

## *The Flora of the Columbia River Gorge*

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A FEW YEARS ago (Detling, 1958) I published a short paper on some of the peculiarities of the Columbia River Gorge flora, in which I included some fairly extensive lists of the plant species commonly occurring there. It is not my wish on this occasion to repeat any considerable part of that paper, but rather, after a brief review of the major features of the vegetation, to consider some of the implications that it holds for the more recent history of the whole Pacific Northwest flora.

From a biological point of view, one of the most notable features of the Columbia Gorge physiography is the fact that it is the only point between the Fraser River in British Columbia and the Klamath and Pit rivers in northern California where the Cascade axis has been cut through to the point where it interrupts the continuity of all the life zones except the lowest. The significance of this fact lies in the role the gorge has played in the migrations of plant species from one side of the range to the other.

The valley floor and lower slopes at the west end of the gap are occupied by a mesic conifer forest consisting largely of Douglas-fir and big-leaf maple, with a dense understory of vine maple, hazel, red huckleberry, salal, and low Oregon grape. With certain exceptions to be noted later, this is the basic type of vegetation on the cool, north-facing slopes of the gorge, extending clear to the east portal. The lower elevations beyond the east end of the gorge are covered with a yellow pine forest or grassland. Representative of this phase are:

<i>Castilleja hispida</i>	<i>Lewisia rediviva</i>
<i>Ceanothus velutinus</i>	<i>Penstemon subserratus</i>
<i>Eriogonum sphaerocephalum</i>	<i>Pinus ponderosa</i>
<i>Helianthus cusickii</i>	<i>Philadelphus lewisii lewisii</i>
<i>Iliamna rivularis</i>	<i>Trifolium macrocephalum</i>

This more xeric type tends to follow through the gorge along the warm, dry, south slopes of the Washington side, some of the species ranging as far westward as Cape Horn.

Another floristic feature of interest is the fact that a considerable area near the bottom of the gorge constitutes an island, or perhaps several islands, of boreal flora. The cool, moist conditions that obtain through the summer

months in the lateral canyons, particularly in the mist around the waterfalls, are apparently what has made it possible for these species to persist here, isolated from the nearest boreal flora above them by at least 4000 feet of mesic forest. You will recognize the following few species of typical members of the Canadian or Hudsonian Zones in the Cascades:

<i>Acer glabrum douglasii</i>	<i>Haplopappus hallii</i>
<i>Alnus sinuata</i>	<i>Penstemon rupicola</i>
<i>Cornus canadensis</i>	<i>Saxifraga bronchialis vespertina</i>
<i>Dodecatheon dentatum</i>	

A group of about 10 boreal species, including three of the foregoing, have a peculiar distribution today, in that they occur in the gorge, on the Saddle Mt. boreal island in Clatsop County, and in the Olympic Mountains, but have not been reported from the low or middle elevations between these points. The group is comprised of:

<i>Acer glabrum douglasii</i>	<i>Phlox diffusa longistylis</i>
<i>Alnus sinuata</i>	<i>Polypodium vulgare columbianum</i>
<i>Antennaria racemosa</i>	<i>Saxifraga bronchialis vespertina</i>
<i>Campanula petiolata</i>	<i>Saxifraga caespitosa</i>
<i>Lomatium angustatum</i>	<i>Stenanthium occidentale</i>

Still another group of species closely allied ecologically to the preceding are endemic to the Columbia Gorge or its immediate vicinity. The best known of these are:

<i>Bolandra oregana</i>	<i>Hieracium longiberbe</i>
<i>Douglasia laevigata laevigata</i>	<i>Sullivantia oregana</i>
<i>Erigeron howellii</i>	<i>Synthyris stellata</i>
<i>Erigeron oreganus</i>	

Of this group the species of *Bolandra* and *Sullivantia* are noteworthy for their occurrence on Elk Rock on the Willamette River, near Oregon City. The distribution of these two gorge species, as well as those occurring on Saddle Mt. and the Olympic Mountains, points to a former occupation of low elevations by the boreal flora represented in the gorge.

Relict occurrences of any floral type can usually be ascribed to changing climates, in the course of which a flora has been forced to retreat, leaving behind small populations in restricted areas of suitable conditions. In the case of the boreal species at the bottom of the gorge, it is not inconceivable that they should have been transported there from the slopes high above their present niches, even though, to my knowledge, they do not occur at intermediate levels. But this would not account for their presence in the more distant boreal islands.

I like to speculate on the timing of any vegetational shifts and migrations

for which we have evidence, largely because of the light such speculation may shed on the rate of evolution. This is sometimes difficult because, as in the case of geological history, later events frequently confuse or obliterate the results of earlier ones.

The only period during which the boreal island or islands in the Columbia Gorge could have been formed was that of the Pleistocene Ice Age. Paleobotanical as well as other evidence indicates that the Pacific Northwest had a temperate climate from the Oligocene through the Pliocene. At no time during that period was the climate severe enough to cause the downward, or southward, migration of a boreal flora into the bottom of the Columbia Gorge. Throughout the Tertiary, however, there was a gradual decrease in mean temperatures, which reached its culmination in the Ice Ages of the Pleistocene. But since the retreat of the last ice sheet this region has again had a temperate climate.

Students of Pleistocene glaciology have shown that during this epoch there was not just one southward advance of an ice sheet, but apparently four, and that these advances were separated from one another by three relatively warm periods when average temperatures were sometimes higher than they are even at the present time. This being so, we must suppose that south of the glaciers in the Pacific Northwest the cold maxima alternated with long periods of warmer climate during which the boreal flora would take refuge in the higher elevations and in more northern latitudes. We suppose that during the glacial recessions some of the boreal species were left in relict islands. During subsequent cold phases of the climatic cycle the islands would be eliminated as such by the spread of the boreal flora over the lowlands, and their loci might or might not be repopulated with the same species as before, and with the next retreat the original relict species might or might not persist. The result is we do not know for certain which glacial advance brought the species of a given present-day island into place. And it is even probable that the present islands are not all of the same age.

The boreal phases of the Columbia Gorge and Saddle Mt. floras, with their relatively large numbers of constituent species, would appear to have originated fairly late in the Pleistocene. Just how late must be determined by a study of individual species. *Saxifraga bronchialis* may serve as an example. Subspecies *bronchialis* occurs in Siberia, while several subspecies have evolved in North America. Ssp. *austromontana* ranges from southern British Columbia and Alberta south through the Rocky and Blue mountains, and in the Cascades to southern Washington. Ssp. *vespertina* ranges from the Columbia Gorge southward in the Cascades to Lane County, and occurs on Saddle Mt. and in

the Olympics. Apparently divergent evolution took place in the Cascade axis after *austromontana* was well established in both the Rockies and Cascades. *Vespertina* was a later offshoot but was well enough established at least by the last or Wisconsin advance to have populated the lowlands between the gorge and Saddle Mt. and the Olympics.

More recent evolutionary change is probably shown in such species as *Arnica amplexicaulis* and *Haplopappus hallii*, whose gorge populations differ slightly from the main populations, but still not to the extent where the taxonomic specialists in these genera are willing to grant the gorge plants even varietal status.

An entirely different phase of the Northwest flora is represented in the Columbia Gorge by a considerable number of species of southern origin, xeric in their ecological requirements, and which arrived here during a warm-dry maximum of the climatic cycle. A representative list of such species would include first of all the Oregon white oak (or Garry oak), and such associated species as:

<i>Balsamorhiza deltoidea</i>	<i>Leptotaenia dissecta</i>
<i>Brodiaea grandiflora howellii</i>	<i>Lupinus bicolor</i>
<i>Brodiaea pulchella</i>	<i>Senecio harfordii</i>
<i>Eriogonum compositum pilicaule</i>	<i>Viburnum ellipticum</i>

This association is common in the Rogue River Basin and occurs more or less sporadically west of the Cascades as far north as southwestern British Columbia, some of the species being found only in very restricted xeric islands. The only place the association occurs east of the mountains is in an area at the head of the Columbia Gorge extending from Yakima County to southern Wasco County. The peak of the xero-thermic phase mentioned above apparently occurred about 6500 years ago (Hansen, 1955). In a previous publication (Detling, 1961) I postulated a mean summer temperature at that time 5°C (9°F) above the present summer mean, and a mean annual rainfall 230 mm (9 in.) less than the present. By that time the Rogue River flora, consisting largely of a chaparral formation, had migrated northward to Puget Sound, while certain elements of it migrated eastward through the Columbia Gorge and spread out into the region at the head of the gorge. During this migration the xeric flora undoubtedly restricted but did not obliterate the boreal flora in the gorge, and may have spread largely by way of the south slopes on the Washington side of the river.

As the climate became cooler and wetter in the Northwest the Rogue chaparral retreated, leaving remnants of its associates in the Columbia Gorge and the other more or less restricted areas where we find them today.

Literature Cited

Detling, L. E. 1958. Peculiarities of the Columbia River Gorge flora. *Madrono*, 14: 160-172.

———. 1961. The Chaparral formation of southwestern Oregon, with consideration of its postglacial history. *Ecology*, 42: 348-357.

Hansen, H. P. 1955. Postglacial forests in south-central and central British Columbia. *Am. Jour. Sci.*, 253: 640-658.