

*The Original Vegetation of the Mid-Willamette Valley,
Oregon*

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THE WILLAMETTE Valley is located in western Oregon approximately 40 miles inland from the Pacific Ocean (Figure 1). The valley, bounded on the east by the Cascade Range and on the west by the Coastal Range, is about 130 miles in length and about 25 to 30 miles in width. The Willamette River, flowing northward and bisecting the valley, joins with the Columbia River at Portland, Oregon. The Willamette River, combined with its many tributaries, constitutes the main drainage system for the Willamette Valley.

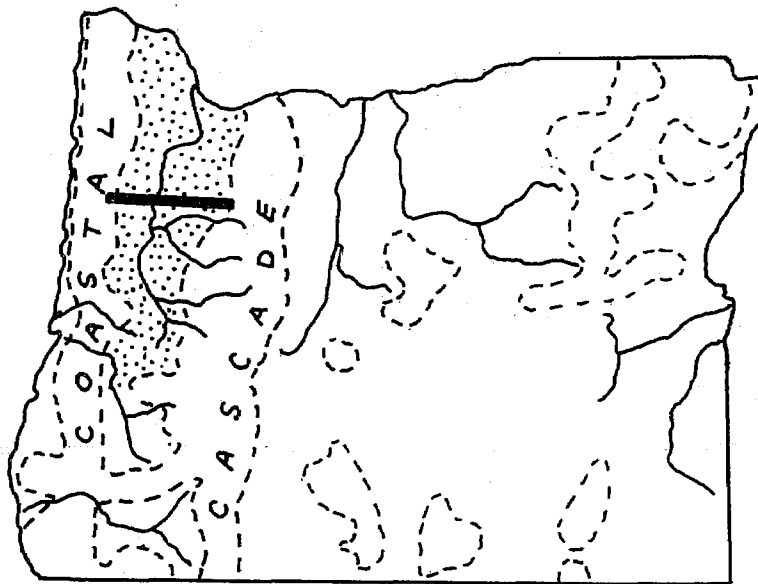


Figure 1. Map of Oregon, showing the location of the Willamette Valley (stippled area) between the Coastal and Cascade mountains. The shaded portion indicates the region discussed in this report and which is shown in greater detail in Figure 2.

The Willamette Valley, as a whole, enjoys a moderate climate. The average yearly rainfall is about 40 inches, most of which comes between December and March. Snowfall is not uncommon during the winter months, but snow rarely remains on the ground for more than a few weeks. Rainfall between June and September is infrequent in much of the valley, and drought conditions during this time are common. Winter temperatures seldom fall below 15° F, and summer temperatures average about 70° F.

A description of the physiographic features of the Willamette Valley is supplied by Peck (1941):

The formation over most of the lower portion of the valley consists of Quaternary gravel, sand and silt. This borders to the westward on sandstones and shales, partly of Eocene and partly Miocene age, and to the eastward on the basaltic formation of the Cascades. Much of the lower land is very level, consisting of heavy alluvial soil rich in humus but poor in lime. The floodplain of the Willamette is in most places very narrow, the soil being a mixture of river silt and fine sand.

The climatic and edaphic features of the Willamette Valley provide suitable conditions for a diversified agriculture. It is probably for this reason that the valley was one of the first areas in Oregon to be permanently settled. Independence, Oregon, located in the mid-Willamette Valley, was a terminus for many of the early settlers who traveled the historic Oregon Trail. White settlers were few in number during the 1840's, but were becoming well established toward the end of the 1850's. The Willamette Valley remains today as the major center of population in Oregon.

The early established and continued agricultural activity in much of the valley has contributed greatly to the extreme alteration of the original vegetation in the valley. Livestock grazing on land not suited for farming has also played a role in the degradation of the natural vegetation. Extensive irrigation, in more recent times, has permitted a more intensive utilization of the valley, particularly during the summer months.

It is primarily for historical interest that this study of the original vegetation in the Willamette Valley was initiated. However, those engaged in current ecological investigations in the valley area should find information about the past flora of some importance in interpreting the present-day vegetation.

Literature Review

Much of what is presently known of the native vegetation in the Willamette Valley has come from early written accounts found in newspapers, personal letters, diaries, and other similar documents. One of the few published papers concerned with the original vegetation of this area (Smith, 1949) reports upon several early accounts which revealed that portions of the Willamette Valley were covered with prairies and oak openings. The term *oak opening* is considered here as a particular type of savanna vegetation, the latter being defined by Seifriz (1943) as grassland with a scattered distribution of open-grown trees.

The descriptions were used by Smith to discount beliefs that the Willamette Valley was originally covered with a Douglas fir (*Pseudotsuga menziesii* (Mirb.) Franco) forest—an impression given on the vegetation maps constructed by Shantz and Zon (1924), Weaver and Clements (1938), and Barnes (1948). The literature reviewed by Smith reveals that the Willamette River floodplain was covered with a rather dense forest which included Douglas fir. However, beyond this narrow fringe of forest there existed extensive areas of prairie, oak opening, and occasionally oak forests. Smith states summarily that the pioneers found the Willamette Valley floor largely covered with tall grass, much of which was burned during late summer by Indians engaged in their annual hunts.

The use of fire by Indians is a well-documented fact for many parts of the United States, particularly in the midwestern prairie states. Curtis (1959) describes the impact of Indians, including their use of fire, on the native vegetation in southern Wisconsin. It is believed that Indian-set fires in southern Wisconsin were largely responsible for perpetuating the grasslands and oak openings. The extensive development of oak forests in many Lake States areas coincides with the control of fires at the time of settlement in that region.

The Willamette Valley seems to have had a parallel history with that of southern Wisconsin. Several writers (Lang, 1886; Kirkwood, 1902; Morris, 1934; Sprague and Hansen, 1946), as a result of their examination of the historical records, have stated that Indians were responsible for many of the fires occurring in the valley before settlement. It is further noted by these authors that the control of fire after settlement brought about an increased development of brush and stands of young trees in areas formerly covered with grassland vegetation. Ring-growth studies conducted by Sprague and Hansen (1946) have shown that fires were frequent in the Willamette Valley since at least 1647, but occurred less frequently after 1848.

Land Survey Records

The kinds of historical information discussed so far provide only a general picture of the original vegetation in the Willamette Valley. It would, of course, be ideal to have available more detailed facts which could be used to learn of the relative amounts and distribution of the various types of vegetation which existed in the valley at the time of settlement. One source of information which can provide such detailed data is the record compiled by the federal land survey office when the Willamette Valley was being subdivided during the 1850's. These land survey records for the Willamette Valley are located in their original form at the U.S. Bureau of Land Management in Portland, Oregon.

The use of land survey records for studies of this kind is not new. Lutz (1930) used survey records to determine the original forest composition in northwestern Pennsylvania. Kenoyer (1929) used survey records in studying the early vegetation in Kalamazoo County, Michigan. Howell and Kucera (1956) studied the presettlement forests of several counties in Missouri. Potzger *et al.* (1956) reconstructed the vegetation for the state of Indiana from land survey records. A detailed discussion of land survey records, including the methods used by the surveyors and an evaluation of the usefulness of these records in current studies, is provided by Bourdo (1956).

Experienced surveyors were hired by the Federal Land Office to subdivide assigned areas into townships and sections. The surveyors followed predetermined instructions in their work. At first, they were concerned with subdividing only those areas in the valley that were likely to be settled first. The lands omitted from the initial surveys were those in the mountain foothills which were covered with dense forests of Douglas fir. Although some parts of the valley were homesteaded and fields planted to crops several years before the surveys began, the major portion of the valley floor was surveyed before or concurrently with settlement.

In establishing township and range corners, four trees, called "witness trees" or "bearing trees," were selected. The name of each tree, its diameter in inches, and its distance and direction from the corner were recorded by the surveyor in his field notebook. These four trees were to be selected from each of the four quadrants surrounding the corner. With this information recorded, it was possible for a future settler to locate the boundaries of his land claim.

At each section corner four trees were also selected and described in a similar manner. At quarter-section corners, only two trees were required to mark the corner. At the end of each mile, the surveyor was to provide a

summary of the landscape features, making mention of the type of vegetation, soil and geology characteristic of the previous mile of surveyed line. When a township was completely divided into 36 sections, an over-all detailed description was written.

It is a basic assumption that the surveyor most often selected the closest trees at each corner, and that he did not show favor for one species over another. In areas of the valley which were nearly treeless, the surveyors would probably have been disinclined to reject one species of tree if it involved walking a greater distance for an alternative tree. The surveyors identified the trees and recorded them in the field notes using the common names popular at that time. The writer's interpretation of the names used by the surveyors is presented in Table 1. The nomenclature used in this report follows Peck (1941).

When subdividing areas which were treeless, a charred stake, a mound of earth, or several large rocks were required to mark the corner. In regard to corners where earthen mounds were erected, an interesting excerpt from the surveyor's manual of instructions (Moore, 1851) can be quoted:

At mound corners, at least, the seeds of fruit trees might be planted, with the hope that, in a few brief years, fruit bearing trees may mark the place of the corner; and indeed, the same might be done with advantage at all other corners.

Original Vegetation of the Mid-Willamette Valley

The information found in the survey records was used in constructing the map shown in Figure 2. The map is a transect of the valley approximately at its midpoint (Figure 1); it includes seven townships in Marion and Polk counties. The transect, totaling 252 square miles, is believed to be representative of a large portion of the Willamette Valley.

In constructing the map, the information concerning the trees at each corner was plotted on graph paper which had been divided into townships with 36 sections each. When the data for one township were complete, the vegetation types were delineated. This separation was made primarily by inspection, but other methods, to be explained later, were also found useful in distinguishing the various vegetation types. Five major types are shown on the map, *viz.*, Oak opening, Oak forest, Douglas fir forest, Bottomland forest, and Prairie. Detailed information and discussion about each of these types will be presented.

Oak opening. The oak openings and the oak forests, both dominated by Garry oak (*Quercus Garryana*), were occasionally differentiated by the surveyors. Although the change from openings to forest might not have

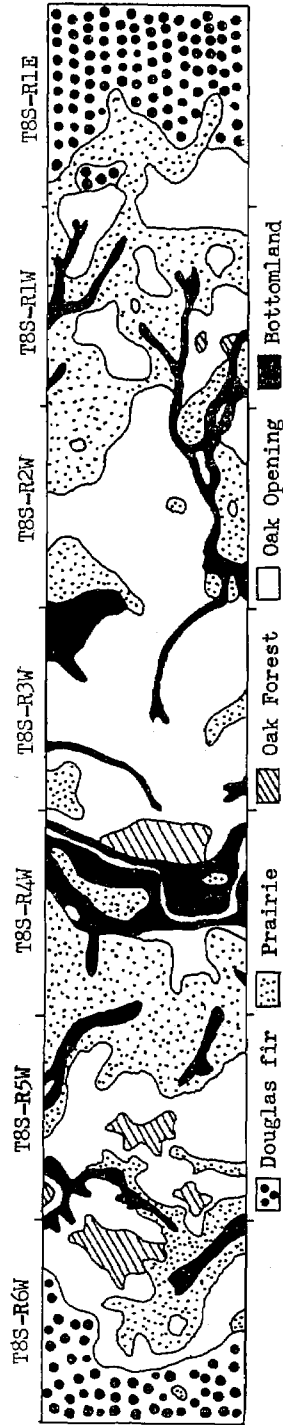


Figure 2. Vegetation map of the mid-Willamette Valley, showing the distribution of the five major vegetation types as they existed during the 1850's.

been always abrupt, the surveyors would sometimes record a definite point along a section line where the change between the two types occurred. In areas where prairie was adjacent to oak openings, the separation between the two was clearly designated by the surveyor. An excerpt from the field notes can be given here to illustrate how the surveyors recorded their data:

Township 8 North—Range 5 West, Willamette Meridian
 North between sections 22 and 23
 3.50 A road, course East and West
 12.00 A swail or drain, 50 links wide, course East and West
 30.00 Leave prairie and enter oak openings
 40.00 Set quarter section post from which a

TABLE 1. INTERPRETATION OF THE COMMON PLANT NAMES LISTED BY THE LAND SURVEYORS

(Nomenclature follows Peck (1941).)

Alder	<i>Alnus rubra</i> Bong.
Aspen	<i>Populus tremuloides</i> Michx.
Balm of Gilead	<i>Populus trichocarpa</i> T. & G.
Cedar	<i>Thuja plicata</i> Donn.
Cherry	<i>Prunus emarginata</i> (Dougl.) Walp.
Chitemwood	<i>Rhamnus Purshiana</i> DC.
Coarse grape	<i>Berberis aquifolium</i> Pursh.
Crabapple	<i>Pyrus diversifolia</i> Bong.
Dogwood	<i>Cornus Nuttallii</i> Aud.
Douglas fir	<i>Pseudotsuga menziesii</i> (Mirb.) Franco
Elder	<i>Sambucus glauca</i> Nutt.
Fern	<i>Pteridium aquilinum</i> (L.) Kuhn. var. <i>pubescens</i> Underw.
Flag	<i>Iris</i> sp.
Hardhack	<i>Spiraea Douglasii</i> Hook.
Hazel	<i>Corylus californica</i> (A.DC.) Rose.
Hemlock	<i>Tsuga heterophylla</i> (Raf.) Sarg.
Laurel	<i>Umbellularia californica</i> Nutt.
Maple	<i>Acer macrophyllum</i> Pursh.
Ninebark	<i>Physocarpus capitatus</i> (Pursh.) Ktze.
Rose	<i>Rosa</i> sp.
Rushes	<i>Juncus</i> sp.
Salal	<i>Gaultheria Shallon</i> Pursh.
Salmonberry	<i>Rubus spectabilis</i> Pursh.
Short grape	<i>Berberis nervosa</i> Pursh.
Vine maple	<i>Acer circinatum</i> Pursh.
White ash	<i>Fraxinus oregana</i> Nutt.
White oak	<i>Quercus Garryana</i> Dougl.
Willow	<i>Salix</i> sp.
Yew	<i>Taxus brevifolia</i> Nutt.

- W. oak 40 inches in diameter, bears S $3\frac{1}{2}^{\circ}$ W 214 links
- W. oak 36 inches in diameter, bears N $86\frac{1}{2}^{\circ}$ E 332 links
- 80.00 Set post corner of sections 14,15,22, and 23 from which a
 - W. oak 16 inches in diameter, bears N 53° E 175 links
 - W. oak 14 inches in diameter, bears S 3° E 54 links
 - W. oak 40 inches in diameter, bears S 77° W 67 links
 - W. oak 14 inches in diameter, bears N 54° W 153 links

South 30 chains gently rolling prairie. North 50 chains scattering oak timber. The surveyors, beginning this particular mile at the corner of sections 23, 22, 27, and 26, encountered a road 3.5 chains (1 chain equals 66 feet) north of this corner. At 12 chains north of the corner, a low, wet area was crossed which was 50 links (1 link equals 7.22 inches) wide. Thirty chains north of the corner, oak opening vegetation was encountered and this is indicated. At the half-mile point along this line, the quarter section post was established, using two oak trees to witness the corner. A description of these trees including their name, diameter, angle, and distance from the corner is recorded. Similarly, at the end of the one-mile line (80 chains), a description of four witness trees is given. The short summary at the end emphasizes the separation between prairie and oak opening along the previous mile.

In the delineation of oak opening and oak forest other information was used when the notes were not so precise. The distances between the witness trees were often used to establish or to verify the separation between the two types. If the trees were 50 or more feet apart, the area was considered to be oak opening; if less than 50 feet, oak forest. An index to relative tree density for all forested types in the transect was devised by averaging the distances from the corners to the witness trees. A total of 80 distances in each forest type was averaged. The average distance for oak openings was 143.6 feet, compared with 36.5 feet for the oak forest type, indicating a much higher tree density in the oak forests.

The oak opening type was widely distributed in the transect, occurring to some degree in all of the townships mapped. One township (T8S-R3W) had about 90 per cent of its area covered with oak openings. Douglas fir was occasionally associated with the oak openings, and in one instance (T8S-R1E) the surveyors described an area as being "oak and fir openings." A rather interesting portrayal of the oak opening type is provided in the following township (T8S-R3W) description:

The timber is white oak and fir, over half of it is scattering and the other part openings or thin timber. There are a few small thick groves. About $\frac{3}{4}$ of it is W oak, the bodies of which are about 6 inches to $3\frac{1}{2}$ feet in diameter, and from three to twenty feet in length from the ground to the limbs and are mostly from 20 to 30 feet in height with rounded branching tops.

The understory vegetation in the oak openings was a mixture of grasses, forbs, and shrubs; however, specific mention of these in the survey notes is infrequent. The occasional use of the words "grass" and "weeds" in describing the understory, as well as the fact that the oak opening type often bordered on the prairie type, leads one to believe that a prairie vegetation was present in the understory of the oak openings. Also listed as being present in some of the oak openings were "ferns," "hazel," and "young oaks."

A search of the midvalley area reveals that at the present time very few oak openings remain. The few that still exist are located on the valley edges on the steep hillsides of the mountain ranges. With few exceptions, even these have been heavily disturbed by grazing. Some of the original oak openings, which received little disturbance from man or fire, have developed into oak forests. An examination of these oak forests reveals the presence of a few large, open-grown Garry oaks enclosed by a dense, even-aged oak forest that is between 90 and 100 years old. The age of the latter trees strongly suggests that they began their growth at the time of settlement, when fires were brought under control.

Oak forest. Only a small percentage of the area included in the transect was covered with oak forests. The methods used in delineating this vegetational type were discussed earlier. Although Garry oak was the most common tree species in this type, occasional individuals or small groves of Douglas fir, red alder (*Alnus rubra*), and laurel (*Umbellularia californica*) were also present. Since oak forests were not present in great abundance, the surveyors did not make specific mention of them in their township summaries.

For even the small areas of oak forest to have been in existence at the time of settlement, they must have been afforded some natural protection from fires. The oak forest located in the eastern part of T8S-R4W apparently received protection from the west, north, and south because of the position of the Willamette River. The oak forests which existed in T8S-R6W and T8S-R5W were located on somewhat higher topography than the surrounding vegetation, but effective fire barriers are not conspicuous.

When the valley fires were controlled and oak reproduction was successful in the oak openings, the total amount of oak forest gradually increased. Today, oak forests are not uncommon in much of the Willamette Valley, but for the most part they are grazed woodlots. An examination of areas which were oak forest at the time of settlement, and which have not been greatly disturbed by cutting or grazing, reveals that they too have undergone change. In such areas big-leaf maple (*Acer macrophyllum*) has become more com-

mon, with maple reproduction composing the major portion of the understory vegetation.

The behavior of Douglas fir in the oak forests is not well understood at this time. Occasional individuals or small groves of fir are frequently present in oak forests; more rarely it has been observed that fire reproduction is very abundant, to the near exclusion of oak and big-leaf maple. On the extreme edges of the valley, rather extensive stands of Douglas fir are present. A complete understanding of the ecological behavior of Garry oak, big-leaf maple and Douglas fir in the valley area will not be available until a detailed phytosociological investigation of these communities is completed.

Douglas fir forest. The Douglas fir forest type dominated both the western and eastern sides of the midvalley transect. This type is located at distinctly higher elevations and should perhaps be more properly considered as a part of the mountain ranges on either side of the valley.

The demarcation of the Douglas fir type was made without difficulty, as the surveyors made frequent mention of the fact that they were either entering into or leaving "fir timber." Douglas fir was the most frequently listed witness tree, and on that basis is considered to have been the most abundant. Other tree species that were associated with fir, but present in considerably fewer numbers, were big-leaf maple, hemlock (*Tsuga heterophylla*), dogwood (*Cornus Nuttallii*), vine maple (*Acer circinatum*), Garry oak, laurel, and cedar (*Thuja plicata*). The average section corner-to-tree distance in this forest type was 21.9 feet, the shortest of all the forest types. The high density of the trees in the fir forest was one of the features which was particularly noted by the surveyors.

Elsewhere in the Willamette Valley, Douglas fir was locally abundant in ravines and on the floodplain of the Willamette River, and infrequently in oak openings and oak forests as mentioned earlier. In order to account for the apparent ability of Douglas fir to exist in such a wide variety of habitats, which differ greatly in moisture conditions, one can accept the conclusions of Irgens-Moller (1960) that ecotypes of Douglas fir are present in this area.

Bottomland forest. The forest communities that occupied the floodplain of the Willamette River comprise the main portion of the bottomland forest type on the transect. The areas adjacent to the main tributary rivers of the Willamette River also possessed bottomland vegetation, but this was often in the form of brushy thickets, marshes, or ash openings (*Fraxinus oregana*). Beyond mentioning them, the survey records provide no information on the latter three types of lowland vegetation. The ash openings, a term used by

the surveyors, were probably areas of wet grassland which were susceptible to burning during infrequent periods of severe drought when the water table was extremely low.

Based on the frequency of selection as witness trees, four species of trees were about equally common in the bottomland forests; these were white ash, black cottonwood (*Populus trichocarpa*), Douglas fir, and big-leaf maple. Other species which were listed in the survey notes include Garry oak, laurel, alder, cherry (*Prunus emarginata*), and willow (*Salix* sp.). The average section corner-to-tree distance in this type was 34.8 feet, indicating a similar tree density to that of the oak forest type.

The understory vegetation of the bottomland forests included a large number of shrub species. Those listed include Oregon grape (*Berberis aquifolium* and *B. nervosa*), salmonberry (*Rubus spectabilis*), elderberry (*Sambucus glauca*), rose (*Rosa* sp.), hardhack (*Spiraea Douglasii*), ninebark (*Physocarpus capitatus*), and cascara (*Rhamnus Purshiana*). Herbaceous flora, as elsewhere in the survey records, is infrequently mentioned; "ferns" and "weeds" are the only references to nonwoody plants.

Much of the area, within the transect, that was covered with bottomland vegetation is presently under cultivation. The construction of dams on the tributary rivers of the Willamette River has played an important role in controlling the water level during the spring run-off. Flooding of the lowlands on either side of the Willamette River was a phenomenon frequently referred to by the surveyors. Today, such floods are uncommon.

Prairie. Grassland vegetation occupied a rather large portion of the mid-Willamette Valley. A small portion of this was low, wet prairie and the remainder was upland prairie. Little difficulty was encountered in separating the prairie type from the other, forest types. The surveyors frequently mentioned in their notes the fact that the survey line was entering or leaving prairie. In most instances the section corners in prairie had to be marked with an earthen mound, a charred stake, or with several rocks. Occasionally the surveyors would select an ash or fir tree in some distant ravine or swale to use as a witness tree, but this was not a common practice in establishing corners on the prairie.

Although the survey records provide a satisfactory description of the locations of prairie vegetation, very little information is provided in regard to the kinds of plants which composed the grasslands. Several shrub species are mentioned; these are hazel (*Corylus californica*), Oregon grape, rose, and ninebark. The only references to herbaceous plants made by the surveyors were "grasses," "ferns," and "weeds."

A study of the grasses in the Salem, Oregon, area by Nelson (1919) provides a list of the native and introduced species of grasses which were present in that area some 60 years after settlement. Of a total of 106 species and varieties of grasses listed by Nelson, 55 were determined to have been introduced, the remaining 51 were thought to be native species. A short description of the habitat supplied for each of the grasses permits a general separation of the native grasses into two categories, wet and dry habitats. A few of those characteristic of wet habitats are, viz.: *Agrostis exarata*, *Alopecurus aequalis*, *Beckmannia syzigachne*, *Deschampsia caespitosa*, *D. danthonioides*, *Eragrostis hypnoides*, *Glyceria leptostachya*, *G. occidentalis*, *G. pauciflora*, *Leersia oryzoides*, *Panicum capillare* var. *occidentalis*, *occidentalis*, *Pleuropogon refractus*, *Poa triflora*, and *Trisetum cernuum*. Some of the grasses found on well-drained sites include the following, viz.: *Agrostis Halli*, *Agropyron pauciflorum*, *Bromus carinatus*, *B. vulgaris*, *Danthonia californica*, *Elymus glaucus*, *Festuca octoflora*, *F. californica*, *F. rubra*, *F. occidentalis*, *F. subulata*, *F. idahoensis*, *Hierochloe occidentalis*, *Panicum Scribnerianum*, *P. pacificum*, *Poa scabrella*, *P. Howellii*, *Sitanion jubatum*, *Stipa Lemmoni*, and *Trisetum canescens*.

A search for prairie relicts in the Willamette Valley proved to be unsuccessful. Areas exist which are covered largely with a grass vegetation, but these areas are composed largely of introduced species. With such a large percentage of introduced grasses present even in 1919, it is assumed that this percentage has increased even more. It is probable that a great number of forbs were also associated with the native prairie grasses, but accurate information about these has not been found.

Summary

A study was made of the original vegetation in the mid-Willamette Valley in western Oregon, utilizing the information recorded in the original land survey records compiled during the 1850's. The Willamette Valley, at the time of settlement, was covered largely with oak openings and prairie. This conclusion is in contrast to earlier suggestions that the valley supported a predominantly coniferous forest. Very little of the original vegetation remains at this time. Control of Indian-set fires has permitted the development of oak forests from the former oak openings, and nearly all of the prairie is now being used for agricultural or grazing purposes.

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