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CHAPTER 6-1

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6. Tillamook Bay River System Characterization

This section of the report provides a series of assessments that define the current state of the river systems in the Tillamook Bay Basin. The assessments provide a compilation of basic data that will be used to develop an IRMS for the Tillamook Bay Basin. Conclusions from the assessments are presented in GIS maps, tables, charts, or diagrams. The goal was to make the conclusions as meaningful and understandable as possible within the constraints of available data and funding. Conclusions derived from GIS were mapped at either the basin extent (Figure 6-1) or the lowland valley floodplain extent (Figure 6-2). The lowland valley floodplain extent is a subset of the geomorphic lowland valley floodplain. Assessment mapping was focused on this smaller area because much of the available spatial data covered this area. The smaller area also allowed the development of a more detailed vegetation analysis (Appendix A).

The assessments are grouped in eight categories: Regional Precipitation and Climate, Basin Landform, River Hydrology, River Hydraulics, Tidal Processes, Vegetation, River System Morphology, Salmon Habitat and Distribution, and Human Land Use and Flood Risk. Each group of assessments builds upon those that precede it and illustrates the integrated relationship between natural and cultural systems. The natural system assessments begin by describing in spatial and temporal terms the interaction between land and water in the basin, moving on to vegetation and salmon distribution. The interaction between land and water is the foundation of the form and function of river systems. River and floodplain forms, combined with flood and tidal processes, create the conditions required to support a variety of native plant communities. These plant communities affect the way tides and floods alter landscape forms and are therefore essential to the geomorphic process. The complete system composed of water, land form, and vegetation in turn supports terrestrial and aquatic species such as salmon. The same conditions that support native plants and salmon have also encouraged human inhabitation in the Tillamook Bay Basin.

The assessments done for this report are intended to support the OWEB Oregon Watershed Assessment Manual, so many of the assessments correspond to activities described in the most recent version of this manual. However, the assessments done here are limited to those that help determine where and how flood risk reduction and salmon habitat enhancement can be achived in a coastal watershed. There are also a number of assessments of coastal and tidal processes that were added because they are not addressed in the OWEB manual. These processes are an integral part of the lowland river systems in the Tillamook Bay Basin and were considered important for assessing estuarine habitat in light of recent Endangered

Species Act listings. They can be done relatively easily and may provide valuable information for Oregon watershed councils. With the exception of institutional characteristics, these assessments also support the categories for the analysis of river corridor conditions presented in Chapter 7 of the Federal Interagency Stream Restoration Working Group manual (Federal Interagency Stream Restoration Working Group, 1998).

These assessments were used to develop an understanding of natural processes and land use patterns with the Tillamook Bay Basin. This understanding was the basis of an IRMS. To demonstrate the IRMS, a concept plan for the lowland valley in the vicinity of the City of Tillamook was developed to locate, at a planning level, potential management actions within the lowland valley. GIS was used as an assessment tool because of its ability to describe the spatial coincidence between natural flood and tidal processes, post-flood permit activity, and salmon habitat. This spatial information was used to locate potential lowland valley actions. All of the assessments, including those using GIS, relied upon available data.

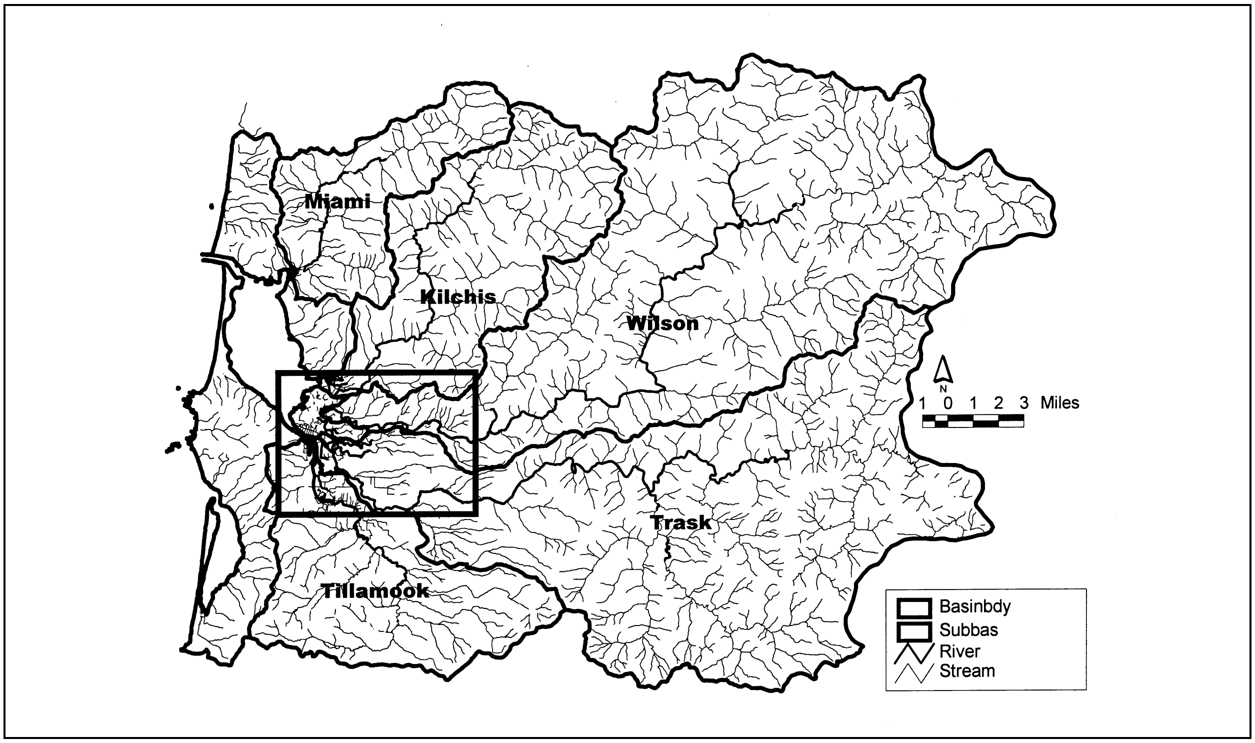

Figure 6-1. Basin Scale Map Extent

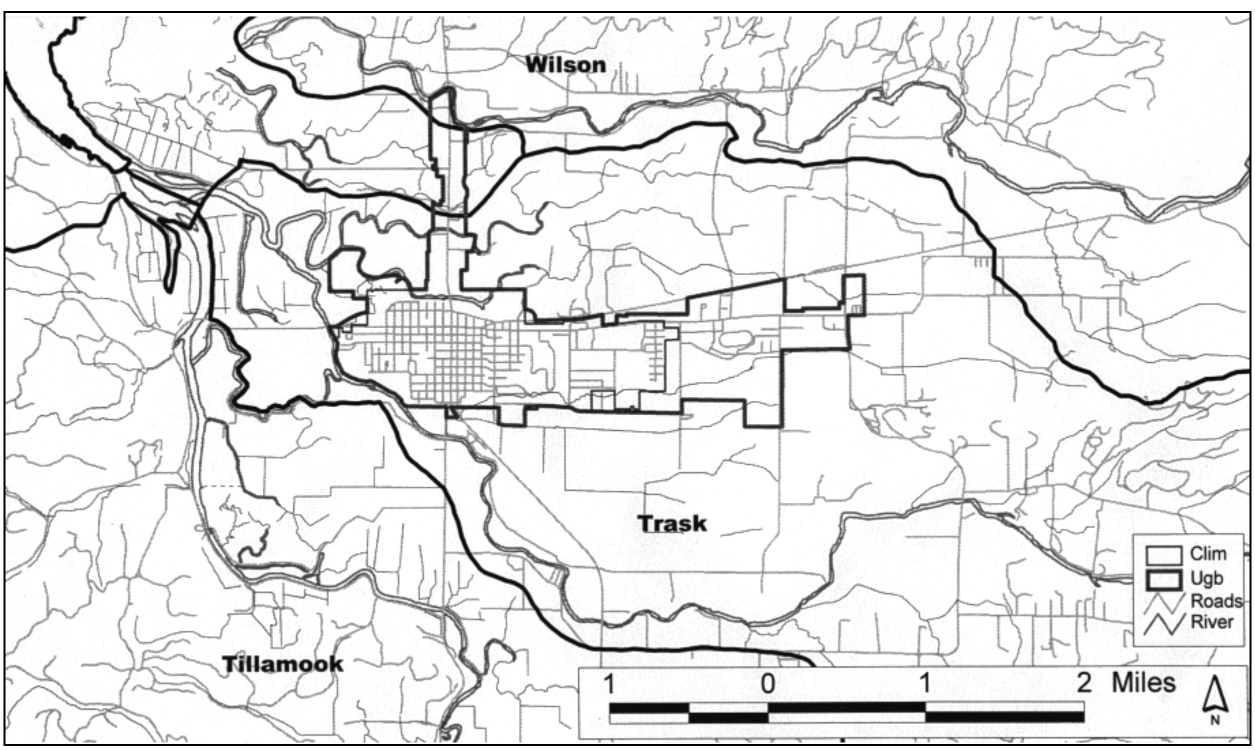

Figure 6-2. Lowland Scale Map Extent

6.1 Regional Precipitation and Climate

Precipitation and climate control the amount, timing, and distribution of water in a river system. They are the principal components affecting both flood risk and salmon population viability. This section discusses precipitation history and trends in the Tillamook Bay watershed, as well as winds, and sun angles.

6.1.1 Precipitation History and Trends

■ **Objectives**

Precipitation, an important part of the hydrologic cycle, is the result of climatic and topographic factors, and is the predominant source of water into a fluvial system. The objective of the precipitation history assessment was to characterize past regional and local precipitation trends in the Tillamook area, and to predict future trends and their effect on fisheries and floods.

■ **Methods**

Historic regional precipitation trends for the Oregon Coast were obtained from the Oregon Climate Service (OCS) web site (http://www.ocs.orst.edu). Precipitation at all stations west of the crest of the Coast Range was averaged for each water year. Figure 6-1-1 provides a summary of each year's departure from average water year precipitation from 1896 to 1995. The bars indicate individual water year departures and the line graph indicates a 5-year moving average. Figure 6-1-2 provides a historic summary of water year precipitation for the Oregon Coast area from data also obtained from the OCS.

■ **Discussion**

Four climatic periods are identified in Figure 6-1-1, alternating between wet and cool periods and dry and warm periods. These periods are generally 20 years in length. Because the last dry and warm period began in 1976, there is a possibility the Oregon Coast may currently be headed into a period of cooler and wetter weather.

These climatic cycles have a direct bearing on flood potential, and have recently been recognized as a possible indicator of salmon behavior, with cooler and wetter conditions being more favorable for the survival and resurgence of salmon. Wetter weather conditions also have direct implications for increased flooding potential, depending on the ability of the watershed system to absorb precipitation and attenuate runoff. Therefore, it may become increasingly important to manage the forested upland watershed areas of the Tillamook basin to slow the movement of water when it enters the river system as precipitation.

The fluctuation between annual and 5-year-average water year precipitation (Figure 6-1-2) appears to be increasing in recent years, as compared to the moderate changes that occurred up to 1945. This variability may have implications on moisture stress and plant growth rates for vegetation basin-wide, including upland forests, lowland agricultural areas, and revegetation efforts associated with floodplain restoration.

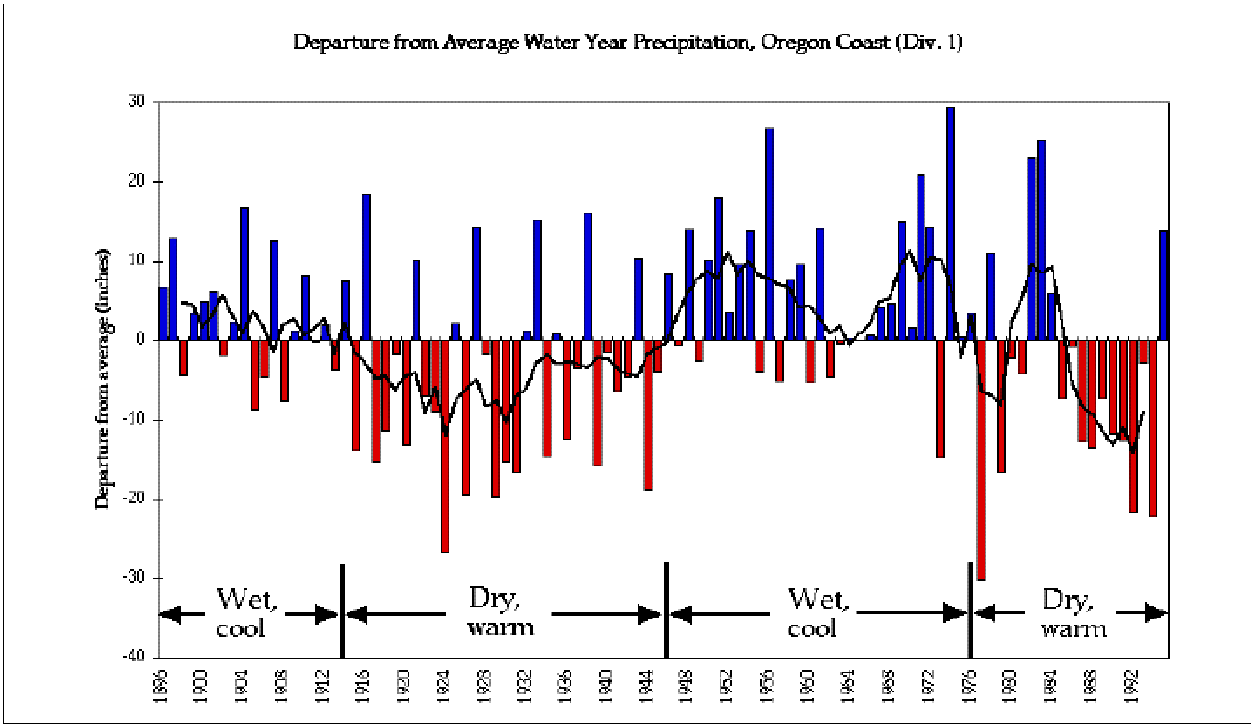

Figure 6-1-1. Departure from Average Water Year Precipitation, Oregon Coast (Div. 1)

6.1.2 Wind Direction and Sun Angle

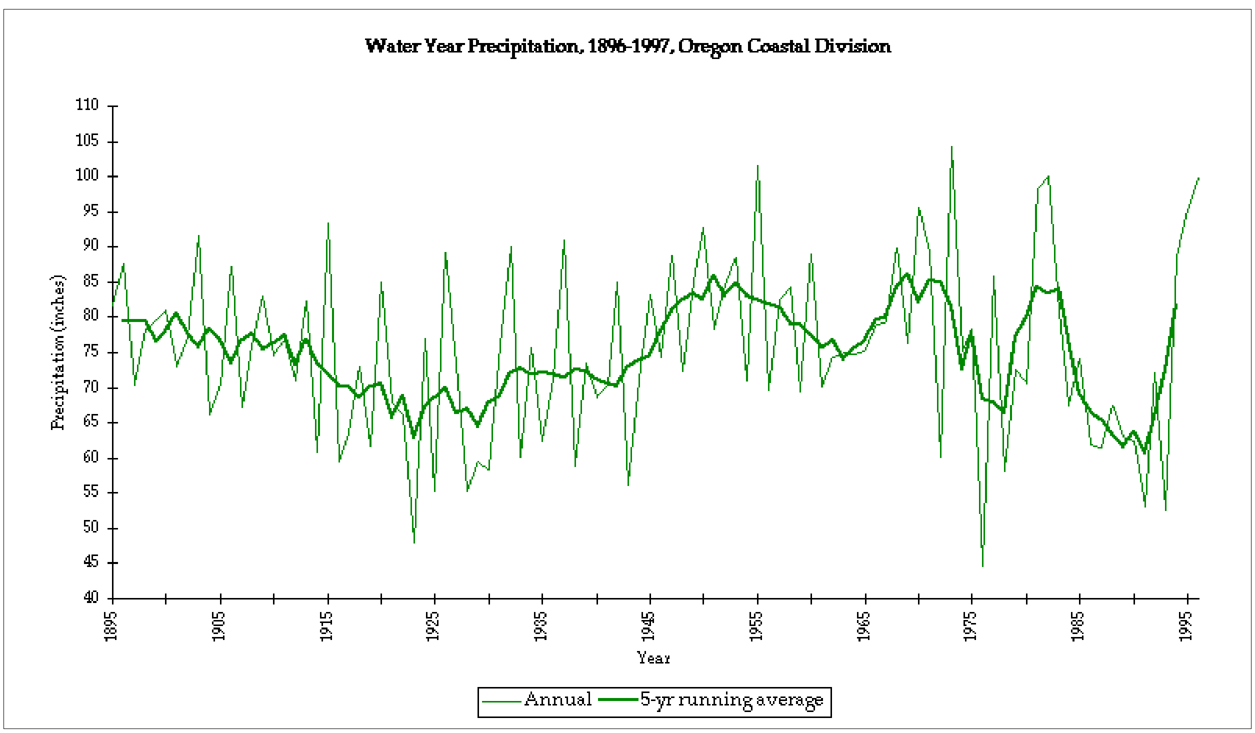

Figure 6-1-2. Water Year Precipitation, Oregon Coast 1896-1997 (with 5-year Smoothing)

▪ Objectives

The objective of this assessment was to understand the characteristics of seasonal wind directions and sun positions, in order to guide the conceptual layout of shelterbelts as a land management measure with multiple benefits for agriculture, flood management and fish and wildlife habitat interests.

▪ Methods

Monthly and annual wind data for Tillamook (wind speed class, direction and frequency) were obtained from the Climatological Handbook for the Columbia Basin States. These data were published in 1968, but are the most recent available for the Tillamook area, and likely remain representative of seasonal wind characteristics.

Figure 6-1-3 shows an annual summary of wind percentage frequency by direction for Tillamook. Predominant wind directions are from the South and the Northwest. Figure 6-1-4 shows representative summer and winter wind percentage frequency by direction using the months of July and January, respectively. Southerly winds generally occur during the late fall and winter, and northwesterly winds occur during the summer months through the growing season.

The annual variation of the angle of the sun was assessed by documenting the altitude of the sun, the angle in degrees from the horizontal (Figure 6-1-5). The sun altitude was estimated at weekly intervals throughout a representative year (Figure 6-1-6) using software available over the Internet [www.susdesign.com/sunposition].

▪ Discussion

Given this generalization of the wind directions for Tillamook, several shelterbelt concepts can be formulated. Shelterbelts may be most beneficial for fish when planted along the northwest edges of streams, such that leaves, twigs and other organic matter are blown into the water and contribute to the food source for benthic invertebrates and, in turn, for fish. Meanwhile, shelterbelts placed along the southern edges of streams can shade surface waters to moderate water temperatures and improve water quality for fish and other aquatic organisms. The sun's position throughout the year (Figure 6-1-6) can be used to guide the placement and height of riparian plantings in relation to water bodies, so that the beneficial effects of shading are optimized during key fishery life cycle stages.

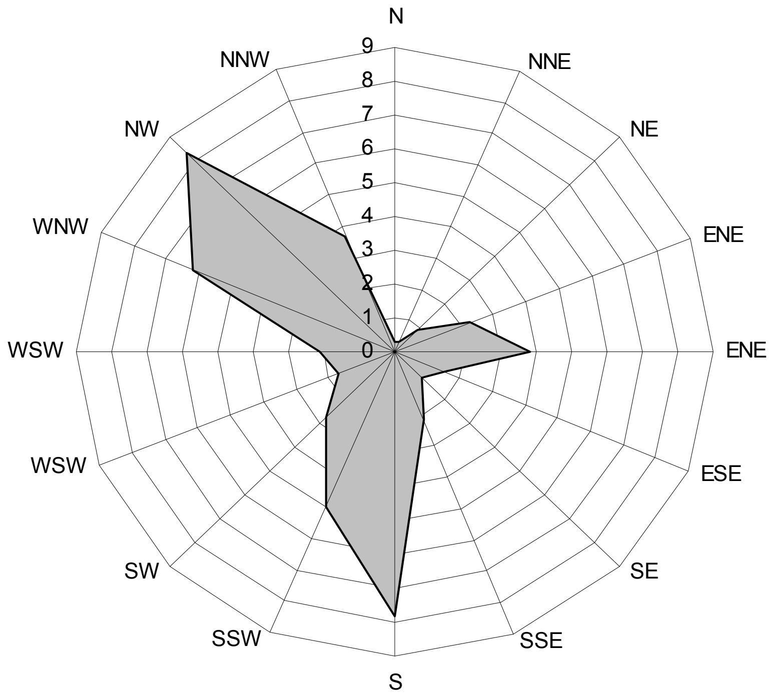

Figure 6-1-3. Annual Percentage Frequency of Wind by Direction for Tillamook County

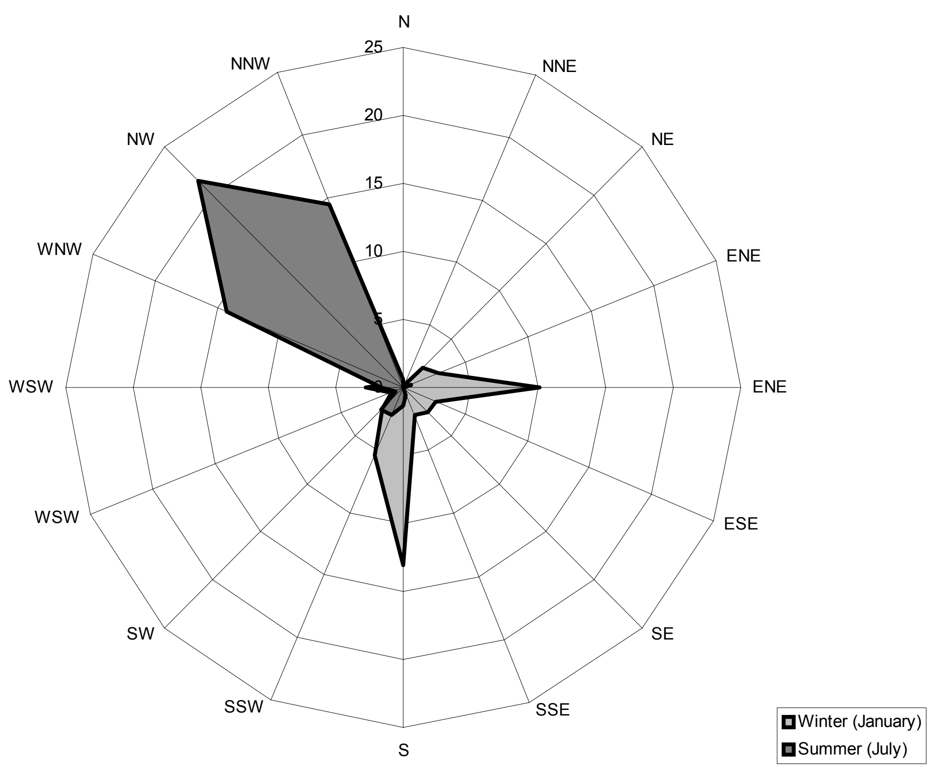

Figure 6-1-4. Representative Percentage Frequency of Summer and Winter Winds by Direction for Tillamook County

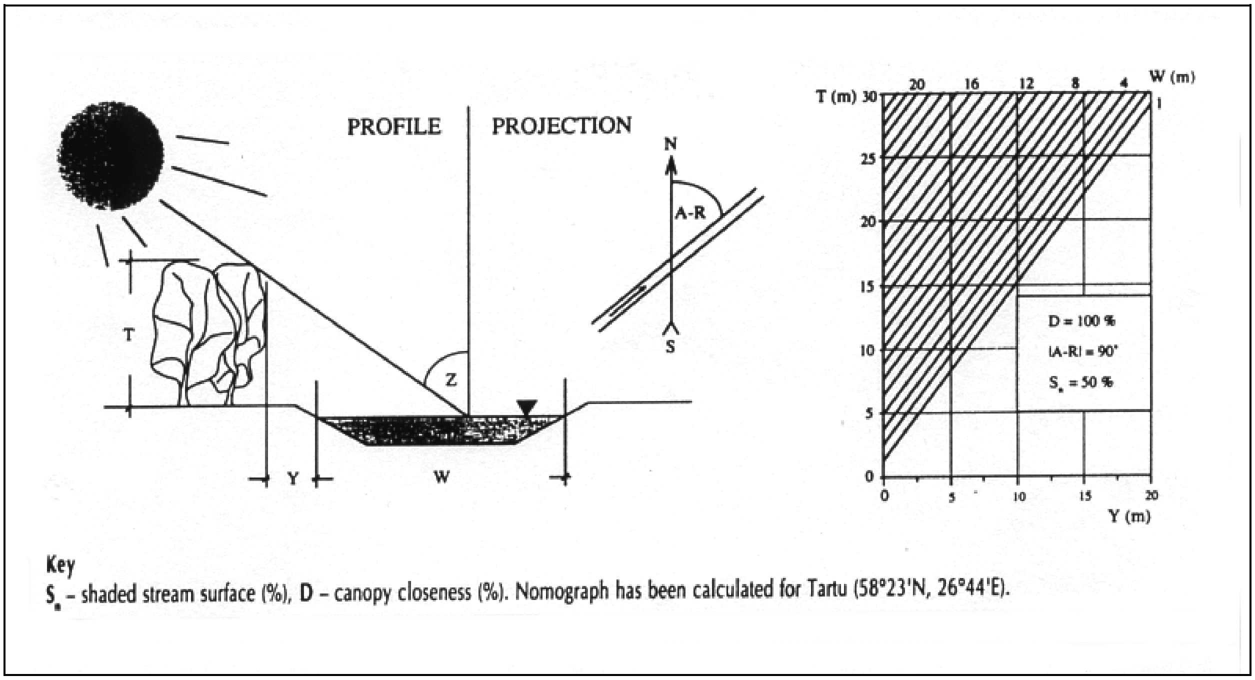

Figure 6-1-5. Scheme and Nomograph for Estimation of the Optimal Parameters of Streamside Vegetation to Stream Surface Shade Source: Eiseltova and Briggs, 1995

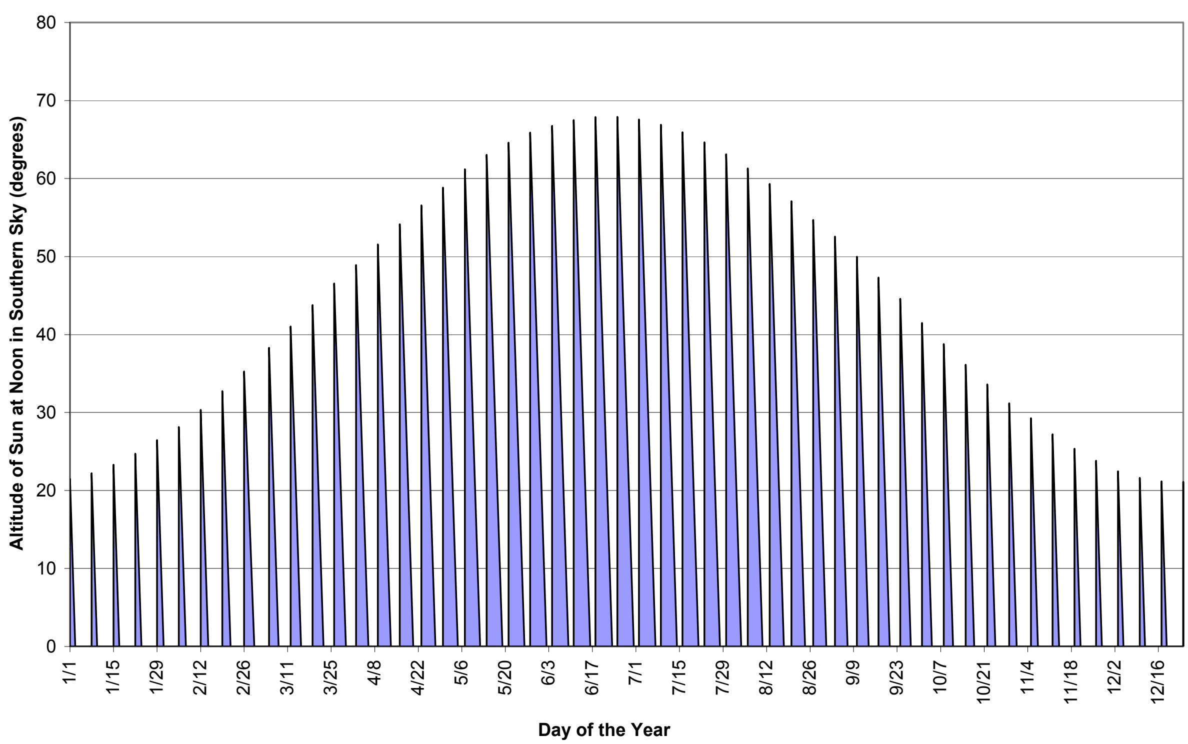

Figure 6-1-6. Annual Variation of Sun Position in Tillamook County [Latitude 45.5 degrees north]