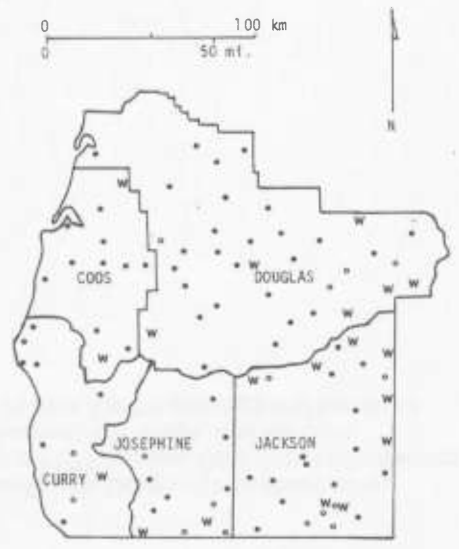


Figure 1. *Location of precipitation gages used in development of the precipitation map: • gages with monthly records; o gages with sporadic (seasonal) records only; W watersheds used in water budget calculations.*

We estimated dry-season precipitation for another 35 stations where only average annual precipitation was known. We obtained this estimate by multiplying the percent of the annual precipitation occurring during the dry season, based on nearby sites with monthly records, by the average annual precipitation of the site (Froehlich et al., 1982).

We based data for these supplementary stations on storage gauge and stream gauging station records. Sources for these data include the Water Resources Department of the State of Oregon, the USDA Forest Service, and the USDI Geologic Survey.

We used data for the period 1960-1980 to develop the map. Those stations that had at least 20 years of record were used to establish the long term trends of precipitation. Using these trends, we adjusted data from stations with shorter periods of record to a common 20-year base.

Preparation of the map

We plotted dry-season precipitation data on an 1:500,000 scale topographic map and divided the region into zones of similar precipitation pattern. We used linear regression to determine the variables influencing precipitation distribution within each zone. Elevation was the only variable we tested that was significantly correlated with precipitation. We then combined zones with similar regression coefficients until only six remained (figure 2). The remaining zones had either different

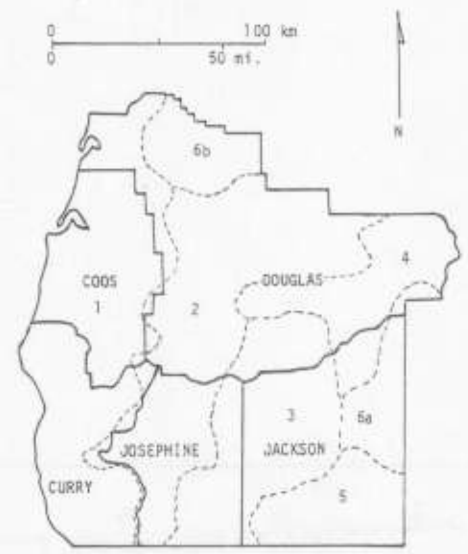


Figure 2. *Zones of similar precipitation patterns in the five southwest Oregon counties.*

Table 1. Characteristics of precipitation zones

Zone	Mean annual ppt. inches	Approximate increase of precipitation with increasing elevation		Mean May-Sept. ppt.* inches	May-Sept. ppt. % of mean annual	Approximate increase of dry-season precipitation with increasing elevation	
		inches/ 1000 ft.	r^2			*inches/ 1000 ft.*	r^2
1	74.0	12	0.357	8.6	11.6	1.0	0.012
2	48.6	15	0.607	5.6	11.7	1.6	0.175
3	30.8	8	0.726	4.0	13.2	0.5	0.234
4	46.6	10	0.847	6.2	14.3	1.2	0.657
5	24.9	6	0.806	4.1	16.7	0.5	0.336
$6_{a,b}$	48.2	7	0.942	6.4	13.4	0.4	0.372

* Average distribution of annual precipitation by month is: May 4.8%, June 2.3%, July 0.7%, August 2.0%, and September 3.0% (Froehlich et al., 1982).

mean rates of precipitation or different rates of precipitation increase with elevation (table 1).

Once the orographic (mountain-related) distribution of precipitation within zones was established, we produced three independent draft maps. We did not rigorously restrict isolines to elevational bands, but we subjectively shifted them, based on drainage orientation, location of prominent ridges, and potential of rain-shadows. Finally, we resolved the three maps into the present one.

Characteristics of dry-season precipitation

Dry-season precipitation is approximately 12.8 percent of the average annual precipitation across southwest Oregon. Of the five dry season months, May is the wettest, followed by September, June, and August. July is the driest. The proportion of dry-season precipitation occurring in all eastern zones is higher than in the coastal zones (table 1). This may reflect more thunderstorm activity locally, particularly for the mountainous regions.

Late-summer precipitation also tends to come from convective storms (less responsive to orographic influences than frontal storms). This is reflected in the lower correlation of dry-season precipitation with elevation than is the average annual precipitation.

The driest points in southwest Oregon are small isolated areas near Copper and Williams (T. 41S., R. 4W., and T. 39S., R. 5W., respectively).

Both areas receive an average of only 3 inches of precipitation during the dry season and are in the rainshadow of high mountains. Precipitation increases rapidly with elevation, particularly around Copper.

The interior of the Rogue Valley receives less dry-season precipitation than the Umpqua Valley. The difference becomes greater with elevation. Grants Pass (950 feet) and Medford (1,390 feet) receive 3.1 and 3.4 inches, respectively, of dry season precipitation, while Roseburg (460 feet) receives 4 inches. At elevations around 3,500 feet, the Rogue Valley receives 2 to 3 inches less precipitation than the Umpqua Valley.

The western Siskiyou Mountains are estimated to receive the greatest amount of dry-season precipitation; however, these estimates are largely based on proportional estimates of the average annual precipitation.

Interpretation

Evapotranspirational demand. Differences in dry-season precipitation across southwest Oregon are only one component of the water balance of any given site. The available moisture-storage capacity of a soil is another critical, site-specific factor. Both factors combine to become the supply side of a water balance that counteracts the high, evapotranspirational demands of the long, hot summer.

While estimates of actual evapotranspiration are difficult to determine, estimates of potential evapotranspiration (PET) that are based on mean monthly temperature and day length are available for many sites in southwest Oregon (Johnsgard, 1963). These estimates for the interior Rogue and Umpqua valleys show that PET is statistically significantly related to elevation, although the elevational gradient of PET is slight (figure 3). For the entire dry season, PET decreases less than 3 inches between 2,000 and 5,000 feet elevation, a decrease of only 15 percent.

The data also show similar PET for equal elevations in the Rogue and Umpqua valleys. In fact, stations as far north as the McKenzie River drainage follow this relationship.

We can assume, therefore, that PET, the water demand side of the water balance, will be nearly constant for sites of similar slope, aspect, and vegetative cover. Thus, the constancy of PET across southwest Oregon on similar sites reinforces the importance of dry-season precipitation for maintaining a variable seedling water balance.

Frequency distribution. Variation in dry-season precipitation across all five counties can be adequately described by a single-frequency curve (figure 4). With this curve, it is possible to assess the relative chance of adequate dry-season precipitation for reforestation success. The dry-season precipitation at any location can range from 25 to 225 percent of the 20-year average expressed on this map.

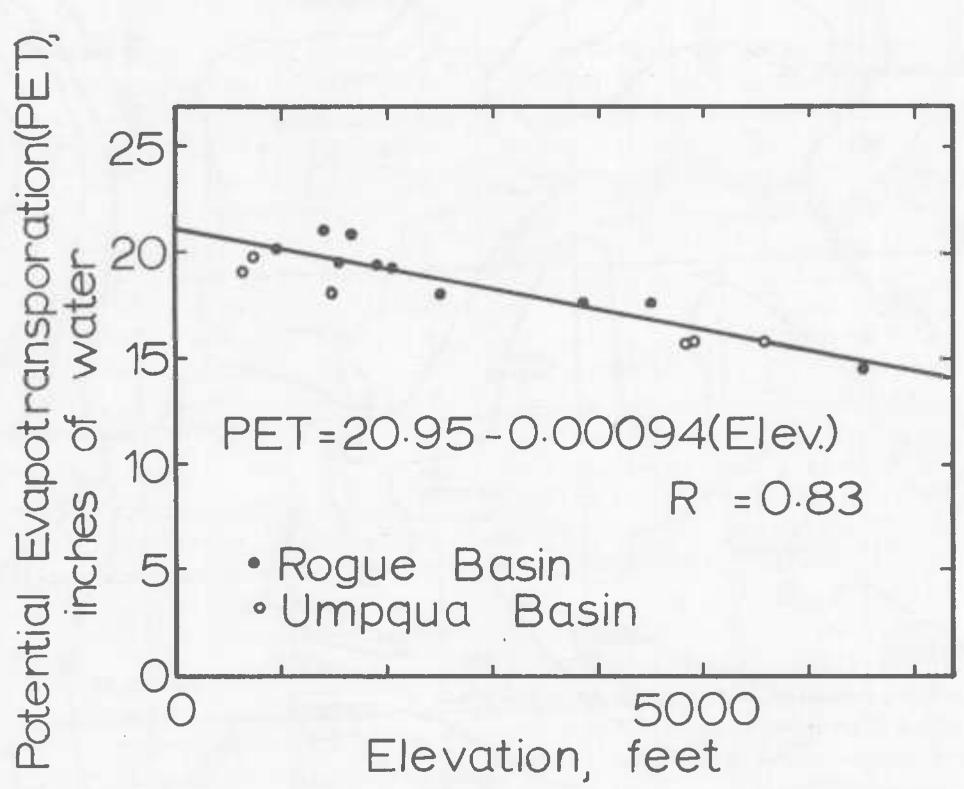


Figure 3. *Dry-season potential evapotranspiration as a function of elevation for the interior valleys of southwest Oregon (source: Johnsgard, 1963).*

Excluding the driest 25 percent and the wettest 25 percent, dry-season precipitation ranges from 75 to 125 percent of the 20-year average. For Grants Pass, with an average dry season precipitation of 3.4 inches, precipitation will range from 2.6 to 4.3 inches 50 percent of the time.

Planning reforestation activities. The dry-season precipitation map will be useful in planning reforestation activities over large areas. Plant areas of lowest rainfall earliest in the spring, progressing to areas of increasingly higher precipitation. This will give seedlings an opportunity to use late, wet-season precipitation to become established rather than rely upon a limited amount of dry-season precipitation and moisture stored in the soil.

Control of competing vegetation will be particularly critical in areas of low

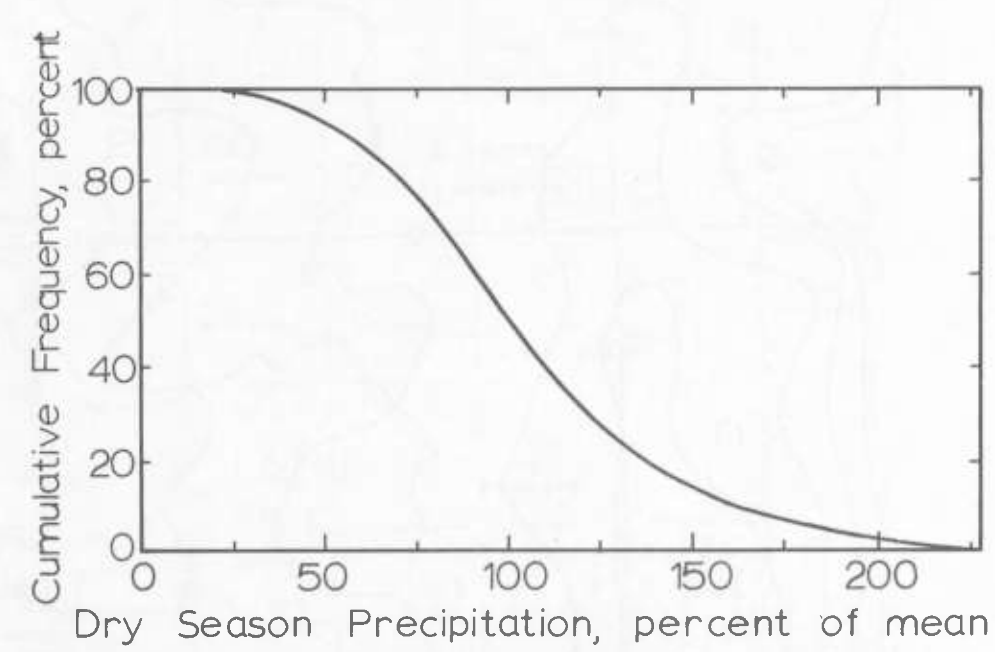
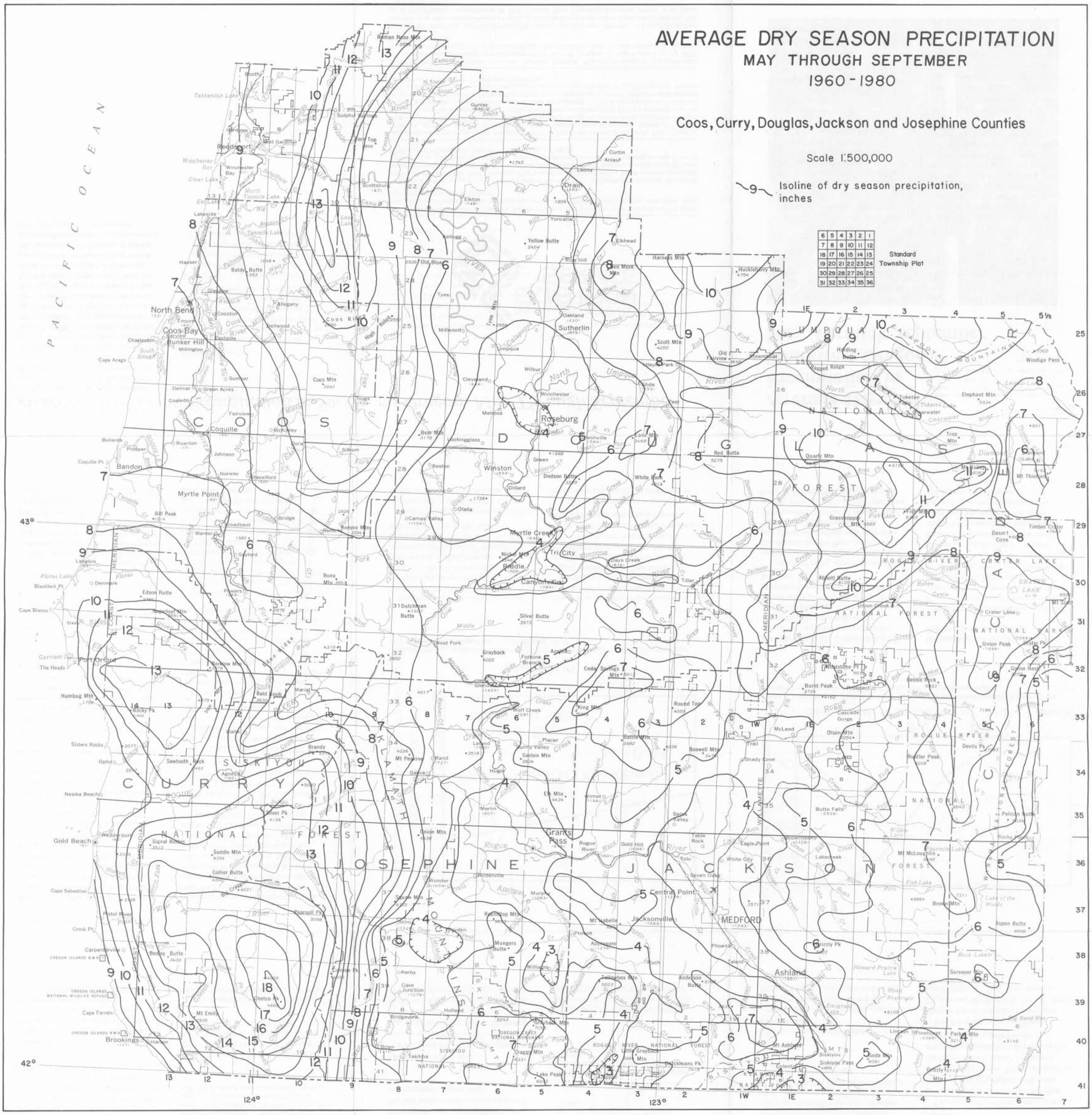


Figure 4. *Cumulative frequency curve of dry-season precipitation variation expressed as a percent of dry-season precipitation at all locations in southwest Oregon.*

dry-season rainfall. Transpiration by competing vegetation will adversely affect the site water balance by accelerating the depletion of moisture stored in the soil and use of the limited rainfall recharging the surface soil horizons.

Control of early, annual grasses will be particularly important because they can rapidly deplete the soil moisture in and above the seedling root zone with their dense, fibrous root system. Dry-season precipitation must replenish this zone before the water can move lower in the profile. This also reduces the potential for dry-season precipitation to benefit the seedlings.

Southerly exposures in low-rainfall areas are more apt to need the shade provided by shelterwoods or mechanical methods to insure successful reforestation. Fewer opportunities for replenishing soil moisture on these sites will result in soils with a low heat capacity. Potentially, these sites will more likely reach lethal soil temperatures over a longer portion of the summer than sites receiving more dry-season precipitation.



Oregon State University Extension Service

Copies of this map are available from the Bulletin Room, Oregon State University, Corvallis, OR 97331, or from the Southwest Oregon FIR Program, OSU Extension Service, Jackson County Office, 1301 Maple Grove Dr., Medford, OR 97501. Ask for OSU Extension publication EM 8226, and enclose $1.25 plus 25¢ for postage and handling.