Spatial Frameworks

Environmental factors such as soils, precipitation, and vegetative cover, and human-related activities such as land use, create a variety of patterns across the landscape. Some patterns are the result of an interplay of factors. For example, urban areas, grain fields, pastures, and second-growth forests are present because of human interaction with the topography, soil fertility, moisture availability, climate, transportation networks, etc. Despite the complexity of the overall mosaic, there are recognizable trends in the landscape, and geographic or spatial frameworks can be defined to describe these in meaningful ways.[60]

A spatial framework describes *regions*: more or less homogeneous areas where pattern variations within-region are less than between-region.[61] While the boundaries of each region can be precisely located in a few cases, they are most likely to be *estimated* by experts using qualitative and, sometimes, quantitative techniques. The scale at which the analysis is carried out affects the definitions of the regions, both with regard to the detail of their classification and the location of their boundaries. The level of detail and accuracy of boundaries increases with finer scale. Thus, a framework is useful in a project when it describes a phenomenon relevant to the objectives of the project, and is at a scale appropriate to the needs at hand. The user of such a spatial framework should recognize that the boundaries are inherently 'fuzzy' and may have varying widths, sometimes undefined.

A common need in research and management is a simplified view of this spatial variation — one that enables people to perceive commonalities and differences between areas of interest. With such a spatial framework, inferences can be drawn and extrapolation of research, data measurements, assessments and management activities from local sites can be made. Such extrapolation is more likely to be robust if the data are representative of the region, and if the target area of the extrapolation is a part of that region.

Watersheds and Ecoregions

Hydrologic units or *watersheds* were originally introduced as a spatial framework to facilitate water resource planning and management (see p. 16). Each zone in the framework is clearly defined by the drainage pattern of surface water. This framework is widely used in natural resource management and has begun to effect political organizations in the form of watershed councils.

Another type of spatial framework is based on *ecoregions:* ecologically distinct areas that arise from an interplay of different environmental resources, ecosystems, and human interactions.[62] The definitive description of these regions has not been agreed upon by the scientific community, and several different ecoregion frameworks have been developed.[63,64,65]

Ecoregions defined by the U.S. Environmental Protection Agency (EPA) include causal and integrative components of physiography, geology, soil, climate, potential vegetation, land use, and land cover, each of which figures differently in importance from one place to another. A hierarchy has been established by EPA which allows users to choose the scale of definition most appropriate to their project. The coarsest definition is that of Level I

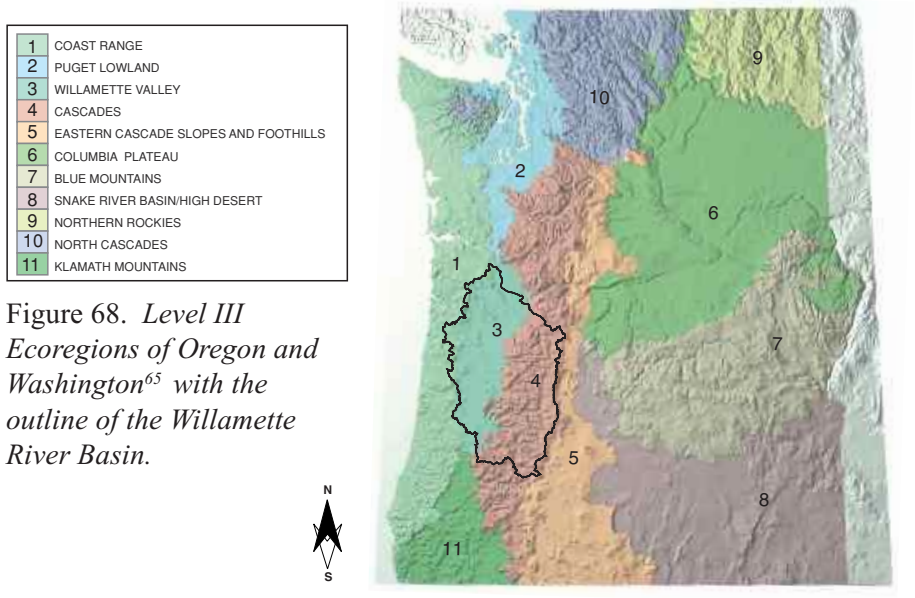

Figure 68. *Level III Ecoregions of Oregon and Washington[65] with the outline of the Willamette River Basin.*

ecoregions, comprising 15 regions within North America, with finer subdivision into 51 Level II ecoregions, and 99 Level III ecoregions [66] (Fig. 68). Level IV regions have been delineated at 1:250,000.

Ecoregions do not conform to watershed boundaries. For example, the Willamette River Basin, a hydrologic definition, contains the Level III Willamette Valley ecoregion and parts of the Coast Range and Cascades ecoregions. In using a watershed approach, researchers and managers should be aware of the relative influence of the different ecological regions within the watershed. Adjacent watersheds of the same approximate drainage area will react differently to environmental stress if they are composed of different proportions of different ecoregions. On the other hand, a watershed framework is useful when studying aquatic ecosystems and water-related issues.[62]

Ecoregions of the Willamette River Basin

Figure 69 provides a bird's eye perspective view of the WRB, looking south from Portland and showing EPA Level IV ecoregions.[65] A strong relationship of ecoregions with physiography can be seen. The Willamette River and Tributaries Gallery Forest ecoregion occupies the Willamette River floodplain. This region contains deep, fertile, silty clay soils, and supports riparian forests of cottonwoods, alder, Oregon ash, bigleaf maple, and Douglas-fir. It is surrounded by the Prairie Terrace ecoregion which covers the remainder of the wide valley floor and lies on relatively flat fluvial terraces supporting a natural vegetation of Oregon white oak, Oregon ash, and Douglas-fir. Historically, wet and dry prairie vegetation as well as savanna covered this area. Land use in this region now consists of agriculture intermixed with urban and rural development. The Valley Foothills ecoregion is found on the foothills, along the edges of the valley floor. Oregon white oak and madrone grow on the drier sites, with Douglas-fir and some western red cedar in moister areas. Contemporary land use comprises timberlands, orchards, vineyards, Christmas tree farms, as well as rural residential development. The geology of this area is andesitic basalt and marine sandstone, in contrast to the glacial and fluvial deposits of the two ecoregions on the valley floor. The Western Cascades Lowlands and Valleys region, of volcanic origin, supports conifer forests of Douglas-fir, western hemlock, and western red cedar, interspersed with alder and vine maples. Forestry, recreation, and pastureland are prevalent land uses. The Western Cascades Montane Highlands occur at higher elevations where snowpack influences the potential vegetation of true firs and mountain hemlock. This region, along with the Cascade Crest Montane Forest and the Cascade Subalpine/Alpine ecoregions, is an important regional water source.

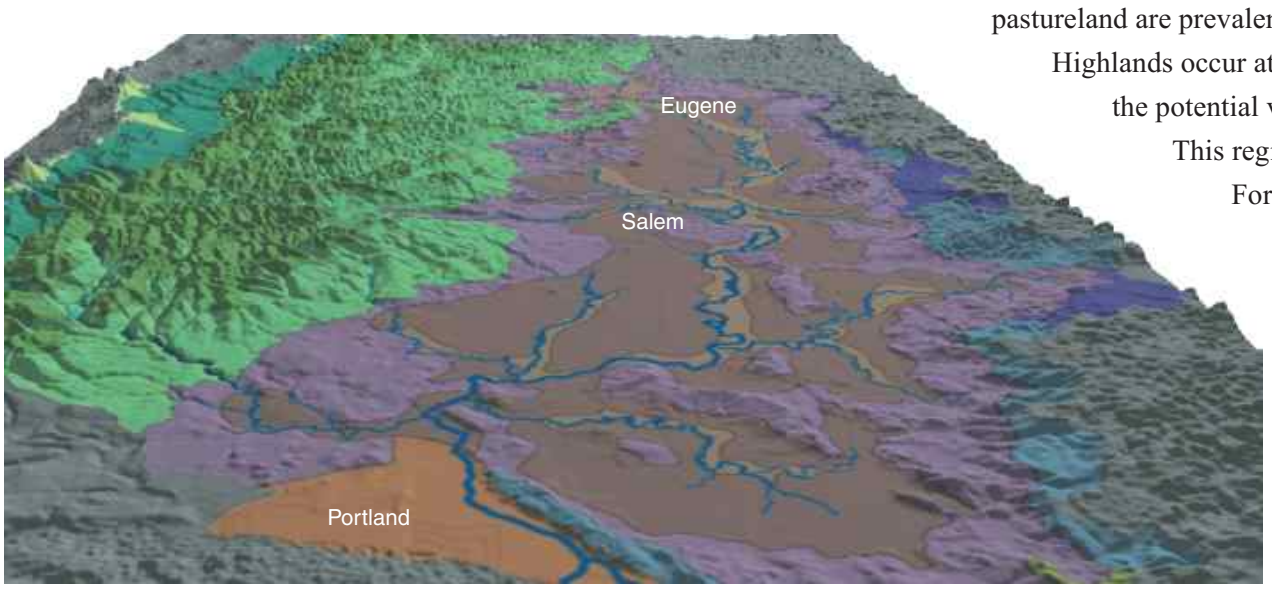

Figure 69. *Level IV Ecoregions of the WRB looking south. The ecoregions are draped over the elevation profile. The color legend is the same as for Map 7.*

Map 7. Level IV Ecoregions