

AN ABSTRACT OF THE THESIS OF

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Title -- HABITAT RELATIONS OF TYPICAL AUSTRAL AND BOREAL AVIFAUNA
IN THE WILLAMETTE VALLEY, OREGON. -----

Abstract Approved Redacted for Privacy
(Major Professor) -----

The purpose of this study has been to find out if birds of the Willamette Valley typically found in either austral (southern) or boreal (northern) regions, associate themselves with habitats similar to or comparable to habitats occupied in the austral or boreal regions of the main area of distribution of the species.

An introductory discussion of the Willamette Valley, its geography, topography, geologic history, geology, soils, climate, vegetation, habitats, and fauna is presented. Several floral and faunal distribution schemes are then discussed.

Of the more than 200 species of birds recorded in the Willamette Valley, 87 species have been picked as possibly being representative of either austral or boreal faunas. Data presented for these species has been gathered on 593 field trips to 86 different localities during the past eight years.

There are two principal ecological divisions in the Willamette Valley - the Coast Forest Association (boreal), and the Woodland and Chaparral (austral). A third division, Grassland, is subordinate to both of the foregoing because it is not equivalent to the typical grasslands of the continent. This grassland seems to be a stage in the development of the Coast Forest Association, or of the Woodland and Chaparral division.

Of the 87 species discussed, the seventeen which typify the boreal Coast Forest Association are: sooty grouse, spotted owl, great gray owl, pileated woodpecker, olive-sided flycatcher, Canada jay, Steller's jay, chestnut-backed chickadee, red-breasted nuthatch, brown creeper, winter wren, Townsend's solitaire, Townsend's warbler, hermit warbler, western tanager, evening grosbeak, and red crossbill. The fourteen austral birds representative of the austral Woodland and Chaparral habitats include: California quail, rufous hummingbird, acorn woodpecker, Lewis woodpecker, California jay, bush-tit, white-breasted nuthatch, wren-tit, Bewick's wren, solitary vireo, black-throated gray warbler, chat, black-headed grosbeak, and spotted towhee. Nine species occur in the grassland stage. Of these, the six austral species are: prairie falcon, bobwhite, burrowing owl, Arkansas goldfinch, lark bunting, and lark sparrow. The three boreal

birds are: short-eared owl, raven, and pipit, indicating that the grassland stage existing in the valley is acceptable to open-country birds of both the north and the south. Nineteen species are found in aquatic habitats. The remaining 28 species are not listed as typical of any of the above divisions, either because they occur more or less equally in more than one of these divisions, or else the observational data is too incomplete to show the proper distribution of the species concerned.

From the evidence shown in the thesis, it seems that birds occupy habitats in the Willamette Valley that are rather closely related to habitats found in the austral or boreal regions of the main area of distribution of the species.

HABITAT RELATIONS OF TYPICAL
AUSTRAL AND BOREAL AVIFAUNA
IN THE WILLAMETTE VALLEY, OREGON

by

FREDERICK GEORGE EVENDEN, JR.

A THESIS

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Most of all I am indebted to Dr. Kenneth L. Gordon, my major professor, for the suggestion of the present problem, and for the many hours of helpful guidance and criticism I have received from him during the course of this study, which touches superficially on birds what he has done in greater detail on mammals (42).

Mr. Charles Cutress, and Mr. Willet Griffie of Portland have generously contributed their accurate nesting records on birds of the Willamette Valley. Without their assistance portions of the discussions on local species would have been pitifully weak.

Mr. Gordon Gullion of Eugene, and Mr. Ben Pruitt of Thurston have given willingly their complete field notes that I might have a more accurate record from the southern Willamette Valley.

Mr. David Marshall and Mr. Tom McCallister have been constantly helpful and enjoyable companions on a great many trips afield the past two years. Mr. Marshall has also contributed useful information on the birds in the

vicinity of Portland.

A number of others have been very helpful in telling me the location of nesting sites in the vicinity of Corvallis. I hesitate to list them, because I will probably not remember them all: Dr. Robert Storm, Mr. Aryan Roest, Mr. Fred Fleck, Mr. George Wint, Mr. Jack Wilson, Mr. Robert Morris, Mr. Philip Dumas, Mr. Park Young, Mr. Robert Livingstone, and Mr. Ralph Wiese.

To all of these people I have mentioned, and any other who I inadvertently overlooked, I express my sincere thanks for their cooperation.

Here, too, I would like to express my appreciation to Dr. Joseph Grinnell and Dr. Alden Miller of the University of California, for publishing the first book on bird distribution in the west giving detailed discussions of the habitats of each species (45). This book has been of invaluable assistance to me, and I have quoted it freely. Future authors writing on our fauna and flora should pattern after this policy set by Grinnell and Miller.

TABLE OF CONTENTS

	Page
Introduction.	1
The Willamette Valley	
General (geography, topography, geologic history, geology, soils, climate). . .	6
The vegetation.	21
The habitats.	28
The fauna	46
Distribution Schemes	48
Floral schemes.	48
Faunal schemes.	54
The Austral and Boreal Avifauna	67
Taxonomic list of species selected . .	69
List of austral birds.	75
List of boreal birds	76
Species discussions:	
Family <u>Pelecanidae</u>	78
<u>Ardeidae</u>	80
<u>Anatidae</u>	87
<u>Cathartidae</u>	105
<u>Accipitriidae</u>	107
<u>Falconidae</u>	109
<u>Tetraonidae</u>	110
<u>Phasianidae</u>	112
<u>Scolopacidae</u>	117
<u>Laridae</u>	123

I have included material for the entire Willamette Valley from Cottage Grove Reservoir and the north slope of the Calapooya Range on the south, to the Columbia River on the north, bounded by the low foothills on both sides of the valley.

My notes have been gathered from 86 different localities, some of which I have visited dozens of times; some perhaps five or ten times, and the majority only once or twice. I have made a total of 593 separately recorded field trips in the Willamette Valley. These were distributed through the year as follows:

January - 35	May - 79	September - 51
February - 68	June - 36	October - 39
March - 72	July - 27	November - 28
April - 82	August - 45	December - 31

The number of field trips taken in each of these months indicates very well my attitude toward the activity of local birds. The late winter to early summer period is the most active, the other months of the year being comparatively monotonous, except for a small increase of activity during the late summer migration period. These 593 field trips varied from brief 15-minute observation periods to field trips involving continuous observation for as long as 16 hours at a time. 1326 hours were spent in the field, for an average of 2.23 hours per field trip. An additional estimated 600 hours were required to record the observa-

tions by my triple-reference system.

I have presented a brief survey of the Willamette Valley, its geography, geologic history, geology and soils, climate, and vegetation. For a better understanding of the problem involved I have discussed in detail the various habitats of which the Willamette Valley vegetation is composed. A very brief summary of the fauna is presented.

Next, various distribution schemes, both floral and faunal, are presented, together with a discussion of the problems of distribution involved.

All of the material is introductory to the problem of this study. Each species is discussed according to the procedure outlined in the general discussion of the austral and boreal avifauna, which see.

Throughout this paper I have made statements which I do not feel qualified to pass as my own. Although many of them are not quoted directly, I have taken the liberty of citing the sources of these statements.

The nine figures pertaining to the climate section are bound with that section. All other figures are bound at the end of the summary to this thesis.

Prior to the present study, two papers have been written on the habitat occurrences of birds in this vicinity. One by Buchanan (17) in 1942; another by Livezey (63) in 1943. Material for both of these papers was gathered in

the immediate vicinity of Corvallis, and not from the entire valley. Mr. Buchanan's material on birds was collected during 26 trips within a ten-mile radius of Corvallis between November, 1941, and April, 1942. Dr. Livezey's study on all the vertebrates of two oak areas west of Corvallis was carried on for a period of ten months from August, 1942 to May, 1943. The information gathered by these two, over such a short period of time was, of necessity, quite inconclusive. Even with the comparatively greater length of time spent in gathering data for my thesis, I feel that the material is not complete. No one is more aware than I that our knowledge of the habitat relations of local birds is very incomplete. If each species had been studied in the field the same amount of time that I have devoted to all the species, I believe that some degree of finality could be put into the conclusions concerning that species and its habitat relationships.

I would like to recommend that any future ecological studies of our avifauna be limited to a single species, or to a measured plot of a particular habitat, similar to that done by Livezey, but over a longer period of time, with more detailed studies and concentrated effort upon the birds.

It is my hope that this paper will serve as a satisfactory basic survey of the habitat relations of our local

avifauna on which future, more detailed ecological studies may be founded.

THE WILLAMETTE VALLEY

Geography

The Willamette Valley, named for the Willamette River, which drains it from north of the Calapooya Range to the Columbia River, is located between latitudes $43^{\circ}30'$ N and $45^{\circ}35'$ N, and longitudes $122^{\circ}30'$ W and $123^{\circ}20'$ W in northwestern Oregon.

It is bounded on the east by the Cascade mountains, with an average crest elevation of 4500 feet; to the south by the Calapooya Range; to the west by the Coast Range, with an average crest of approximately 2000 feet; and to the north by the Columbia River.

The exact limits of the valley are difficult to set. In its largest area, that is, the drainage basin, the valley is approximately 170 miles long and up to 100 miles wide at the most, covering approximately 11,000 square miles. Of this, the central lowland, or valley proper occupies about 3000 square miles. The elevation within the valley proper, exclusive of basaltic intrusions, ranges from 25 to 450 feet above sea level. For the purposes of this thesis, an elevation of 1000 feet on the mountains and side valleys will be set as the boundaries of the Willamette Valley.

Topography

For the most part, the main floor of the valley is a level plain, rising gently here, and abruptly there into the surrounding foothills. Occasional hill ranges, buttes, and other rocky outcrops disrupt the evenness of the valley floor, particularly in the extreme northern, and southern parts. The area from Salem south to Eugene is comparatively level.

Many extensions of the main valley floor occur east or west, deep into the foothills along the larger streams. Streams entering the Willamette River from the east are the Clackamas, Molalla, Pudding, Santiam, and McKenzie. Streams entering the Willamette from the west are the Tualatin, Yamhill, Luckiamute, Marys, and Long Tom.

The Willamette River, itself, is a fine example of a "braided" stream (87:34). The "natural levees built up by the Willamette River during flood stage, gently rising toward the river, have caused the tributary streams to meander across the flat floor of the valley, dividing and anastomosing in a maze of channels and sandbars with numerous oxbow lakes and sloughs scattered along the main channel" (87:34).

Geologic History

In post-Cretaceous times the Cascade mountains began to rise, and about the same time the Puget Trough began to sink, remaining as a sinking geosyncline for most of Tertiary times according to Fenneman (36:450). During this time it was receiving the sediments which constitute at present the underlying rocks. Following this, these strata were folded compactly here and there, and later on they were deeply eroded.

During the erosion stage, most of the old peneplain, resting on softer rocks, was eroded till only the present-day basalt remained. A new lowland was thus created in the Willamette-Puget Trough. However, these lowlands have since been buried; in the north by glacial drift and outwash; in the south by sediments from the Columbia and Willamette rivers, during the time when these streams were below sea level.

There were no continental ice sheets or glacier lobes in the Willamette Valley. However, the valley lowland was inundated by glacial meltwater during the glacial and interglacial periods. These inundations were caused by Upper Columbia River valley fill and numerous ice jams in the Columbia River, backing the water into the Willamette lowlands to a depth of 200 feet, according to Hansen (50:13). "During the Pleistocene, also, meltwater from the valley

glaciers in the Cascade Mountain Range to the east deposited silts, sands, and gravels chiefly along the eastern border of the valley" (50:13). The present day water courses in the valley have been excavated in this Pleistocene fill.

Geology

The age of the bedrock formations that underlie the unconsolidated deposits of the lowland and form the foothills and mountains to the east and west date from late Eocene to Miocene. This bedrock is of a non-marine sedimentary type. Other fragmental, and non-fragmental volcanic rocks and associated detrital rocks range in age from Oligocene to Recent according to Piper (76:1). Some rocks of marine origin do exist on the sides of the valley, and infrequently "break through" the present valley fill. Most of these have been formed into shales from sandstones and muds.

The Tyee Sandstone forms a most conspicuous and heavily-bedded sedimentary formation along the western margin of the valley. The older valley fill is above this, over the valley floor. According to Piper, the valley fill may be up to 300 feet thick. A younger alluvium exists upon the older alluvium along the Willamette River, and its main tributaries. Broad alluvial fans spread outward from the mountain valleys, joining along their outer margins. The lower northern parts of the valley are more or less

irregular due to extensive basalt intrusions that have cut through the older sedimentary layers. Smith reports that excavations in most of the buttes in and about the valley reveal a hard core of basalt, the lava having pushed its way up from below. These intrusions probably occurred in Miocene times (87:36).

Soils

Soil types depend upon the parent rock, and the climate. There are three main soil groups distinguished by Powers, Jones, and Ruzek (79:8) for the Willamette Valley:

1. Recent alluvial stream bottoms. These soils are of mixed character, derived from basaltic alluvial materials deposited so recently that they have undergone little change in profile since deposition. These soils are fine sandy loams, silty clay loams, clay, peat or muck, and occur as smooth or slightly undulating brown-colored lands of the river bottom areas. They are occasionally inundated by backwater from river floods.

2. Old valley filling soils on main valley floor. These are alluvial in origin, having matured under a humid coast climate, with moist winters and dry summers. They can be silt loams, silty clay loams, or clay loams, and they occupy the gently rolling, naturally poorly, or well-drained, brown-colored lands in the old valley floor.

3. Residual "red hill" lands. These are the hill

soils of western Oregon occupying extensive areas in the Cascades and the Coast Range. They may be clay loams, silty clay loams, or clays. They are residual soils developed on consolidated rock material and may be from two origins:

- a. From primary basic igneous rocks consisting of basalt and diabase, or
- b. From sedimentary shales and sandstones.

They occupy varied topography from very smooth rolling to hilly and even mountainous areas. Vegetation is chiefly fir, with a scattering of oak, cedar, and spruce. Ferns come in on cleared land of this type.

With this summary of geography, topography, geology, and soils in mind we can discuss next the climatology of the valley. All of these factors are important in producing the vegetation, which in turn influences greatly the fauna present.

Climate

Information on early post-glacial climate of the Willamette Valley has been interpreted from pollen analysis of Pacific Northwest bogs by Hansen (50:117). It seems that six thousand to ten thousand years ago there was a much drier climate than at present. The presence of small stands of yellow pine in the southern part of the valley, and scattered trees elsewhere, may be relict of ex-

pansion into the valley at that time. Since about four thousand years ago the climate has been turning more cool and moist.

The present climate of the Willamette Valley is classified several different ways under present world climate schemes. Two of these are better than the others: Finch and Trewartha classify it as Marine West Coast (37:210), whereas Blair classifies it as Humid Marine (15:211). Main features of a marine climate are: abundant precipitation during a rather mild winter; a fairly cool and dry summer; a long frost-free season; a small annual range in temperature for the latitude; and wind off the ocean most of the year.

The climate of the valley coincides with the above requirements quite well. The mean annual average temperature for 22 stations (see Table I) in the valley is 51.96°F. The average January temperatures range from 36° to 40°F, while those of July range from 63° to 67°F. The mean annual rainfall for 27 stations (see Table I) is 47.73 inches, with a range from 28 to 77 inches (the latter reading is a foothill station). At least three-quarters of the rainfall comes from low pressure areas moving east off the ocean during the period from October through March. Rainfall for the April-September period ranges from 6 to 14 inches.

The prevailing wind is from the north and northwest in summer and the south and southwest in winter. However, air currents flowing down the Columbia Gorge from the Columbia Plateau often bring exceedingly hot weather in summer, or very cold weather in the winter.

The average growing season ranges from 180 to 215 days.

By checking the Elevation-Rainfall graphs (Figures 2-5) of west-east transects of the Willamette Valley, it can be seen that a slight increase in altitude to the east or west results in a slightly higher precipitation. The map (Fig. 1) gives the location of the stations used on the eight graphs (Figures 2-9) and on Table I as well. A high degree or rate of correlation will be noted between changes in elevation and rainfall.

The same type of graph plotted for stations along longitudinal north and south transects (Figures 6-9) fail to show the same degree of relation between elevation and amount of rainfall. Instead, local topography is responsible to some extent for varying conditions. The distance north or south seems to have no direct effect on the amount of rainfall, but there is still correlation, to a lesser degree, between altitude and rainfall.

Our climate is influenced by the topography, the proximity of the ocean, and to a much lesser extent by the more inland continental areas.

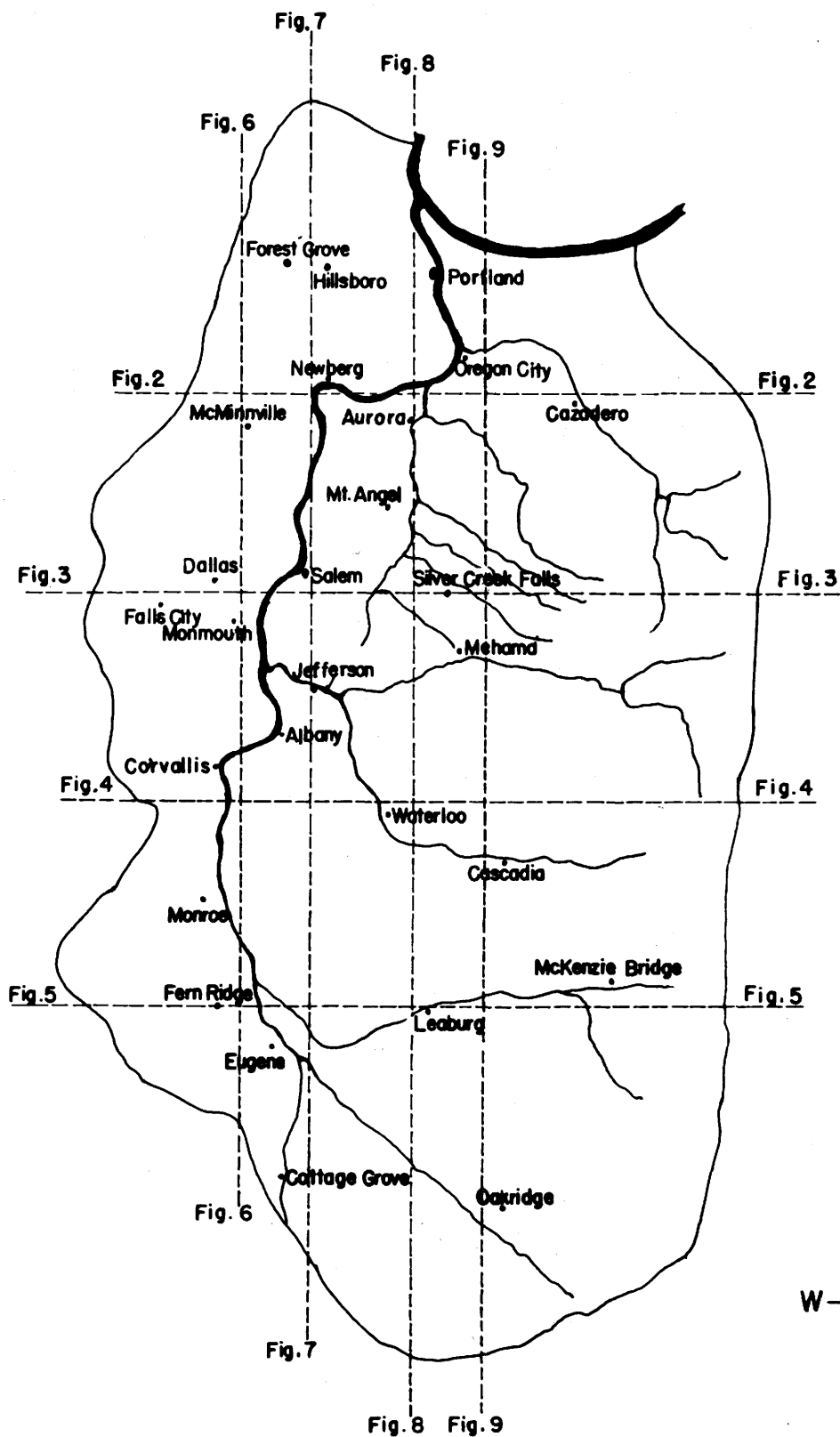


Figure I. WILLAMETTE VALLEY WEATHER STATIONS

TABLE I
CLIMATIC DATA - WILLAMETTE VALLEY STATIONS

Station	Elevation (Feet)	Years of Record	Mean Rainfall					Mean Temperature		
			Jan.	Apr.	July	Oct.	Annual	Jan.	July	Annual
Albany	212	56	6.57	2.82	0.45	3.13	41.60	39.5	66.6	52.6
Aurora	148	12	5.72	3.12	0.39	3.02	40.95	41.3	67.5	53.7
Cascadia	950	25	9.03	5.12	0.82	5.07	63.06	36.8	64.3	50.6
Cazadero	503	26	7.95	4.42	0.74	4.44	55.68	39.5	65.6	52.7
Corvallis	266	46	6.67	2.61	0.29	2.93	40.67	39.2	65.7	52.0
Cottage Grove	650	19	6.31	3.65	0.14	3.24	42.52	40.0	64.3	51.6
Dallas	325	7	6.69	2.99	0.47	4.25	46.62	37.5	65.2	51.2
Eugene	450	45	5.46	2.65	0.36	2.75	37.71	40.2	65.8	52.4
Falls City	355	26	11.43	3.85	0.25	4.95	70.98	38.2	63.8	51.0
Fern Ridge Dam	100	4	3.89	2.29	0.72	4.22	28.53	38.6	66.4	52.2
Forest Grove	220	42	7.43	2.76	0.36	3.37	46.33	37.4	65.9	51.5
Hillsboro	203	7	4.96	1.89	0.49	3.60	37.03	37.4	66.4	52.0
Jefferson	239	28	6.30	2.72	0.51	3.11	40.45			
Leaburg	675	7	7.23	5.16	0.98	6.05	60.10	40.2	67.3	53.2

TABLE I - CONTINUED

Station	Elevation (Feet)	Years of Record	Mean Rainfall					Mean Temperature		
			Jan.	Apr.	July	Oct.	Annual	Jan.	July	Annual
McKenzie Bridge	1372	20	10.14	4.69	0.91	5.54	68.53	35.0	65.6	50.3
McMinnville	145	46	7.13	2.71	0.38	3.04	43.14	39.0	66.2	52.2
Mehama	512	12	8.80	4.13	0.23	5.13	61.48			
Mormouth	215	12	4.99	2.98	0.27	2.92	39.44			
Monroe	288	16	8.28	2.60	0.33	3.19	49.15	39.8	65.2	52.0
Mount Angel	167	41	6.99	3.44	0.69	3.64	47.22	39.6	67.2	52.9
Newberg	175	12	6.68	3.68	0.43	3.36	48.61	39.6	65.9	52.0
Oakridge	1313	19	5.51	3.23	0.34	2.78	36.89	36.7	67.2	52.7
Oregon City	45	28	7.07	3.48	0.56	3.73	46.74			
Portland	57	64	6.60	2.87	0.61	3.12	41.62	39.4	66.7	53.1
Salem	191	43	5.67	2.62	0.38	3.00	38.11	39.8	66.5	52.7
Silver Cr. Falls	1340	7	8.32	6.09	1.04	8.12	76.78	36.7	61.7	48.7
Waterloo	411	12	4.84	3.15	0.06	2.97	38.80			
						Ave.	47.73		Ave.	52.0

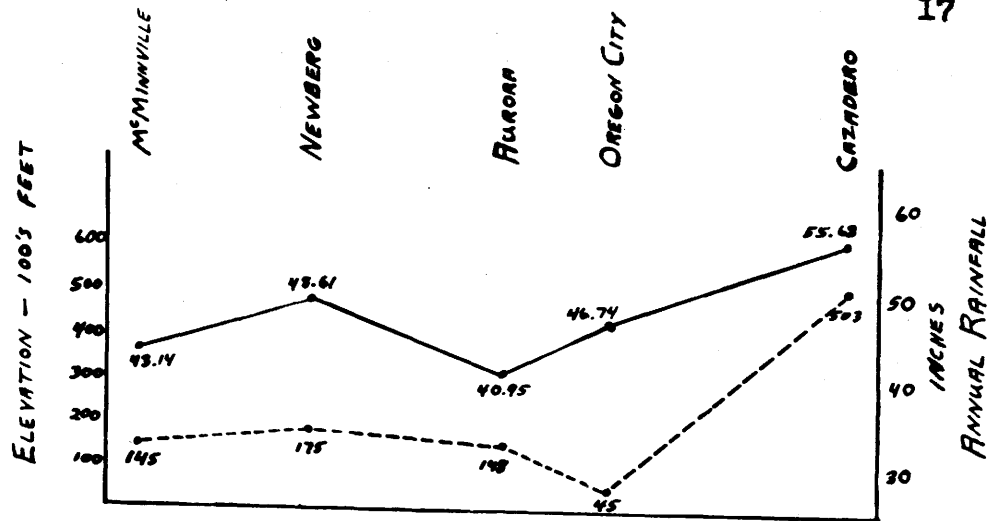


FIG. 2. WEST-EAST TRANSECT

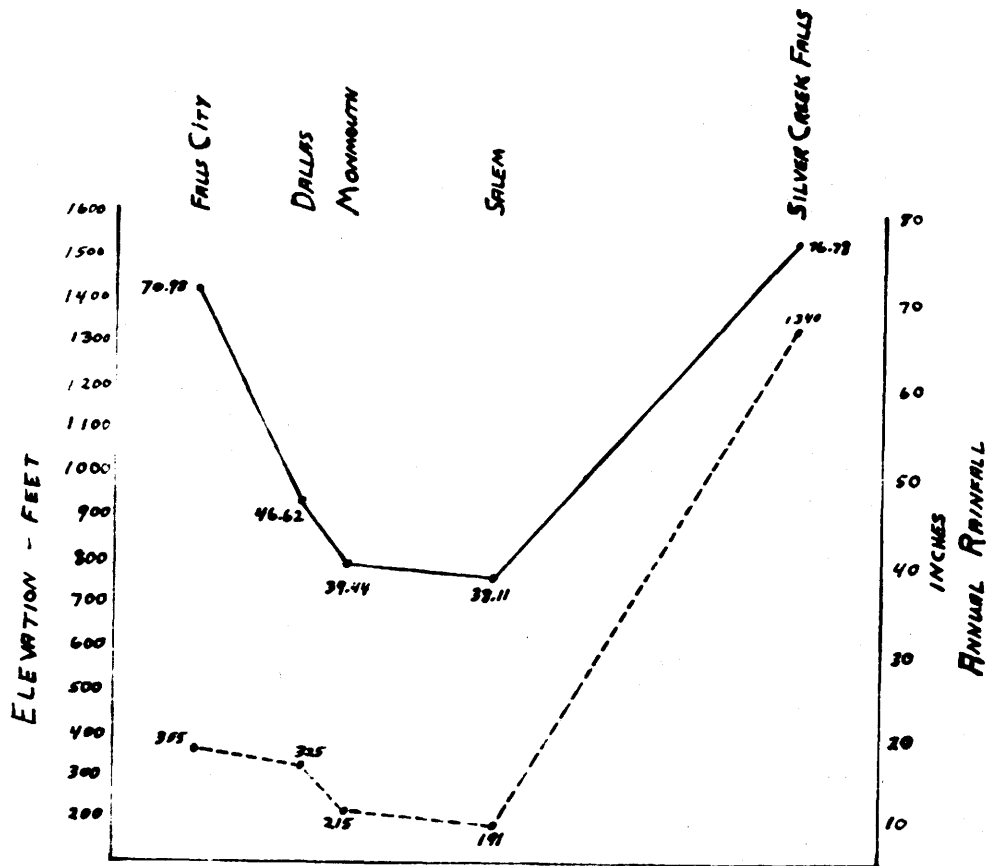


FIG. 3. WEST-EAST TRANSECT

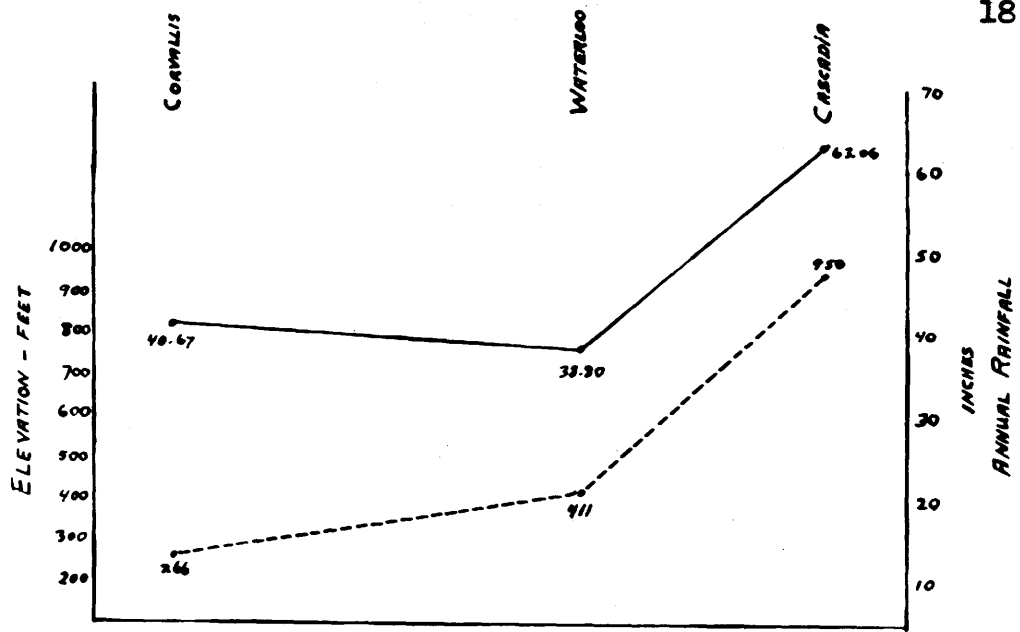


FIG. 4. WEST-EAST TRANSECT

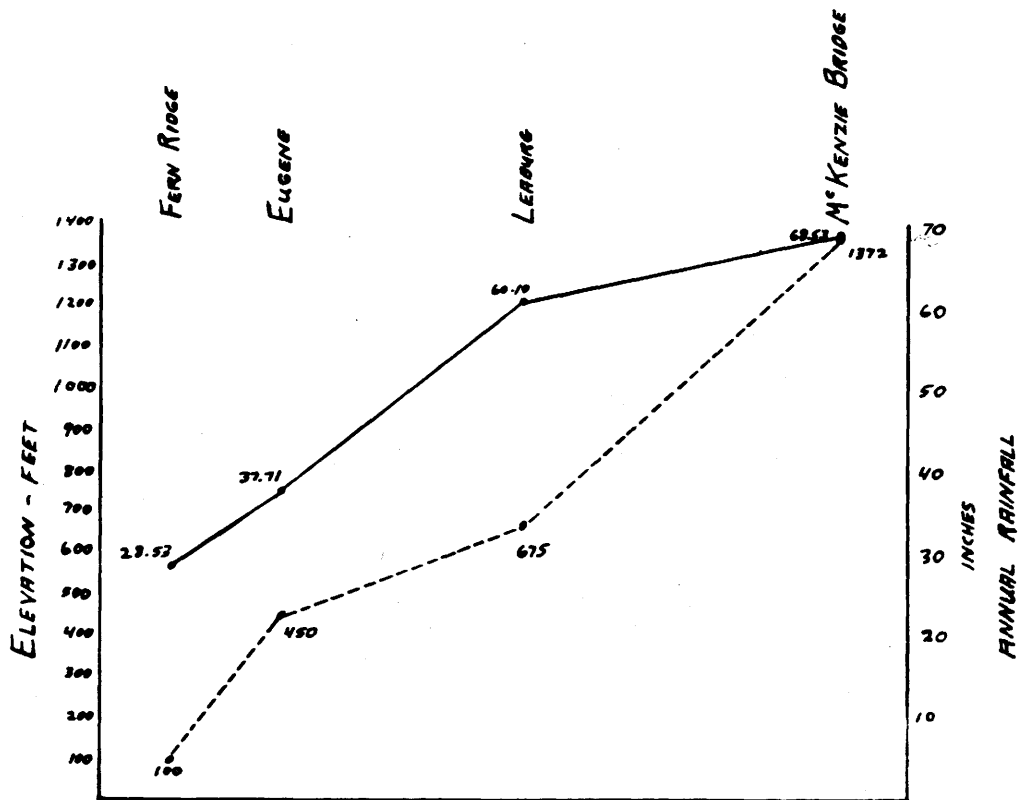


FIG. 5. WEST-EAST TRANSECT

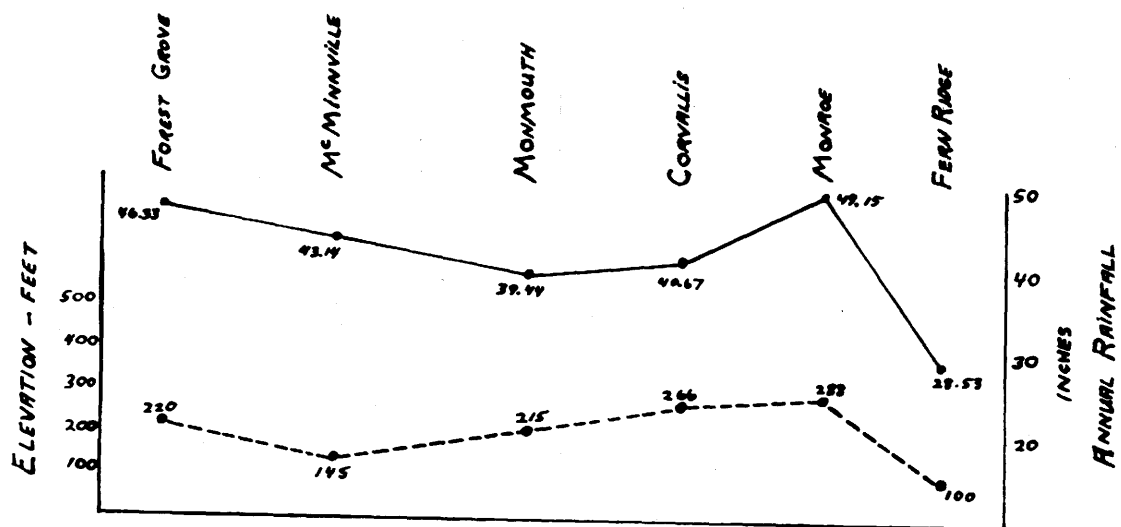


FIG. 6. NORTH-SOUTH TRANSECT

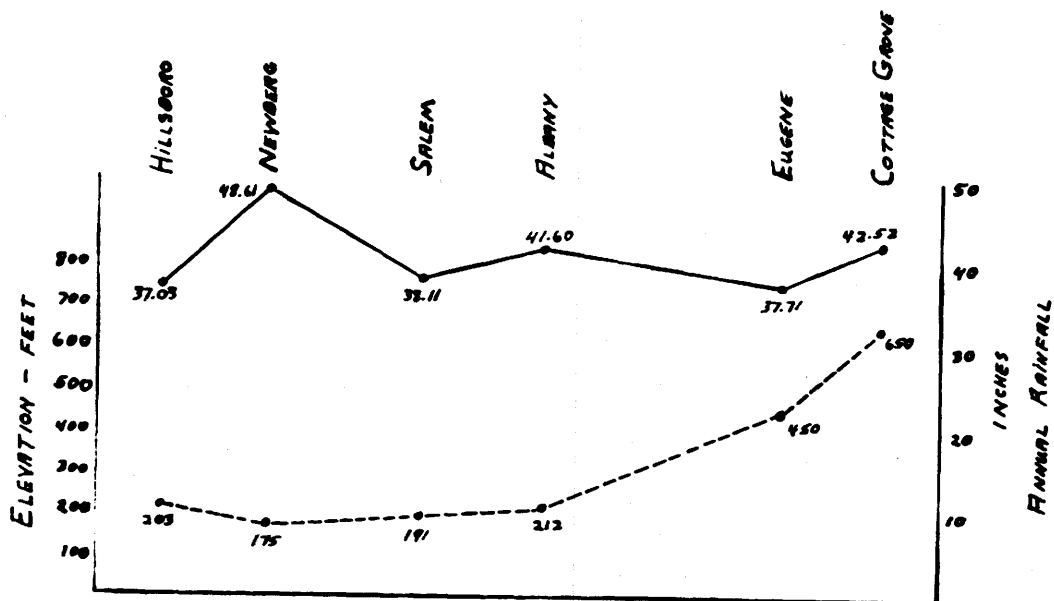


FIG. 7. NORTH-SOUTH TRANSECT

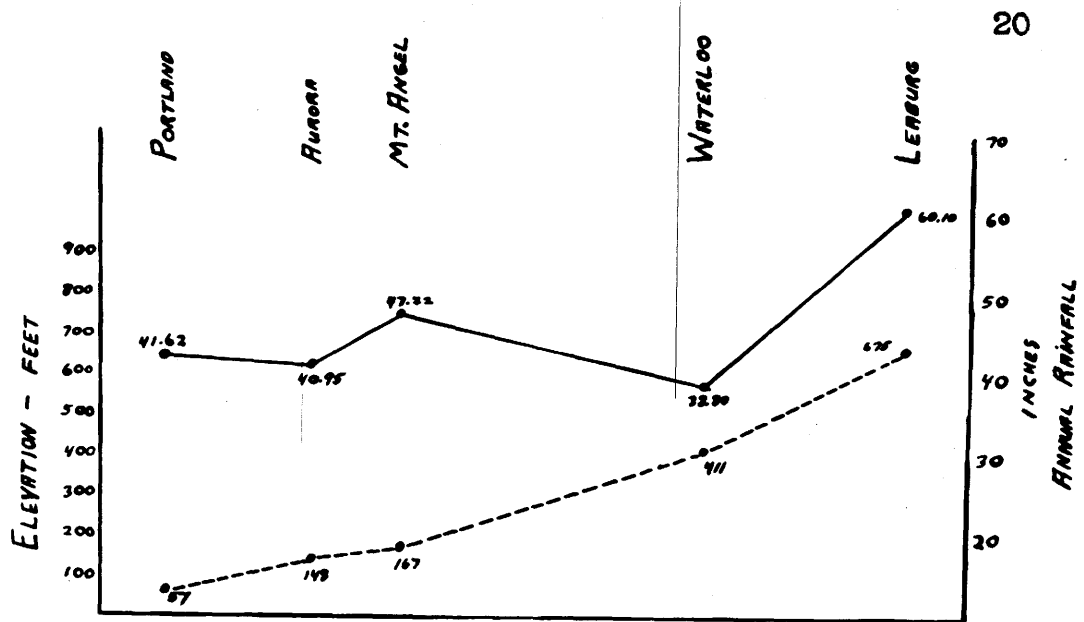


FIG. 8. NORTH-SOUTH TRANSECT

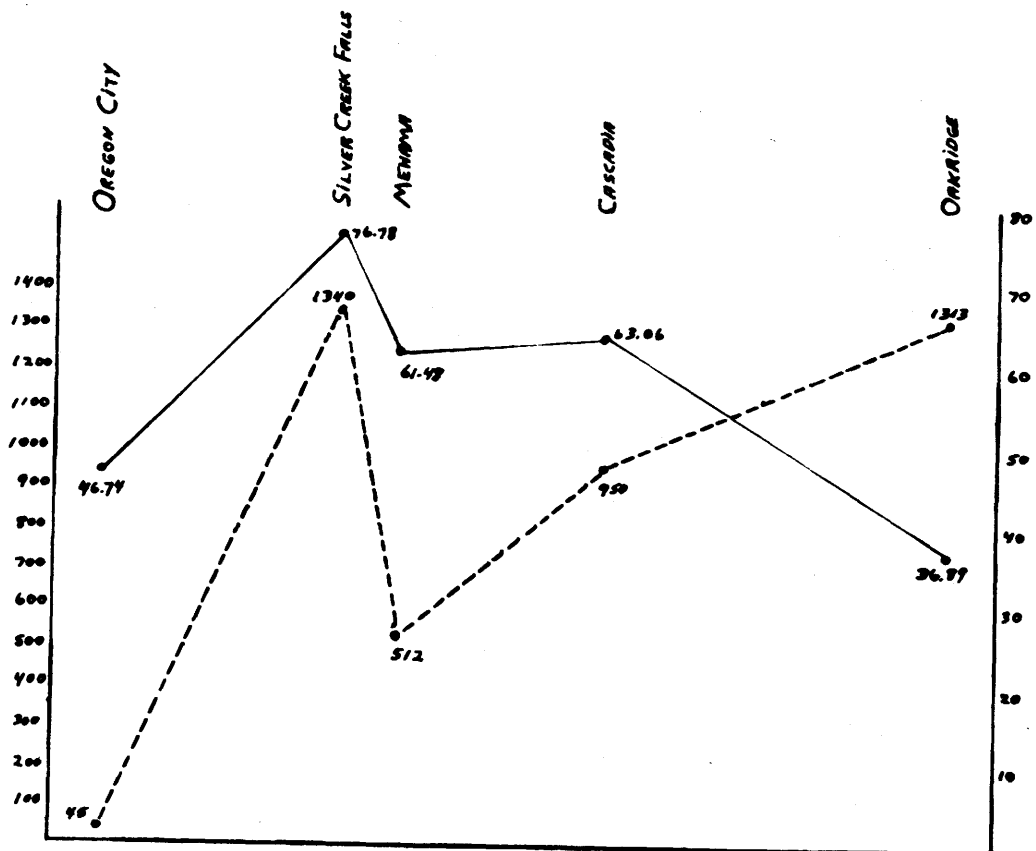


FIG. 9. NORTH-SOUTH TRANSECT

Climate, in all of its aspects, helps determine the vegetation, and to a great extent, the soil types. Indirectly, and sometimes directly, it controls the distribution of animal life. Because of mild temperatures in the Willamette Valley, rainfall is probably the most important climatic factor, and it has been shown that its distribution is governed to a large degree by the topography. Rainfall decreases as it moves eastward across the valley from the Coast Range, and increases as the air mass moves up the slopes of the Cascades on the east side of the valley. This plan is slightly altered by irregular hill ranges jutting up from the valley floor, resulting in more rain on the west side and less on the east side of the hill ranges in most instances. The influence of rainfall distribution can be seen readily by next studying, from an overall point of view, the vegetation of the valley.

Vegetation

Late glacial and post-glacial pollen studies by Hansen (50:115) show that lodgepole pine was predominant, with Sitka spruce and white fir at a maximum, while hemlock and Douglas fir were scarce about 18,000 years ago. About 16,000 years ago lodgepole pine began to decline, and Douglas fir increased slowly while hemlock was static. 12,000 years ago oak was still absent, and lodgepole pine, Sitka spruce and white fir were all declining as there was

a progressive decrease in moisture, and a rise in temperatures. Douglas fir made rapid expansion about 11,000 years ago, but was retarded during the dry period 9,000 to 6,000 years ago. During this dry and warm period oak increased rapidly to a maximum about 6,000 years ago, while hemlock declined, and lodgepole pine, Sitka spruce, and white fir continued to decline. "The persistence of small stands of yellow pine in the southern part of the Willamette Valley suggests a formerly warmer and drier climate. The pine may be relict of expansion into the valley at that time" (50: 117). Lodgepole pine and Sitka spruce disappeared at this time. Since about 4,000 years ago the climate has become more cool and moist, resulting in the decline of oak, a slight increase in the abundance of hemlock (still held in check by our present dry summer climate), and a maximum expansion of Douglas fir at the present time.

The present natural vegetation of the Willamette Valley is the visible expression of the climate, topography and the soil. Unfortunately, a good share of this natural vegetation has been destroyed by man through his agricultural and forestry practices, or through frequent burning and overgrazing. Of the 11,350 square miles of land area in the valley, approximately 4400 square miles are under some type of agricultural practices according to Potter (78:162). "Before the coming of white men to Western Oregon it is probable that there were numerous and sometimes

extensive grass-covered prairies in the chief river valleys. These were in many cases very likely subclimax and kept treeless by repeated burnings by the native tribes" (86: 106-7).

The Willamette Valley is mapped as a Humid Transition Zone in the life zone scheme (67). In Shantz and Zon's classification (83:7) the valley is mapped as Cedar-Hemlock Forest. Weaver and Clements (92) call this same area the Cedar-Hemlock Forest Association of the Coast Forest Formation. They list as a part of this association the Douglas fir subclimax consocieties. The valley forests do not advance beyond the Douglas fir succession stage because of the dry summers which have less than 25 per cent of the annual rainfall in the valley.

All the aforementioned plant formation schemes give a picture of a homogenous vegetation here in the valley. This view is erroneous, however, for there are several vegetation types represented. The valley proper is almost completely rimmed by coniferous forests which ascend all the surrounding mountain slopes. Units of coniferous forest are found on the valley floor and on the small hill ranges rising from the valley floor. Lowland white fir (Abies grandis) is found on moist ground, especially along water courses and on flood plains. There is a scattering of western red cedar (Thuja plicata) and western yew (Taxus brevifolia), and there are isolated patches of western

yellow pine (Pinus ponderosa) on rocky ground throughout the valley (Fig. 12). Incense cedar (Libocedrus decurrens) occurs occasionally along the southeast side of the valley (Fig. 13). Douglas fir (Pseudotsuga taxifolia) is the predominant conifer found in this area (Fig. 10).

Slope exposure is important in determining the plant species present on an area. In a phytogeographical study (30) it was found that Douglas fir has a high frequency on all slope exposures; white oak has a slight preference for southerly exposures; and yellow pine was on flat terrain or southerly slopes (Fig. 12). Bigleaf maple (Acer macrophyllum) shows a preference for north to east slopes.

The units of the deciduous forest are not continuous but are quite well scattered. There is enough of a representation of deciduous forest species to be reckoned with in the valley. Oak flourishes on the valley floor in scattered groves (Fig. 14), and on south slopes, and the low foothills on both sides of the valley are often partly covered with white oak (Quercus Garryana).

Beginning in the latitude of Eugene, or a little farther north, and extending southward, the black oak (Quercus Kelloggi) occurs more frequently and tends to replace the white oak according to Sipe (86:106).

Along water courses (Fig. 15) are willow (Salix sp.), black cottonwood (Populus trichocarpa), Bigleaf maple, red alder (Alnus rubra), creek dogwood (Cornus occidentalis),

and Oregon ash (Fraxinus oregana). "The favorite habitat of the ash is the poorly drained flats along the innumerable streams originating in the foothills and mountains. These poorly drained flats, often covered for long periods in the winter with standing water, may be occupied by dense thickets of ash, with a mixture of various shrubs and small trees such as hawthorne (Crataegus Douglasii) and serviceberry (Amelanchier floridana)"(86:106).

The madrone (Arbutus menziesii) is found scattered, or in small clumps on xeric slopes throughout the valley (Fig. 16), but it is much more abundant in the southern part.

Besides the forests and farmlands there are prairie-like grasslands (Fig. 19), abandoned pastures (Fig. 13), and shrub-lands of many different types.

"It appears that the climate and the edaphic conditions of the Willamette Valley are such as to form a tension zone in which oak and fir are in equilibrium"(50:63). A decrease in annual precipitation would probably result in a trend toward an oak-grassland sere. From the phytogeographical study by Evenden (30) it was found that Douglas fir reproduction is half-again greater than that for white oak, and over five times greater than reproduction of yellow pine. Statistical studies of forests in the foothills of the Coast Range by Sprague and Hansen (88) show that Douglas fir is gradually replacing the oak that thrived in

areas deforested by fire and lumbering during the middle of the last century. In a phytogeographical study of McDonald Forest by Evenden and Aller (32) it was found that there were approximately 70 per cent as many oak seedlings as there were Douglas fir seedlings. This is significant inasmuch as there are over three times as many Douglas firs 1 inch DBH or over, as there are white oaks. However, oak showed a higher frequency on the south slopes and on the north slopes it is being replaced by Douglas fir. There are many relict oak "giants" remaining on the north slopes. All these facts help to show the dynamic condition of the vegetation of the Willamette Valley.

A study of the frequency of the five life form classes (phanerophytes, chamaephytes, hemicryptophytes, cryptophytes, and therophytes) of the Willamette Valley (see Table II) shows a preponderance of those plants with buds close to or below the ground level, or plants that reproduce by seed. Only 13 per cent of the plant species have buds above the ground level, having them protected only by their own devices.

Plant life forms are a result of all the life processes which are affected by the environment. Therefore, it seems that the majority of the plants here in the valley are prepared to thrive under unfavorable conditions such as heat, cold, or drought. However, conditions are really quite mild, and the true picture is distorted by the

presence of many varieties of therophytic exotic weed plants, introduced with local farming practices. We have no way of knowing what the original ratio of life forms was for the valley, for no ecological studies were undertaken by the early pioneers who first settled here.

Data for the following comparative table is from three sources. The Willamette Valley percentages are by Dr. H. P. Hansen; those for other Oregon regions by Mr. William Baker and Mr. Robert Yancey (10); and those outside Oregon are from Braun-Blanquet (16:298).

Table II
Life Form Spectra

Region	Ph*	Ch*	H*	Cr*	Th*
Normal World	46.0	9.0	26.0	6.0	13.0
Seychelles, Indian Ocean	61.0	6.0	12.0	5.0	16.0
Death Valley, California	26.0	7.0	18.0	7.0	42.0
<u>Willamette Valley, Oregon</u>	10.7	2.3	29.7	24.0	33.1
Cascade Mountains, Oregon	10.2	9.5	35.8	37.2	7.3
Eastern Oregon	7.7	5.7	37.3	22.0	27.4
Southern Oregon	12.0	6.0	38.2	21.7	22.1
Oregon	9.6	6.3	37.3	25.3	21.3

* Ph - phanerophyte, Ch - chamaephyte, H - hemicryptophyte, Cr - cryptophyte, Th - therophyte.

Willamette Valley Habitats

From a general discussion of the vegetation of the Willamette Valley I will turn directly to the large variety of habitats available to the avifauna, and discuss them in detail at this point. For a brief and general outline of these habitats, see Table III (page 29).

Perhaps the most distinctive habitat is that of the coniferous forest. It is represented in small to large stands throughout the valley, and almost completely encircles the valley from its periphery on up the slopes of the mountains. The dominant species making up this habitat is the Douglas fir. It must be noted that this habitat is not uniform, so far as the fauna is concerned. The habitat varies from dense old growth fir to second growth fir, burned-over forest, selectively-cut, and clear-cut logging, as well as the open park-like growths found along the water courses of the valley.

Old growth fir areas (Fig. 10) are usually so dense that little light can penetrate the canopy, and consequently there is little if any storying of lesser vegetation underneath. Smaller trees and shrubby vegetation occur only at the peripheries of such forests. Consequently, the old growth fir areas are often a habitat possessing the lowest number of avian species, as well as the lowest number of individuals. Areas of this type are still to be

Table III

Willamette Valley Habitats - General Outline

Coniferous Forest

Old growth
 Second growth
 Burned-over
 Logged - selective- or clear-cutting
 Open park - river bottom (also maple-cedar)

Deciduous Forest

Oak
 Ash
 Maple
 River bottom - willow-cottonwood (maple-cedar-fir)

Shrub

Chaparral - Ceanothus-chinquapin
 Madrone
 Scotch broom
 scrub oak
 Thicket
 Open brush
 River bottom tangles

Pastureland and Abandoned Farmland

Open
 Sweetbriar
 Sweetbriar - Poison Oak - Oak - small Douglas fir

Open

Balds
 Prairie-like grasslands

Swamps and Marshes

Farms - Buildings and plantings
 Orchards and fields
 Fence rows - posts, poles, and wire lines

Urban areas

found on north slopes, in larger, isolated woods areas around the valley, and even more abundantly in logged areas of the surrounding foothills.

Second growth fir can be, at times, as dense and light-restrictive as the old growth fir, and hence as low in variety and numbers of birds present. However, second growth fir is usually not dense, having a variable degree of openness, a result of activities of man. The more open the stand of fir, the greater is the abundance of other trees, shrubs, and herbaceous flora present, and hence the more desirable is the area for birds. Second growth fir areas predominate on the floor of the valley, and over a good share of the foothill area surrounding the valley. This latter part is rapidly being converted into the types to be discussed next.

Carelessness of man, through various causes, is creating many burned areas, particularly in the foothill and mountain areas, where logging operations exist. Burned areas are typically a jumbled mass of fallen trees, logs, stumps, and charred snags. The living vegetation that follows a fire differs from that following other clearing methods to be discussed later. Usually all the local shrubs, small trees, and herbaceous species, together with forthcoming reproduction, are destroyed during the fire. The ash resulting from the fire presents a chemically different environment for plant invasion, so that the first

species to appear are those able to tolerate such conditions and those capable of rapid spread by agencies such as wind, or animal life. Examples of plants that follow fire are the bracken fern (Pteridium aquilinum) and fireweeds (Epilobium sp.). Later on, wild blackberries (Rubus vitifolius), elderberries (Sambucus sp.) and others move in, these being followed by a long succession of species, finally resulting in the original condition. The succession story is too complicated to relate here, but it can be seen that varied habitats are presented over a period of time in a burned area, because of the usually complete destruction of the original condition.

Logged areas (Fig. 11) are becoming increasingly prominent in the foothills now that the smaller companies are trying to take not only the second growth fir, but the third growth as well. Two types of areas result from these operations. Some outfits clear-cut, meaning that they clean nearly every tree, regardless of size, from an area, leaving nothing but stumpage, piles of debris, and the destruction of a great deal of the vegetation. An area of this type is quick to acquire vegetative cover, however, for the original species, with the exception of the trees, are so spread by the logging activities that they will cover the area. Within a year or so there is usually a good shrub growth present. This type of habitat is wonderful for birds, and other animal life as well. Areas of identical

habitat are found throughout the valley in such places where man has cut all the trees on an area, leaving the stumps to be cleared out at a later date for farming purposes. Sometimes stumpland is abandoned at this stage, and like the clear-cut areas in the foothills, proceeds through much the same successional stages. Most of the logging is supposedly of the selective type in which they take out a majority of the trees, leaving many of inferior size still standing. These trees are usually well-spaced, allowing the full quota of light to reach the earth's surface, thus actually presenting the same conditions as would clear-cutting (Fig. 11). Whatever plant species were originally there are quick to spread, and other "mobile" species soon appear. Shrubs such as elderberries, hazel (Corylus californicus), ocean spray (Holodiscus discolor), vine maple (Acer circinatum), bigleaf maple, and many others quickly come into prominence. Much later, seedling firs will make their appearance. Habitats that develop from these various cleared areas produce a variety of ecological conditions, and so are quite attractive to many bird species.

The last type of coniferous forest to be mentioned is that of open groves, or park-like growth found here and there on the right type of soil in river bottom areas. This forest is not necessarily Douglas fir alone, but may be a mixture with lowland white fir and, or western red

cedar. Several deciduous species may also enter into this mixture. Examples are bigleaf maple, dogwood (Cornus nuttallii), Oregon ash, and the chokecherry (Prunus demissa). This area, having open timber, has a variety of shrub species such as the hazel, ocean spray, ninebark (Physocarpus capitatus), and wood rose (Rosa gymnocarpa) that usually form a sort of ring-like growth or stand around the small clumps of conifers, or the individual trees, leaving clear areas, matted with many forbs and grasses, inbetween. This condition is maintained without much change in the habitat picture because grazing is usually practiced in such areas. This is one of the best habitats for birds because of its proximity to water, and because of the wide variety of growth forms present, offering an excellent mixture for food and shelter.

Scattered throughout the valley are some yellow pines, and occasionally a small stand of these trees is found (Fig. 12), often of young trees as well as the older ones. Coincident with some of these areas, species of birds normally found in the yellow pine east of the Cascades have been found in such areas in the valley. They will be discussed later.

I know of one "forest" of incense cedar located on the east slope of the valley that is very distinctive and different from any other coniferous area in the valley. There are some almost pure stands or thickets of this species in

places (Fig. 13), and in other places they are mixed in with Douglas fir and yellow pine reproduction. The "forest" is quite open, and the area inbetween is an abandoned pasture now growing to sweetbriar (Rosa rubiginosa) and young incense cedar. I have not spent enough time in this particular habitat to note whether it is characteristic for any particular avian species, but it is doubtful because of the comparatively small area concerned.

The deciduous forests of the valley area are composed of five species, three of which make up separate groves, or forests. These are the white oak, the Oregon ash, and the bigleaf maple. The other two species are usually combined in a river bottom mixture - willow and black cottonwood.

The white oak is a xerophytic species found on shallow soiled, dry, and possibly rocky slopes. It prefers southerly exposures (30), but is found in a more or less continuous belt on the foothills from the northern part of the valley, increasing southward on both sides of the valley to the Calapooya Range south of Eugene, where it is partially replaced by black oak. It is found in groves (Fig. 14), scattered over the valley floor on the drier situations. Some of these groves may be quite compact in their structure, allowing little vegetation to grow beneath. Typically the oak woodland is quite open, with plenty of room for forbs and shrubs to be present. Many of the oak areas are utilized for grazing and so the regular species low on the

preference list of the grazing animals, such as sweetbriar, and poison oak (Rhus diversiloba), are usually found associated with the oaks, the more preferred plant species having been destroyed by the grazing. The oak forest forms an open habitat structure with considerable variety, and it is utilized by many species of birds, both during the breeding season, and as feeding area for winter flocks.

Ash groves form rather small habitat niches on the poorly drained flats along the many water courses in the valley. Usually there is very little shrub growth under ash. The foliage of ash is not very dense, so that this habitat does not attract many birds, except for feeding and perching, although a very few species utilize ash for nesting (Fig. 24).

Bigleaf maple groves or forests are rare in the valley area, but have been noted in moist situations on north and east slopes of some of the foothill ridges. These groves are open enough to permit considerable growth of the usual shrubs of the valley area such as hazel, ocean spray, red-flowering currant (Ribes sanguineum), and indian peach (Osmaronia cerasiformis). Maple also enters into the river bottom coniferous forest mixtures already mentioned, together with the red cedar and white fir.

A river bottom forest of willow and black cottonwood is very common along the Willamette River (Fig. 15) and many of the other large streams entering the valley.

Except for a few dense willow thickets, it is an open habitat, with many undergrowth shrubs. This habitat is usually grazed considerably, so that there is often a "park-like" appearance to the area, with scant herbaceous vegetation between the shrub clumps and trees. The brush thickets, together with the varied tree heights, and the proximity to water offer excellent habitats for a large variety of birds, and they are usually found in great abundance.

Shrub habitats occur at edges of woods, in natural or man-made clearings in the woods, in areas that have been burned over, in areas that have been cleared by any of the logging methods, in areas that have been cleared and abandoned from their original use, and in river bottom areas that have been swept clean by flooding, with later succession taking them to the shrub stage. Shrub habitats may be of four types: Chaparral, thickets, open brush, and river bottom brush.

First, chaparral, that is, an area of thick, almost impenetrable brush that covers, perhaps, more than several hundred square yards of slope. In the coast range buckbrush (Ceanothus sanguineus) and chinquapin (Castanopsis chrysophyllus) often form a dense chaparral-like growth. Also, scotch broom (Cytisus scoparius) forms typical chaparral areas (Fig. 17), not only in the coast range foothills, but also in places along the east side of the val-

ley. Madrone (Arbutus Menziesii) occurs infrequently as a chaparral growth at isolated points around the valley foothills (Fig. 16), more often in the southern part of the valley. Much of the white oak belt found around the valley foothills is in the form of a dwarf or scrub growth that at times grows so close together that it is quite difficult to make passage through it. This scrub growth often covers large areas. This chaparral-brush habitat is not a very productive one because it is too homogenous throughout, and except for a few species that love the brush, other birds utilize such areas infrequently. Even the brush-loving species tend to restrict themselves to the outer borders of such large chaparral thickets so that the central area is nearly void of bird life.

Second, thickets, or areas of thick brush that, too, are almost impenetrable, but cover much smaller areas. In the foothill areas thickets may be of the same plant species as mentioned for the chaparral growths; that is - buckbrush, chinquapin, madrone, scotch broom, and scrub oak, but may also involve other species such as dense stands of young Douglas fir reproduction, or poison oak, and out on the valley floor, thickets of hawthorne (Crataegus Douglasii) are often found (Fig. 18). Willow and rose is another combination found along ditches in farming areas. Any fisherman knows the struggle of going through a thicket of vine maple along some of the stream courses. All these

thickets, because of their small area, and their dense cover are ideal habitats for birds for nesting, protection, resting, feeding, and most other activities. The small size of the thickets makes other habitats readily available to the birds.

The third type, open brush, is more common. It is not closely packed together, and can be passed through without too much difficulty. It occurs under forest canopies, at the edges of the forest, in natural and man-made clearings in the woods, as well as stages in succession on land cleared for agricultural purposes, or by logging practices. A typical stand of open brush in a forest clearing might be composed of hazel, ocean spray, dogwood, ninebark, bigleaf maple, vine maple, Oregon grape (Berberis sp.), indian peach, and young forest trees, either coniferous or deciduous. Of course, any of the species previously mentioned as growing in compact form can also grow in this more open form. There is really no restriction to a particular species type in the open brush. Open brush areas, because they are so varied in their structure, and because they furnish so many edge effects, are highly desirable bird habitats. Many species ordinarily not found in a coniferous forest may be present in these open brush clearings that simulate the birds normal brush habitats outside the coniferous forest.

A fourth shrub area that should be mentioned is that found in the river bottoms, or around ox-bow lakes, or other bodies of water on the valley floor (Figs. 20, 25). This type is truly a tangle, even as much as the chaparral type of vegetation cover. Willow, alder, cottonwood, vine maple, bigleaf maple, ash, creek dogwood, ocean spray, western wayfaring-tree (Viburnum ellipticum), ninebark, thimbleberry (Rubus parviflorus), salmonberry (Rubus spectabilis), syringa (Philadelphus gordonianus), wild blackberry, honeysuckle (Lonicera ciliosa), and many other species make up such tangles. This river bottom brush may be in continuous belts, but is usually somewhat broken up so that much edge effect is produced. Because of this condition, and its proximity to water, to fields, and to trees it is a habitat adopted by a great many species of birds.

I want to make a distinction between open pastures and prairie-like grasslands. Pastureland is a disclimax created by man, and if left undisturbed, will proceed through the stages of succession to shrub growth and white oak. Prairie-like grassland (Fig. 19), although it has the same herbaceous appearance, is a subclimax, and even though undisturbed, tends to remain a grassland, so long as the present environment remains unchanged.

Pastureland varies with the stage of use or disuse, and succession from area to area. The pasture is most often derived from previously tilled land that is no longer

suitable for tilled crops. At first this pasture will have few grasses, most of the area possessing forbs, but as the age progresses, more and more grasses come in, and some shrub and tree species may invade the area. If the plants are palatable to the grazing stock, they will not grow long before being grazed down. However, not all shrub and tree species are on the preferred food list of the grazing stock, and they remain untouched, growing at a normal rate. Such species are sweetbriar, poison oak, blackberries, and scrub oak. In the early stages, when these scattered shrub species are not numerous, the area could be almost classified as a savannah. As succession progresses, the open area is reduced, the shrubs increase, sometimes forming thickets, and these offer protection to tree species which then begin to encroach on the shrub area, eventually resulting in a woodland type of vegetation. The pastureland habitats are not the best of bird habitats, although certain species do utilize them more than they use other habitats. For instance, in winter when the flat pasturelands are quite boggy, an ideal and preferred habitat is available for Wilson's snipe. But in summer, when the lands are dry, very few species use the area. Pastures in later stages of development furnish shrubbery for feeding winter flocks of birds, but even this is not utilized to the extent of other brushlands. All in all, pasturelands, winter or summer, or in early or late stages of succession do not

offer a very good habitat for many birds. It is suitable for temporary usage, but seldom is used for such permanent activities as nesting, unless the pasture has not been grazed for a long while, and rank vegetative growth exists.

Grasslands occur as prairie-like expanses, or as "balds". Both are sub-climaxes. The "balds" are found on the top of hills and mountains, or on higher slopes with a southerly exposure. Good examples of these would be "Baldy", a few miles due west of Corvallis, and Mary's Peak in the Coast Range. In the case of "Baldy", oak growth is found on the north side, right up to the top, but none on the south side. "Balds" offer a habitat to the prairie forms of birds, but usually they occur as such small areas that they are not really of much importance as avian habitats. A word might be said about the bald on Mary's Peak. It is not a true arctic-alpine zone, as one might expect, but it is interesting to note the presence of certain alpine species of plants such as Phleum alpinum and Phlox Douglassii; and Erythronium montanum and Lupinus Lyallii of the Hudsonian life zone. I thought I observed a pair of rosy finches (Leucosticte tephrocotis), an alpine species, on the southside snow fields late in the spring of 1942, and again in 1948, but the specimens were not collected to verify this observation. This would seem to indicate that the winter and spring conditions on this bald satisfy the requirements of some alpine birds.

There are many prairie-like expanses of grassland in the Willamette Valley (Fig. 19), particularly in the flat area from Corvallis, Albany, and Lebanon southward to the McKenzie River and the Calapooya Range at Eugene; and the French Prairie north of Salem is another large expanse of this type. Some of these prairies have been tilled not too long ago, and they have a predominance of forbs of many types, particularly species that have been imported with farming practices, and mixed with many species of grasses. Other areas are predominantly grasses, with few forbs, except in the early spring and summer. These prairies are quite readily classified as austral, and surprisingly enough, there are several birds associated with the prairies that would have a difficult time finding suitable habitat elsewhere in the valley if there were no prairies. In fact, this habitat, in the southern part of the valley, is very interesting because of the peculiar fauna that can be identified with it.

The abundance and number of avian species associated with the prairies is low, except for occasional large wintering flocks that might be observed. Compared to some of the other habitats, it is not productive, but what it has is interesting, and this habitat will form one of the fundamental parts of this thesis.

Swamps and marshes are found in the Willamette Valley, but not to the extent of those found in such states as

Georgia and Florida. These areas are small. In fact, they are most often overlooked in a description of the valley habitats. However, when it comes to birds, there are many species that have been recorded in the vicinity of these areas that have not been recorded in any other habitat here in the valley. They may exist as shallow ends of lakes, or low flood plain areas along some stream, or perhaps as found along the border of a large reservoir such as Fern Ridge in Lane County (Fig. 23). Swamp and marsh habitats are not usually distinct as such, for they may merge with open water (Figs. 23, 22), or with each other (Figs. 21, 22), instead. This is the condition found in most of the areas that I have visited - there may be a section of swamp and then some marsh area, and perhaps some open water, and then more swamp, and so on (Fig. 21). Swamps and marshes are seldom far from the valley floor, and only occasionally are there any conifers associated with this habitat. There may be oak, ash, and willow, with the latter two often growing partially submerged a good share of the year, and forming dense stands, or scrub growths. The main shrub associated with the swamp growths of scrub ash, etc., is hardhack (Spirea Douglassii) (Fig. 21). In the more marshy areas cattails (Typha latifolia), smartweeds (Polygonum sp.), pondweeds (Potamogeton sp.), water plantain (Alisma plantago-aquaticum), spike-rushes (Eleocharis sp.), and sedges (Carex sp.) form habitats for marsh-loving species

(Figs. 22, 23). The open waters are attractive to many species of waterfowl. The shallow waters and bordering fields are good habitats for shorebirds of many kinds. In this valley, when a small, true marshy area exists, it soon begins to develop into a swamp, as plant succession progresses. Swampy, marshy, or boggy lands were mentioned once before, but it should be pointed out again that in winter many habitats on flat terrain are converted into aquatic habitats that attract the winter resident aquatic birds.

A discussion of farm habitats would probably be worthy of a thesis by itself, so I will attempt to present only the more general considerations. Farms are varied in the methods in which they are handled, and in the crops which they produce - truck gardens, berry patches, orchards, and fields. Most farms have one thing in common, that is, fencerows separating their fields, thus creating excellent edge effects, offering protection to brush-inhabiting species, and at the same time, making several habitats available. Fence rows offer food, protection, resting cover, and nesting cover. Even the fence posts, electric line poles, and wires offer a niche in the habitat that is readily utilized by many birds for activities such as resting, lookout posts, perches from which to spot prey, or enemies, and to a limited extent for nesting. The farm fields offer peculiar habitats for certain species

and the berry fields and orchards offer another type of habitat, probably for another group of birds. Farm buildings are often the only attraction within miles for certain species such as the English sparrow, house finch, and certain swallows which are more often found near habitation that away from it. Plantings around the farmstead oftentimes offer an environment desired by certain species more than the habitats that might be available in the surrounding farmlands.

Urban and suburban areas take up a considerable area in the valley, and will probably utilize even more land as industry and populations increase here. We all know what these areas have to offer in the way of habitats for birds. It is a poor residential district in which you can not find more birds that there are in some areas outside the city limits. Shade trees, shrubbery plantings, hedges, and border gardens all contribute little niches that are suitable to a large variety of bird species. As on the farm, the homes, and the buildings of the business district contribute a habitat necessary for several species. For instance, holes under eaves and in older buildings furnish roosting and nesting places for species such as purple martins, English sparrows, and swallows. In other words, the urban areas can not be very well left out of a discussion of habitats of the Willamette Valley.

I realize that this discussion on habitats has been

rather lengthy, but habitats form an important portion of the basis of this thesis, and consequently details must be given to aid in a thorough understanding of the bird-habitat relationship. It is hoped that after reading this, it will be understood that habitats are not of a definitely fixed form, and that they will not remain in any form for long - they are dynamic, and ever-changing, through the activities of man and other animals, and principally through the processes of plant succession. Over a long period of time it should be understood, too, that climate can change the macro-habitats as well as the micro-habitats. Because of this ever-changing process of plant succession, it is difficult to define any habitat clearly. Each habitat merges or blends into the adjoining one, and, within itself, each habitat varies a great deal in its structure and species composition.

Fauna of the Willamette Valley

A discussion of the Willamette Valley would not be complete without some mention of the vertebrate fauna, excluding the birds.

According to Dimick and Merryfield (26:3) there are 34 species of fish in the Willamette River system; 23 of these are indigenous and 11 are exotics.

Amphibian species number 12 in the valley, while there are 15 species of reptiles. One of the latter, the Pacific

rattlesnake (Crotalus viridis oreganus) is found in the valley as far north as Lebanon on the east side, and Monroe on the west side (39:79). This rattlesnake is classified as a sonoran form.

Mammals are too numerous to discuss in detail in this paper. However, inasmuch as the Willamette Valley is normally thought of as being in a boreal zone, it might be of interest to mention some of the sonoran mammals. Bailey (9:31-3) says that the raccoon (Procyon lotor), spotted skunk (Spilogale sp.), striped skunk (Mephitis sp.) black-tailed jack rabbit (Lepus californicus), grey digger (Citellus beecheyi), brush rabbit (Sylvilagus bachmani), and the gray fox (Urocyon cinereoargenteus) occur in the area.

DISTRIBUTION SCHEMES

Distributional classification is merely a useful tool in research; a method of organizing the manifold detail of field observations, and an aid in orienting the student of distribution problems.

During the past century there have been many distribution schemes, both for the plant life, and for the animal life around the world. This is not the place, nor is there any need for a discussion of all of these schemes. However, in order to obtain a suitable background for this thesis, it seems advisable to discuss a few of them. Some of the plant schemes will be taken first, and then two faunal schemes will be discussed, leading up to the basis of this thesis - to test on birds of the Willamette Valley a scheme being tested on mammals of North America by Dr. K. L. Gordon at the present time; I want to determine how distinct the difference may be between the habitats selected by the austral and the boreal forms. Discussion of the distribution schemes follows:

Floral Schemes

In 1921, Livingston and Shreve developed their continental vegetation classification on the manifold action of environmental conditions. The plan they devised (64:32) is briefly outlined here.

1. Desert
 - a. Continental Desert - sclerophyllous or succulent
 - b. Coastal Desert
2. Grassland
3. Forested
 - a. Deciduous
 - b. Evergreen Needle-leaved
 - (1). Mesophytic
 - (2). Xerophytic
 - (3). Hygrophytic
4. Alpine Summits
5. Swamps and Marshes

By this scheme, the Willamette Valley has three vegetational classifications. Parts of the valley are of the Pacific Semi-desert, and the forests are of two types - the northwest Hygrophytic Evergreen, and the northern Mesophytic Evergreen Forests (64:1). From these three classifications alone, one would have a difficult time getting a clear and accurate picture of the vegetation of the Willamette Valley.

A second plant distribution scheme, using the biological unit as the basis of classification (83) has vegetation as the indicator. They say "The natural vegetation is the expression of environment, it is the integration of all climatic and soil factors, past as well as present, and, therefore, if it can be distinctly and clearly indi-

cated, provides often a better basis for classification of environments than any other one factor or set of factors" (83:3). If adhered to, this is certainly the correct outlook on distribution problems.

According to this scheme by Shantz and Zon, the vegetation of the United States may be broadly divided into forest, grassland, and desert scrub. The forests are divided into eastern and western regions, and it is under the latter division that the Willamette Valley is included. The western forest region is further divided as follows:

1. Woodland
 - a. Chaparral
 - b. Pinon-Juniper
2. Timberland
 - a. Western Yellow Pine - Douglas Fir
 - b. Cedar - Hemlock
 - (1). Pacific Coast Douglas Fir
 - c. Spruce - Fir

Of these divisions of the western forest region, the Willamette Valley comes under the Pacific Coast Douglas Fir subregion of the Cedar-Hemlock forest region. This subregion has two associations: the Douglas fir - Hemlock - Cedar, and the Douglas fir (83:14). No mention of other existing habitats in the Willamette Valley is made in their scheme.

The third vegetation classification system I wish to

mention is probably the most thorough vegetation analysis of North America. It was published by Weaver and Clements (92) in 1938. In it they list a total of six climaxes, with many formation and association subdivisions. However, like all the other schemes dealing with large areas, they must be quite general, and consequently their scheme is incomplete when dealing with a detailed study of a relatively small specific region. According to them the Willamette Valley is covered by the forest climax.

They have sub-divided the forest climax into the following Forest Formations (92:481):

- Boreal Forest - Picea-Larix Formation
- Subalpine Forest - Picea-Abies Formation
- Lake Forest - Pinus-Tsuga Formation
- Coast Forest - Thuja-Tsuga Formation
- Montane Forest - Pinus-Pseudotsuga Formation
- Deciduous Forest - Quercus-Fagus Formation

Accordingly, the Willamette Valley is classified as in the Coast Forest Formation. This formation is further sub-divided as follows:

1. Cedar-hemlock forest: Thuja-Tsuga assoc.
 - a. Douglas fir subclimax - Pseudotsuga
consociates
2. Larch-pine forest: Larix-Pinus association

The cedar-hemlock association is the more massive of the two, has fewer dominants, and the composition is less varied. They say this is a direct outcome of moderate

temperatures and excessive rainfalls. Shrubby societies are characteristic of this forest, and forbs are correspondingly reduced. The Willamette Valley, and most of the surrounding foothills of the mountains represent the Douglas fir subclimax of the cedar-hemlock association.

With this discussion of three "zonation" plans based on vegetation, we can turn to one, not based on vegetation, but usually with plants named as prominent indicators of the various zones. This is Merriam's Life Zone plan (67). Merriam's idea was that the distribution of terrestrial animals and plants was governed by the temperature of the period of growth and reproductive activity, and not by the temperature of the whole year. With some obscure figures and this idea in mind, he originated the Life Zones. Life Zones designated by this scheme are the Arctic-Alpine, Hudsonian, Canadian, Transition, Upper Sonoran, Lower Sonoran, and Tropical. These zones are theoretically distributed as circumpolar belts from north to south, but topography and marine influence modify this plan tremendously. On the map of the Life Zones of Oregon (9:frontis.), the Willamette Valley is mapped entirely as transition zone. Peck (69:20) says that the upper limits of the transition zone rise to a maximum altitude of about 1300 meters, but are much lower to the north, on cooler slopes, and in narrow valleys. Of the Upper Sonoran zone, Gabrielson and Jewett (38:33) say

"The farthest northward extensions recognizable are along the Willamette River north of Eugene, where several patches of almost typical Upper Sonoran vegetation are to be found". They are about the first ones to acknowledge the existence of a Sonoran or Austral vegetation in the Willamette Valley, although it has been here since long before man began to devise vegetation distribution schemes. Accompanying this austral vegetation there is a semblance of an austral fauna, and it is the occurrence of the austral avifauna that forms one of the fundamental parts of this thesis. From this it can be seen that I am utilizing two of Merriam's major divisions, i.e., boreal (northern) and austral (southern). Bird species do not seem to agree with Merriam's Hudsonian, Transition, Upper and Lower Sonoran zones.

This scheme of Merriam's has been accepted by many scientists for a good many years, the old Biological Survey being one of its strongest backers. It has proved convenient to ornithologists dealing with small areas and not having to tie the local pattern into the continental pattern. However, within the last two decades it has undergone a great deal of criticism by Kendeigh (56), Shelford (84), Daubenmire (22), and others. All of these criticisms point out many technical errors in computations, lack of proof, poor description of the life zones, and erroneous physiological assumptions. Probably the biggest failure is

that some of the zones cut directly across continuous natural plant formations (such as the grasslands), and also that areas mapped as in the same life zones may have highly dissimilar faunas and floras. Even with all these criticisms, Merriam's terminologies are still in use, and as mentioned earlier, this thesis is utilizing two of them.

In other words, his entire plan has not been condemned. Instead, workers in the fields of ecology and zoogeography are today using parts of his scheme, and establishing new units compatible with the present-day increase of knowledge of climate, soils, environments, animals and past floral and faunal history.

Faunal Schemes

Portraying this trend, two schemes worthy of discussion have been published within the past decade. These are: The Biome (19), and Biotic Provinces (24).

In 1943, Dice published his Biotic Province scheme for North America (24). He divided the continent into twenty-nine biotic provinces, each of which "covers a considerable and continuous geographic area and is characterized by the occurrence of one or more important ecological associations that differ, at least in proportional area covered, from the associations of adjacent provinces" (24:3). There is no need to list here all the provinces that he set up.

He divides these provinces into Biotic Districts which he says cover a "definite and continuous part of the geographic area of a biotic province. Biotic districts are distinguished by ecologic differences of less importance than those that separate biotic provinces" (24:3). There are also vertical provincial subdivisions that may, or may not be continuous, known as Life Belts. Although he prefers to have each life belt limited to a single province, he admits that they "often occupy corresponding positions in adjacent biotic provinces" (24:3). Any ecologically uniform and relatively stable community below the rank of life belt and biotic district he calls an Ecologic Association.

The boundaries between all of these divisions, as with any scheme, can not be sharply defined, for they are not stationary, but slowly and constantly shifting their positions.

The Willamette Valley is within the boundaries of the Oregonian province which extends from northern coastal British Columbia southward, west of the summit of the Cascade Mountains, to southern Oregon, and thence southward through the coast mountains to San Francisco Bay, California (24:31). In Oregon it is bounded on the east by the Palusian and Artemisian, and on the south by the Californian province (24:4).

Dice's hope was that this general plan for North America would stimulate local workers to study and report the details of the subdivisions and relationships of their own particular province. This has recently been done for the Oregonian province (60, 62). Larrison describes three Biotic Districts for this province pertinent to the Willamette Valley, and the Oregon Coast Range districts. So far as they go these districts seem to be valid divisions.

The distribution of the biotic provinces is supposedly based principally upon the vegetation, but the province boundaries conform only slightly to the plant climaxes as mapped by Weaver and Clements (92:frontis.). Besides this criticism of the scheme, there are others. One of the most important is that the scheme is based on the assumption that a biotic province is never discontinuous, thus allowing ecological communities typical of one province to lose their identity in adjacent provinces. However, Dice (24:6) does admit the possibility of species occurrence far beyond the area of its greatest abundance. All of the provinces have been granted equal rank with no explanation of inter-relationships; and finally, the fauna is confined to a certain area, not permitting the existence of an ever-changing assemblage of animals.

This review of the Biotic Province scheme leads us into a discussion of a more tenable distribution scheme -

The Biome Theory. The biome "is regarded as the exact synonym of formation and climax when these are used in the biotic sense" (20:20). In other words, the plant-animal formation is the basic community unit (68:194; 77:135). Therefore, two separate communities, plant and animals, do not exist in the same area (20:20). The biome is characterized by uniformity of physiognomy of the plant climaxes, and in a lesser way by the climax stages. Also it is characterized by a combination of major and minor influent animals, a few climax influents, and many small influents and subinfluents. These influents exert an important effect on the group and habitat. An area made up of several "associations" is given unity by certain binding plant and animal species whose range extends through all the associations.

"The biome is conditioned primarily by climate and secondarily by edaphic and other local conditions during its developmental stages" (18:85). Physical barriers are indirect determinants of biomes since they greatly affect climate and vegetation.

The Life Zone theory differs from the Biome theory in that it approaches the distribution problem emphasizing the effect of physical factors on species, or other taxonomic groups, whereas the biome theory emphasizes the development and distribution of communities (68:195). This scheme differs from Dice's Biotic Provinces chiefly in that the

biome is coincident with its climaxes, no matter how far detached any climax area may be. In opposition, the biotic province is never discontinuous (24:4). To me, this is an argument against Dice's own scheme, for climaxes do occur discontinuously; consequently the better distribution scheme should deal with discontinuities.

The biomes of North America are (77:115):

Tundra (Alpine tundra)

Tundra-Coniferous Forest ecotone
(sub-arctic forest)

Coniferous Forest

Coniferous-Deciduous Forest ecotone
(sub-Canadian forest)

Coniferous-Grassland ecotone
(Aspen parkland)

Deciduous Forest

Oak-Pine subclimax (ecotone)

Pine subclimax

Deciduous Forest-Grassland ecotone
(oak parkland)

Grassland

Sage subclimax

Desert scrub subclimax

Creosote-bush desert

Sagebrush

Coastal Chaparral

Pinon-Juniper - Interior Chaparral

Moist Coniferous Forest

Coastal-Montane Forest ecotone

It will be recognized readily that the biomes have essentially the same units that have been proposed for the plant formations of Clements. According to Odum (68:194) this is because plants are usually dominant in terrestrial habitats. Biomes are determined largely by the "climatic climax" vegetation, but to some extent also by influent animals.

It will be noticed that a considerable proportion of the habitats of the Willamette Valley, previously discussed (see Table III, p. 29), come nicely into the habitat divisions of the biomes just listed.

"Though a biome may be composed of several different life forms, its characteristic physiognomy is due mainly to a single life form in the case of land climaxes,..." (20:229). Pitelka (77:135) says that correlation of birds with vegetation reveals no relation to specific dominants or groups of dominants in a single biome. Consistent correlation, however, does occur between species and the life forms of plants. For instance, thicket birds select bushy growths of a specific density, rather than of a particular shrub species, and coniferous forest birds are usually found in coniferous forest, regardless of species of conifer, showing this preference for a particular habitat, rather than any particular plant species. Going into still finer detail on habitats it can be said that "the presence

of a certain kind of perch or particular sort of forage surface is practically essential to the presence of a given kind of bird whose structures and instincts are adapted to it" (44:183). Pitelka (77:135) says that a true avian indicator of climax communities is confined to a niche which is available within that climax and, barring biotic and geographic factors, does not vary subspecifically. Life forms, then, seem to be very important as a controlling factor in distribution of birds.

In agreement with this, it must be said that many avian species are very adaptable to changing species of vegetation, but are unable to adjust to a change in life forms of habitat structure. Thus it is not uncommon to have a species occupy the climax of one biome, and the seral stages of other biomes (68:198). "Birds which occupy the climax portion of a biome are most frequently restricted to that biome and are indicators of it. This is because the climax life forms are often peculiar to that one biome" (74:248). It should be noted here that, in general, man increases tremendously the areas occupied by seral vegetation, at the expense of the climax areas. Inasmuch as biomes are based on the primitive or potential conditions, it is important to distinguish between these climax and seral stages. Bird distribution is greatly influenced by the dynamic nature of succession. This is

shown when it is remembered that certain species have spread into areas where they previously did not occur, although there has been no change in climate in those areas.

In species ranging over several biomes variation tends to show correlation with climatic factors; among species confined to one major community variation appears to be affected by geographic and biotic factors (77:135). A much better understanding of the facts of bird distribution can be obtained through an appreciation of the laws of biotic succession and recognition of developmental, as well as climax biotic communities over the continent. Habitat is all important in determining local distribution, and also is an important factor in limiting the over-all range.

In concluding this discussion on biomes it should be remembered that the community units include not only the vegetation of a characteristic life form, but also all other vegetation of a developmental or subordinate nature.

The biome scheme, like any other scheme, has its fallacies: It is usually not applicable in the field because animals for which the biome is named may not be found. Although plants and animals of the final stage invade the biome readily, there is often little area in the final stage of development, for the territory of a biome is the area that will be covered by a characteristic biotic climax. This "planning for the future" is not advisable.

In general, a classification system that produces a better correlation of its divisional units with the distribution of a larger number of species, as well as climatic and habitat factors and intra-community relations, will be much better than one which is based on only one system. The scheme devised by Gordon (42) seems to fulfill these requirements.

Valid divisions of North America are the boreal and austral units used in other distributional schemes. From this point, however, Gordon's units differ somewhat from other schemes. An outline of his scheme follows:

A. Boreal

1. Tundran
2. Coniferan
 - a. Northern Coniferous Forest Association
 - b. Subalpine Forest Association
 - c. Montane Forest Association
 - d. Coast Forest Association

B. Austral

1. Deciduan
 - a. Deciduous Forest Association
 - b. Southern Pine Forest Association
2. Sonoran
 - a. Desert Association
 - b. Sagebrush Association
 - c. Short-grass Association

d. Woodland and Chaparral

Gordon's scheme differs from others, chiefly in the following points: The divisions are not limited to any definite geographical area, though they tend to be identified by certain flora and fauna. The divisions are based on a study of the distribution of soil, climate, fauna, vegetation types and past geological history; not just on one or two of the factors, but all of them.

Although these divisions associate one's thought with specific vegetation, they are supposed to be indicated more strongly by the faunal evidence, both past and present. An animal form classified either boreal or austral is certainly not limited to any certain area, for if it is mobile it will spread far beyond the site of origin and will tend to settle in areas where similar suitable conditions may be found. These niches may be quite small, but nevertheless representative of the conditions which fulfill the requirements of this species. Faunistically and floristically two widely separated geographical areas will probably possess very few identical species, though many highly similar forms may exist in both areas. Though widely separated, and differing in plant species, these two areas may be surprisingly similar in the life form structure they present. Under such conditions closely related or similar avian species are often present in both areas. That is, in this way, boreal forms may occur in the regions normally thought

of as austral, and austral forms may occur in the boreal regions.

In the Willamette Valley there are two definite and valid representatives of Gordon's divisions. These are the Coast Forest Association (Fig. 10) of the boreal division, and the Woodland and Chaparral (Fig. 17) of the austral division. A third division, grassland (Fig. 19), must be given a subordinate position to the other two divisions. The grasslands of the valley are not typical of the tall grass, short grass, or bunch grass regions. Instead, they seem to be a stage in the development of one or the other of the two major divisions, Coast Forest, or Woodland and Chaparral. It can not be stated whether these grasslands or meadows are more closely related to the Coast Forest Association, or to the Woodland, because there is a lack of historical records of previous vegetation relations.

The boundaries of the Willamette Valley have been set at an elevation of about 1000 feet, which is not high enough to include another of Gordon's divisions, the Sub-alpine Forest Association, which does exist in western Oregon.

In the Willamette Valley, the Coast Forest Association is represented principally by such animal forms as Trowbridge's Shrew (Sorex trowbridgii), the Pacific shrew (Sorex pacificus), Dusky-footed Wood Rat (Neotoma fuscipes) Mountain Beaver (Aplodontia rufa), Spotted Owl (Strix

occidentalis), Chestnut-backed Chickadee (Parus rufescens), Russet-backed Thrush (Hylocichla ustulata), and the Hermit Warbler (Dendroica occidentalis). Douglas fir is the dominant plant species. Other species discussed in the section on the Willamette Valley habitats occupy relatively smaller areas of the valley. Although the Coast Forest is typically coniferan, certain deciduan avifauna such as Bewick's Wren (Thyromanes bewickii), Cassin's Vireo (Vireo solitarius cassini), and Oregon Towhee (Pipilo maculatus), and plant species such as maple, alder, and ash are representative of developmental stages of the Coast Forest Association.

The austral woodland is represented by such birds as the California Quail (Lophortyx californica), Acorn Woodpecker (Balanosphyra formicivora), Lewis's Woodpecker (Asyndesmus lewis), California Jay (Aphelocoma coerulescens), and Slender-billed Nuthatch (Sitta carolinensis), and by the plant species white oak (this is replaced by the black oak in the southern parts of the valley). Chaparral (Fig. 17) is represented by such birds as the Bush-tits (Psaltiriparus minimus), House Wren (Troglodytes aedon), and Chat (Icteria virens), and by the plant species buckbrush, chinquapin, Scotch broom, madrone, and sometimes scrub or white oak. The grasslands of the valley tend to possess a distinctive austral avifauna that I will discuss in this thesis.

The lack of accurate and detailed historical data on the fauna and flora of the Willamette Valley makes it practically impossible to give any generalized statements about the boreal or austral trend of the fauna or flora at the present time. It seems logical to assume, however, that more austral faunas were present in the valley during geologic periods when more arid conditions existed in the valley than at present. A boreal fauna predominates now, but there are several known examples of quite recent increases in abundance of certain austral birds. Many human activities tend to benefit certain "open country" or austral birds.

THE AUSTRAL AND BOREAL AVIFAUNA

The boreal fauna is a northern fauna, and is closely allied to the fauna of the northern parts of the Old World. On the other hand the austral fauna is more southern, only remotely related to the fauna of the Old World, but possessing many representatives of South American origin, as well as many forms endemic to North America, especially in the southwestern portion.

The austral and boreal birds to be discussed in this thesis constitute a difficult problem of selection. Some of the birds can be placed readily under one or the other of the two classifications, but the proper classification of other birds is more difficult.

In stating that a particular species is austral or boreal I have taken into consideration several factors: the present breeding and wintering ranges of the species; the history of origin and distribution of the family to which it belongs; the relationship to, and distribution of other species of the same genus; and lastly, the general consensus of opinion found in the ornithological literature. These factors would be too voluminous to discuss in detail for each of the avian species that I have selected for this thesis.

There have been approximately 430 avian species recorded in the State of Oregon, of which 261 species have been recorded in the Willamette Valley. Although I have

seen and recorded the greater majority of these species in the Willamette Valley, I must keep the length of this thesis within reasonable bounds by restricting the number of species that I will discuss. Therefore, I will limit this thesis to the habitat relations of the more typical austral and boreal forms, as implied in the thesis title. Those species considered less selective in their habitat, the widespread forms, will not be discussed.

Primarily this has been a field study and not in the laboratory. Consequently, no specimens were collected, and all identifications were made of the living birds. After studying birds for over eight years I feel fully qualified to make this type of identification. However, under our present taxonomic system there are a great many subspecies of birds that are absolutely impossible to distinguish in the field. Collecting is the only accurate means of identification of many of these subspecies. I might add that even a few full species found in our Willamette Valley can not be distinguished readily in the field. A good example of this is the confusion that exists between the immature Audubon warbler and the adult Myrtle warbler. The latter species is one which I had originally planned to use in this thesis, but I have discarded it because of uncertainty in its identification in the field. With these thoughts in mind I think it is wise to use no subspecific scientific

names. Following the trend established by Grinnell and Miller (45), I will use vernacular names that apply to the species as a whole, including all of the subspecies. Some of these vernacular names may not be familiar to everyone. For the sake of clarity, however, the subspecies thought to be present in this area will be mentioned in each discussion.

In dealing with these species, they will be arranged in taxonomic order, regardless of their austral or boreal classification. This policy is best because related species will be grouped together, and thus easily referred to. Here is the full list of 87 species which I will discuss, showing their taxonomic relationships (accuracy of the scientific names has been checked against the American Ornithologists' Union Check-list, and its latest supplements (see 3, 4, 5, 6, 7, 8):

Order Pelecaniformes

Family Pelecanidae

Pelecanus erythrorhynchos - White Pelican

Order Ciconiiformes

Family Ardeidae

Butorides virescens - Green Heron

Casmerodius albus - Common Egret

Nycticorax nycticorax - Black-crowned Night Heron

Order AnseriformesFamily Anatidae

Anas platyrhynchos - Mallard

Anas cyanoptera - Cinnamon Teal

Spatula clypeata - Shoveller

Aix sponsa - Wood Duck

Bucephala clangula - Common Golden-eye

Bucephala albeola - Buffle-head

Histrionicus histrionicus - Harlequin Duck

Oxyura jamaicensis - Ruddy Duck

Lophodytes cucullatus - Hooded Merganser

Order FalconiformesFamily Cathartidae

Cathartes aura - Turkey Vulture

Family Accipitridae

Accipiter gentilis - Goshawk

Buteo lagopus - Common Rough-legged Hawk

Family Falconidae

Falco mexicanus - Prairie Falcon

Order GalliformesFamily Tetraonidae

Dendragapus obscurus - Sooty Grouse

Family Phasianidae

Colinus virginianus - Bob-white

Lophortyx californica - California Quail

Order CharadriiformesFamily Scolopacidae

Numenius phaeopus - Hudsonian Curlew

Totanus melanoleucus - Greater Yellow-legs

Limnodromus griseus - Dowitcher

Capella gallinago - Common Snipe

Family Laridae

Chlidonias niger - Black Tern

Order ColumbiformesFamily Columbidae

Zenaidura macroura - Mourning Dove

Order StrigiformesFamily Tytonidae

Tyto alba - Barn owl

Family Strigidae

Speotyto cunicularia - Burrowing Owl

Strix occidentalis - Spotted Owl

Strix nebulosa - Great Gray Owl

Asio flammeus - Short-eared Owl

Order MicropodiformesFamily Trochilidae

Selasphorus rufus - Rufous Hummingbird

Order PiciformesFamily Picidae

Hylatomus pileatus - Pileated Woodpecker

Balanosphyra formicivora - Acorn Woodpecker

Asyndesmus lewis - Lewis's Woodpecker

Sphyrapicus varius - Yellow-bellied Sapsucker

Order PasseriformesFamily Tyrannidae

Tyrannus verticalis - Western Kingbird

Sayornis nigricans - Black Phoebe

Sayornis saya - Say's Phoebe

Nuttallornis borealis - Olive-sided Flycatcher

Family Corvidae

Perisoreus canadensis - Canada Jay

Cyanocitta stelleri - Steller's Jay

Aphelocoma coerulescens - California Jay

Corvus corax - Holarctic Raven

Family Paridae

Parus rufescens - Chestnut-backed Chickadee

Psaltiriparus minimus - Bush-tit

Family Sittidae

Sitta carolinensis - White-breasted Nuthatch

Sitta canadensis - Red-breasted Nuthatch

Family Certhiidae

Certhia familiaris - Brown Creeper

Family ChamaeidaeChamaea fasciata - Wren-titFamily TroglodytidaeTroglodytes aedon - House WrenTroglodytes troglodytes - Winter WrenThryomanes bewickii - Bewick's WrenTelmatodytes palustris - Long-billed Marsh WrenSalpinctes obsoletus - Rock WrenFamily TurdidaeIxoreus naevius - Varied ThrushHylocichla guttata - Hermit ThrushHylocichla ustulata - Swainson's ThrushSialia currucoides - Mountain BluebirdMyadestes townsendi - Townsend's SolitaireFamily MotacillidaeAnthus spinoletta - Water PipitFamily LaniidaeLanius excubitor - Boreal ShrikeFamily VireonidaeVireo huttoni - Hutton's VireoVireo solitarius - Solitary VireoVireo gilvus - Warbling VireoFamily ParulidaeVermivora celata - Orange-crowned WarblerDendroica nigrescens - Black-throated Gray WarblerDendroica townsendi - Townsend's Warbler

Family Parulidae(continued)Dendroica occidentalis - Hermit WarblerIcteria virens - ChatWilsonia pusilla - Pileolated WarblerFamily IcteridaeXanthocephalus xanthocephalus - Yellow-headed
BlackbirdFamily ThraupidaePiranga ludoviciana - Western TanagerFamily FringillidaePheucticus melanocephalus - Black-headed GrosbeakPasserina amoena - Lazuli BuntingHesperiphona vespertina - Evening GrosbeakCarpodacus purpureus - Purple FinchCarpodacus mexicanus - House FinchSpinus pinus - Pine SiskinSpinus psaltria - Arkansas GoldfinchLoxia curvirostra - Red CrossbillPipilo maculatus - Spotted TowheeCalamospiza melanocorys - Lark BuntingChondestes grammacus - Lark SparrowSpizella passerina - Chipping SparrowZonotrichia leucophrys - White-crowned SparrowZonotrichia coronata - Golden-crowned Sparrow

Here is a list of the birds that I have classified
as being typically austral:

<u>Pelecanus erythrorhynchos</u>	<u>Psaltriparus minimus</u>
<u>Butorides virescens</u>	<u>Sitta carolinensis</u>
<u>Casmerodius albus</u>	<u>Chamaea fasciata</u>
<u>Nycticorax nycticorax</u>	<u>Troglodytes aedon</u>
<u>Anas cyanoptera</u>	<u>Thryomanes bewickii</u>
<u>Aix sponsa</u>	<u>Telmatodytes palustris</u>
<u>Oxyura jamaicensis</u>	<u>Salpinctes obsoletus</u>
<u>Cathartes aura</u>	<u>Vireo solitarius</u>
<u>Falco mexicanus</u>	<u>Vireo gilvus</u>
<u>Colinus virginianus</u>	<u>Dendroica nigrescens</u>
<u>Lophortyx californica</u>	<u>Icteria virens</u>
<u>Zenaidura macroura</u>	<u>Xanthocephalus xanthocephalus</u>
<u>Tyto alba</u>	<u>Pheucticus melanocephalus</u>
<u>Speotyto cunicularia</u>	<u>Passerina amoena</u>
<u>Selasphorus rufus</u>	<u>Carpodacus mexicanus</u>
<u>Balanosphyra formicivora</u>	<u>Spinus psaltria</u>
<u>Asyndesmus lewis</u>	<u>Pipilo maculatus</u>
<u>Tyrannus verticalis</u>	<u>Calamospiza melanocorys</u>
<u>Sayornis nigricans</u>	<u>Chondestes grammacus</u>
<u>Sayornis saya</u>	<u>Spizella passerina</u>
<u>Aphelocoma coerulescens</u>	total - 41 species

Here is a list of the birds that I have classified
as being typically boreal:

Anas platyrhynchos

Spatula clypeata

Bucephala clangula

Bucephala albeola

Histrionicus histrionicus

Lophodytes cucullatus

Accipiter gentilis

Buteo lagopus

Dendragapus obscurus

Numenius phaeopus

Totanus melanoleucus

Limnodromus griseus

Capella gallinago

Chlidonias niger

Strix occidentalis

Strix nebulosa

Asio flammeus

Hylatomus pileatus

Sphyrapicus varius

Nuttallornis borealis

Perisoreus canadensis

Cyanocitta stelleri

Corvus corax

Parus rufescens

Sitta canadensis

Certhia familiaris

Troglodytes troglodytes

Ixoreus naevius

Hylocichla guttata

Hylocichla ustulata

Sialia currucoides

Myadestes townsendi

Anthus spinoletta

Lanius excubitor

Vireo huttoni

Vermivora celata

Dendroica townsendi

Dendroica occidentalis

Wilsonia pusilla

Piranga ludoviciana

Hesperiphona vespertina

Carpodacus purpureus

Spinus pinus

Loxia curvirostra

Zonotrichia leucophrys

Zonotrichia coronata

total - 46 species

I will try to follow the same general pattern of discussion for each of these except where a lack of data does not permit me to do so. I will give the overall breeding range of the species, the range of the supposed local subspecies, its distribution and status in Oregon and the Willamette Valley. Then I will mention the austral or boreal classification of the bird, and its habitat occurrence as given by other authors. The remainder of the text on each species will be based on my notes and the records of my colleagues - data on habitat occurrences, nesting data, and miscellaneous habits of the species, followed by a short summary. Where enough habitat observations of a species have been made, they will be found in chart form with habitats and months as coordinates. The number then listed will be the number of times a species has been seen in a particular habitat during each month they were observed. The discussions of the 87 species follow:

PELECANIDAEPelecanus erythrorhynchos

White pelican

The white pelican breeds in the lake regions of the interior of western North America from Manitoba west to southern British Columbia and south to the Salton Sea in California. In Oregon, Gabrielson and Jewett (38:90) say this bird "Breeds, or formerly bred, in Klamath, Lake, and Harney Counties. Now much reduced in numbers". No mention is made of the summer colony that we have found established at Fern Ridge in Lane County. This pelican seems to be a spring and summer resident in the Willamette Valley.

Because of the southerly breeding range I have placed the white pelican on the austral list. Throughout its range the habitat of this bird seems to be the larger, fresh-water lakes that contain islands for nesting, as well as an abundant fish food supply. The Fern Ridge Reservoir area provides a habitat of these qualifications.

Gullion (49:17) has recorded them at Fern Ridge from April 19 to November 15. He estimates the population at over 100 individuals. I have seen them at Fern Ridge during the months of May, June, July, August, and September, but I have never seen over 50 individuals in any one day over the entire reservoir area. The presence of this colony in the valley during their breeding season would indicate they breed here, but so far neither Gullion or I

have found any evidence that they do breed. Suitable islands are available for this purpose. On May 1, 1948 I did observe some birds with the upright "horn" on the upper mandible which is indicative of the breeding season. In the late summer a flock of these birds will take off together, circle over the area, and soar to heights of several thousand feet above the water.

In summary, it seems that the white pelican has become a resident of the Willamette Valley within the last few years through the creation and gradual improvement of a suitable habitat following the erection of Fern Ridge Dam in Lane County. Their presence during the entire breeding season means that they should breed at Fern Ridge, possibly within the next year or two.

ARDEIDAEButorides virescens

Green Heron

The green heron breeds from the northern United States and southern Quebec south to the Gulf of Mexico and South America. Anthony's Green Heron (B. v. anthonyi), our local subspecies, breeds from Washington south to Lower California and northern Mexico. In the Willamette Valley it has become established as a breeding species, present from March to October. A few individuals winter here, as they do in the Seattle area of Puget Sound, Washington (61:87).

The overall range of the green heron subspecies indicates a southern center of abundance, and so this species is listed as an austral form. Primarily, its habitat seems to be the willow-bordered sloughs, ponds or lakes, and slow-flowing streams at low elevations.

The bird is present from March to December, the earliest date being March 19, and the latest, December 27 (49:19). This would seem to indicate it is a permanent resident, at least in small numbers here in the valley. Most of the individual birds have established their summer's location by late May or early June. Very few birds are seen after mid-September.

Here in the Willamette Valley I have seen it most often about the willow or ash-bordered ponds or lakes, and

sloughs along the Willamette River and other large streams on the valley floor. Some other habitats in which I have observed the green heron are at the local swamp; a creek flowing through the city of Salem, just 3 blocks from the state capitol; once on the Commerce building on the Oregon State College campus (43:51); and once on the South Santiam River, feeding in pools in exposed bedrock during late summer. It always stays close to brush and deciduous tree cover, for I have seen it in open areas very seldom.

It seems that the green heron has always been quite rare in Oregon, and it hasn't been until recent years that their abundance has increased greatly. They are now a common summer resident throughout the Willamette Valley, as discussed by Graf (43:51). With all the observations made on this species in recent years it seems quite unusual that no actual nesting was found until 1946. In June, 1942 I observed adults, with two young birds that could barely fly, in the willows at the edge of Horseshoe Lake in northern Marion County. Jewett (54:219) reported a young green heron in Portland in 1944. These are indirect, but quite sure records of nesting, for the young were not able to fly any distance when they were observed. Finally, in July (18), 1946, I found two nests of the green heron (28:322-3). The first nest was found on the east side of a small lake about 4 miles east of Corvallis, in Linn County (Fig. 20). The nest was in an ash tree, and was about 12

feet above the water. It was well-shaded, even though the tree was in the direct rays of the hot afternoon sun. Two downy young and three pale blue eggs were in the nest (Fig. 24). The three eggs never did hatch. The young left the nest by July 31, and they remained about the lake till at least August 26, for that was the last time I saw them. They were recognized by the leg bands I put on them. The second nest was "suspected" on July 1, but was not located until July 18, by which time the nest had been vacated. The nest was 15 feet over water in a willow (Salix lasian-dra) on the east side of Stewart Lake, two miles north of Corvallis, in Benton County. On July 23 I saw a single young of the year perched on a snag at this lake. Mr. Ben Pruitt located a nest containing five young at Thurston, in Lane County, in July, 1947. The nest was in an alder on the north side of a small overflow slough near the McKenzie River, at about 15 feet above the water. Again, on June 23, 1948, a nest containing four young was found on the south side of this same slough, just 100 feet from the 1947 nest. This nest was on the drooping branch of a large hazel bush about 8 feet above the water.

From the observations and evidence at hand, the green heron is an established breeding, and sometimes a wintering species closely associated with ponds and sloughs, in the deciduous oak, ash, and willow tree and brush areas on the floor of the Willamette Valley.

Casmerodius albus

Common Egret

The common or American egret breeds in Oregon and California, and from Arkansas and North Carolina south into South America. In Oregon it is a summer resident and breeding species in Klamath and Harney Counties. It has been recorded several times in Lake county, too, and Gabrielson and Jewett (38:107) list a single occurrence in Multnomah County in September. In the Willamette Valley it is, as yet, a straggler.

Gabrielson and Jewett (38:34) place this egret as a sonoran form, and its entirely southerly breeding range would seem to indicate beyond a doubt that it is an austral bird. Grinnell and Miller (45:59) give the habitat of this bird as "Marshes, tide-flats, irrigated lands, and margins of rivers and lakes".

The American egret seems to be a sporadic visitor to the Willamette Valley, and from my own notes, only in the spring and summer months; all my observations were made in 1947 when, for some reason or another, the egret appeared in the valley in numbers never recorded before. I saw a single one at a local swamp on May 6. Gullion (49:19) reported one at Fern Ridge on May 3, which could very well have been the same bird that I saw wandering north three days later. At the swamp I saw five of them on August 9,

2 on August 13 (Fig. 25), and 1 on August 29. At Fern Ridge I saw 4 of them on August 8, and 3 on August 29. The August records could be post-breeding wanderings from the breeding colony in Klamath County, but the records by Gullion and I for early May cannot be called post-breeding wanderings. Instead, this bird, or these two birds came into the Willamette Valley on their spring migration flight. If there were more observers in the Willamette Valley, perhaps we would know where these birds were in June and July.

The egrets observed at Fern Ridge inhabited the margins of spike-rush (Eleocharis) and cat-tail (Typha latifolia) growths (Fig. 23). On August 9 I watched two of these birds busily catching bullfrog (Rana catesbiana) tadpoles from the shallow water among the areas of spike-rush at the south end of the local swamp. One of the birds had taken so many of the tadpoles that its neck was bulged irregularly all the way back to the body proper. At the same time, 3 other birds were observed over the central and northern parts of the swamp, feeding in the clear, shallow channels running through the smart-weed (Polygonum hydropiperoides). These birds utilized the water-killed ash trees at the margin of the swamp as perches.

This egret has been observed in numbers only in 1947, so it is rather likely that their occurrence here was only

accidental. The local swamp and Fern Ridge both provide suitable habitats for feeding and nesting. This species may become established as a breeding bird in the future.

Nycticorax nycticorax

Black-crowned Night Heron

The black-crowned night heron breeds from northern Oregon and extreme southeastern Canada south to Paraguay in South America. In Oregon it is a summer resident, and occurs less abundantly as a winter resident. It seems to be more common in eastern Oregon. It used to be quite common around Portland according to Gabrielson and Jewett (38: 111) but has decreased in recent years. In the Willamette Valley it is not recorded very often although suitable habitats are available.

This heron is listed as austral because of the extent of its breeding range, and because the center of abundance is south of the United States. Grinnell and Miller (45:61) give some data on its habitat activities: "Forages along margins of lakes and mud-bordered bays and in marshy places where there is standing or slow-running water. Roosts usually in dense foliage of trees, but not necessarily near marshy ground. Nests in colonies, usually in trees, occasionally in tule patches".

In my experience this bird is one of the rarest. I saw one on December 6, 1941 at the edge of a drainage ditch

grown to aquatic vegetation in a field about 9 miles south of Corvallis. Gullion (49:20) saw one along the Willamette River on October 5, 1940. These are the only records in recent years.

Very little can be said about this bird's habitat occurrence in the valley for it has been recorded a comparatively few times. It has stayed close to an aquatic habitat in both cases mentioned above. Many more observations are needed on this species.

ANATIDAEAnas platyrhynchos

Mallard

The mallard ranges over at least the northern half of the northern hemisphere, both in Eurasia, and in North America. In North America it breeds south to Virginia, Missouri, Kansas, New Mexico, and Lower California. It is a permanent resident in Oregon. Abundance in the Willamette Valley is greatly increased by migrants from the north during the late fall and winter months. It is probable that many of those birds present in the summer are adjusted to milder conditions, and so they actually head south for the winter, being replaced by birds from the north.

I have placed this species on the boreal list because of its northern or holarctic distribution. Its normal habitats are fresh-water lakes, ponds, rivers, sloughs, and marshes.

The following list shows the number of field trips on which mallards were recorded during each month:

January - 12	May - 25	September - 11
February - 35	June - 6	October - 9
March - 33	July - 7	November - 8
April - 21	August - 15	December - 9
Total - 191 times		

This list seems to indicate the greatest abundance in

late winter and early spring, and this indication is correct for I have weekly data on the abundance of the various species of waterfowl at the local swamp throughout the year.

Nesting dates and nesting sites vary considerable in this species. Pairing begins while the winter flocks are still in the valley in February and early March, and most of the birds are paired before they migrate northward. The resident birds are paired and I have found full sets of eggs as early as April 13. Egg-laying continues into late May, at least, for small downy young have been seen at the local swamp as late as June 17. Adult birds enter the molting period about the time the young begin to shift for themselves. I have captured adults with primaries about $1\frac{1}{2}$ inches long as early as July 23 at Stewart Lake, north of Corvallis.

Nesting sites are varied. Charles Cutress tells me of a nest he found April 2, 1940, 60 feet from Milwaukee Lake, Clackamas County, at the base of an alder. At the local swamp nests are usually in clumps of slough sedge (Carex obnupta) which are either growing by themselves or in conjunction with hardhack (Spirea Douglassii). Nests are usually made of available local materials, and lined with down. At Fern Ridge a nest was situated on the north slope of a dike, the marsh area being to the south of the dike (Fig. 26). Other types of nest locations are found. For

instance, along small meandering creeks and sloughs, nests are often found in trees. One nest was in an alder, on a horizontal limb, 15 feet from the main trunk, and 12 feet above the water of the creek. Another nest was located on a pile of dry grass left on some dead branches hanging over the water (by the winter's high water, I presume). The nest was just 15 inches above the water. Unfortunately, there were two direct connections from the nest to the nearby bank, and the eggs were destroyed by some mammalian predator.

An idea of the winter abundance of the mallard can be given for the local swamp. Numbers increased through the winter, reaching a maximum of about 1500 birds in January, with as many as 700 present as late as March, the numbers dropping off rapidly thereafter. Summer residents may total 6 or 8 pairs.

In the winter the mallards spend much of their time feeding in shallow water, wherever it may be - the edges of lakes, rivers, or marshes, or the winter pools of the cultivated fields of the valley. The areas in which they feed are usually open, but during periods of strong, cold winds very few birds will be seen. They are in the brush and tree areas where water is available, and they are sheltered from the wind.

Winter or summer, feeding or nesting, the mallard adheres closely to an aquatic habitat.

Anas cyanoptera

Cinnamon Teal

The cinnamon teal breeds in western North America from the east base of the Rocky Mountains west to southern British Columbia, northwestern Washington, central Oregon, and south through California (except in the extreme northwestern section) and New Mexico. In Oregon it is a breeder in the marshes of the eastern part of the State. It is a straggler in the Willamette Valley.

The breeding range of this duck centers in the Great Basin and desert areas of the southwestern United States. Gabrielson and Jewett list it as a sonoran form (38:34). With these facts in mind I have classified the cinnamon teal as an austral bird. Throughout its range it is restricted to fresh water, in the vicinity of tule and grass-bordered ponds, irrigation ditches, sloughs, and slow-moving streams.

No record was made of this duck in the Willamette Valley until 1942 when a field zoology class saw a brilliantly plumaged male at the local swamp (27:28). Since that first record, they have been observed at the local swamp on the following dates: April 8, 13, 14, 20, 22, and May 18. At Fern Ridge I have seen them on June 13, and September 28. Gordon Gullion has recorded them at Fern Ridge between June 5 and November 16 (49:26). He indicates a nesting record

for the Fern Ridge area, for on July 28 he recorded adults and 9 young. These were seen again on August 3. This is the first breeding record for the Willamette Valley. Several "blue-winged" females have been observed alone, and consequently I cannot state whether they were cinnamon or blue-winged teal.

These two areas where the cinnamon teal has been seen are both marshy habitats (Fig. 22, 23), the vegetation consisting of such plants as smartweeds, spike-rush, sedges, and cattails, interspersed with patches of open water. These teal do not inhabit areas of brush and trees.

The very recent appearance of the cinnamon teal in the Willamette Valley is difficult to explain, but I feel that one of two explanations is the answer. Either the birds did just "discover" the valley within the past few years, or else they have been here as stragglers all along, the bird students of the past failing to observe them. Both of these reasons have about equal strength of argument.

In either case, the cinnamon teal has been recorded quite frequently as a straggler within the past few years, and it appears that this bird breeds occasionally in the Willamette Valley, contrary to existing knowledge found in the literature. In the valley, it is found in habitat/niches similar to those which it occupies over most of its breeding range elsewhere in the United States.

Spatula clypeata

Shoveller

The shoveller is holoarctic in its distribution, being found in northern Eurasia, and North America. In North America it breeds south to Indiana, Colorado, New Mexico, and southern California. In Oregon it supposedly breeds only east of the Cascades. In the Willamette Valley it is a common winter resident.

The shoveller is placed on the boreal list because of its wide breeding range in the northern hemisphere. Grinnell and Miller (45:80) give its typical habitat as "shallow fresh-water or brackish ponds, sloughs and estuaries, and adjacent marshlands. Seeks open water of larger lakes, and even bays of seacoast, for loafing and safety".

I have observed shovellers on 68 different field trips here in the Willamette Valley anytime from August through May. Gullion (49:27) reports them as late as June 16 at Fern Ridge. This would almost classify them as permanent residents, for July is the only month in which they have not been recorded. The number of trips I have seen them on each month is given in the following list:

January - 7	May 5	November - 6
February - 13	August - 1	December - 1
March - 12	September - 4	
April - 14	October - 5	

In my experiences here in the valley, the shovellers do not occur on running water areas, but stay on the ponds (Fig. 20), lakes, and marshes (Fig. 22). At the same time, they do not occur in wooded areas to the extent that mallards will. I have no data or records of nesting here in the valley, but with some of the birds staying into June, there is a possibility that nesting may sometimes occur.

The winter abundance of the shoveller varies, for in early winter (October and November) I have seen over 250 birds at the local swamp, but the abundance decreases greatly the following months, evidently as more of the birds move on south, leaving few birds here in December and January; Numbers increase again in February, reaching a peak in March, with the migrants leaving for the north in April, few staying on into May.

Some pairing begins to take place in late March. In April I have observed that there are from 4 to 5 times as many unattached adults and immatures that are surplus, as there are paired birds.

In summary, the shoveller has been recorded in the Willamette Valley in every month but July. It reaches two peaks of abundance, in the late fall, and in spring. Its winter habitat seems to be the more open water areas of the valley, about the larger bodies of water.

Aix sponsa

Wood Duck

The breeding range of the wood duck is from extreme southern Canada south to the West Indies and the southern United States. In Oregon it is found mainly west of the Cascades, but also it is in scattered localities east of the Cascades. It is a permanent resident in the Willamette Valley.

The majority of this duck's breeding range is in the United States, and here is closely restricted to the areas of deciduan growth. It has been placed on the austral list of birds. Grinnell and Miller (45:81) give the following complete habitat description for this duck in California: "Exclusively fresh-water areas; preferably slow-moving, lower parts of rivers, and secluded bottomland sloughs and ponds, especially where screened by deciduous trees such as willows, cottonwoods and valley oaks. Acorns commonly are taken as food. Large trees in the riparian woodland afford the nesting cavities above ground required by this species".

Here in the Willamette Valley I have recorded the wood duck on exactly 90 different field trips. The number of times they were seen in each habitat is given on the following chart:

	Lakes	Swamps	Streams	Total
January		1		1
February			3	3
March	4	2	7	13
April	3	5	8	16
May	4	11	4	19
June	2	2	1	5
July	4	2	2	8
August	6	3	2	11
September	5		1	6
October	1	3	3	7
November				
December	1			1
Total	30	29	31	90

These three habitat divisions have two things in common - water and deciduous trees. The "lakes" division includes both large and very small bodies of water (Fig. 20); "swamps" includes marshy habitats (Fig. 21, 22); and "streams" include backwater sloughs of the Willamette River as well as creeks and rivers. Wood ducks have been seen in each of these habitats chiefly on the main valley floor, being absent from similar habitats in higher side valleys, or hill ranges and foothill spurs at the edge of the valley. Those seen along rivers and streams have all been seen in the quieter portions of these waters, and not in areas of rapids and swelling currents. The main deciduous

trees associated with these habitats are the white oak, Oregon ash, maple, willows, and cottonwood. Another feature of these habitats is that there is usually considerable brush growth present.

The earliest that I have observed courtship is April 24, in Linn County, but Charles Cutress has told me of a nest containing 13 eggs that he found on April 22. This nest was at a height of 35 feet in a dead bigleaf maple, and only five feet from a screech owl nest in the same tree. I have seen downy young as early as May 23, and young still attended by the parents as late as July 13. One bird was seen on August 13 in flightless, molting condition.

Wood ducks tend to flock into small groups in late summer, and early spring, and into very large groups in mid-winter. They are most often seen during the period of small-group flocking during the spring and fall. During the breeding season the pairs are well-scattered and hence are not observed so easily. Various observers have told of seeing flocks of perhaps several hundred during the winter, but the largest flock I have recorded was one numbering about 90 individuals on an exposed mud bar at Fern Ridge Reservoir (Fig. 23) on December 7. 75 per cent of this flock were males.

In summary, the wood duck is a permanent resident in the Willamette Valley, most often seen from early spring to

late fall, and infrequently during the winter months because the birds tend to congregate in quite large flocks on the larger water areas of the valley. If these areas were visited regularly all through the winter, perhaps they would be recorded as frequently as they are during the seasons when they are scattered through the variety of habitats which I have discussed. All these habitats have deciduous trees, with considerable brush growth, and although they occur widely over the valley area, the wood ducks stay quite close to those habitats occupying the lower elevations of the valley floor.

Bucephala clangula

Common Golden-eye

The common golden-eye breeds from the extreme northeastern and north-central part of the United States north to the limit of large trees in Yukon and Alaska. It is a winter resident in Oregon, rarely seen in the Willamette Valley.

The breeding range of this duck indicates it is a boreal bird. Its winter range seems to be primarily in the salt-water bays of our coast, although it also winters on the larger rivers such as the Columbia, and other large streams.

I have only three records of this golden-eye in the

Willamette Valley: April 13, and 20, and May 1, all in 1948. This single male bird stayed on the small patches of open water at the local swamp (Fig. 22), presumably throughout this period of 3 weeks. Grinnell and Miller state that it "prefers open, quiet water of lesser depth" (45:85) so it seems that this individual I observed was in a normal habitat.

The common golden-eye is a rare winter resident of western Oregon, for I know of no other records of this species in the valley proper.

Bucephala albeola

Buffle-head

The buffle-head breeding area ranges from central Alaska and northern MacKenzie south in the mountains to northeastern California, northern Montana, northern Minnesota and central Ontario. In Oregon, it is a winter resident and rare summer breeder (29:169). In the Willamette Valley it is a winter resident.

I have placed this duck in the boreal list because of its entirely northern breeding range. Grinnell and Miller give a good habitat description for this species: "In winter, chiefly coastal bays and salt-water sloughs; otherwise both fresh-water and alkali lakes and ponds in interior.... In summer, timber-bordered lakes in mountains"(45:86).

I have recorded the buffle-head 15 times in the Willamette Valley. The earliest date I have seen them is November 19 and the latest date is June 13. Gabrielson and Jewett state from their records: "Our earliest date is September 20 (Lake County); our latest, May 15 (Tillamook County)"(38:164). Their earliest date for the State is a full two months ahead of my records for the valley, and I have seen them here in the valley a full month later than their records show. Most of my observations have been in late winter and early spring, few birds being seen before or after that period. 3 males and 3 females is the largest group I have seen at any one time. In the winter they occur on ponds and lakes (Fig. 20), and in swamp areas where they stay more in the open water (Fig. 22). The two birds seen on June 13 were either immatures or females, for the immature birds resemble the adult female. These birds were in open water of the local swamp (Fig. 25) in company with a hooded merganser.

Very little information is available of their winter habitat in the valley, except that they stay on the open water rather than brushy areas.

Histrionicus histrionicus

Harlequin Duck

The harlequin duck breeds from Alaska and MacKenzie southward in the mountains to Colorado and California. In

Oregon it is a permanent resident, breeding along mountain streams in the Cascades and Wallowas. It winters on the coast. Non-breeding individuals remain on the coast through the breeding season. In the Willamette Valley the bird occurs during the spring and summer at the very margin of the valley, in suitable habitat along typical mountain streams, in the foothill areas of the Cascades.

Gabrielson and Jewett classify this duck as representative of the Canadian zone (38:39), and Grinnell and Miller state that it breeds only in the transition and boreal zones in California (45:88). Taking the present northern breeding range of this species, together with the opinions of these authors, I have listed the harlequin duck as a boreal bird.

I have seen harlequin ducks on four different occasions here in the valley: On the Mollala River 3 miles southeast of Molalla in Clackamas County, on April 12. This was a male riding downstream on the current, feeding as he went by me. On March 14 I observed two males on the Mary's River just south of Corvallis, Benton County. On March 19 I saw a single male on the Molalla River just upstream from the U. S. 99E highway bridge. On June 13 and 14 I observed a female along one particular stretch of the North Santiam River in Marion County. She would dive into the swift current and swim as much as 30 feet across the current underwater. Three of these observations were in

the harlequin duck's typical habitat - swift mountain streams of the Cascades, but the fourth, the 2 males on the Mary's River in Benton County is rather unusual, for no records have been made on any stream on the east side of the Coast Range. Also, this part of the Mary's River is a quiet, deep-flowing, meandering valley-bottom stream, rather than a swift mountain stream. Perhaps they were just resting on their flight across the State into the Cascades.

Although very few records are available, this duck must nest on most of the streams coming out of the Cascades on the east side of the valley. All the birds seen on the east side of the valley were on the lower reaches of typical streams, indicating the habitat they prefer.

Oxyura jamaicensis

Ruddy Duck

The ruddy duck has a spotty breeding range from northern Manitoba south to Wisconsin, Iowa, and the West Indies, west to southern British Columbia, eastern Oregon, and Lower California. In Oregon it has been reported as breeding in Klamath, Lake, and Harney Counties. In winter it is found wherever open water exists, on the coast, or inland. It is a winter resident in the Willamette Valley.

From its wide breeding range it is difficult to state whether the ruddy duck is boreal or austral, but the majority of its breeding range is in areas where a predominance

of austral forms are found, and its closest related subspecies are even more definitely austral. It seems that the important factor for breeding habitat is a marshy bordered pond or lake. It breeds in austral areas of eastern Oregon so I have placed the ruddy duck on the austral list.

I have recorded the ruddy duck over 30 times here in the valley. A few times in fall and early winter, the earliest date being September 28; but most frequently in late winter and early spring, the latest date being April 25. From my notes, it seems that the late winter period is also their period of greatest concentration. I have seen 15 to 20 of these ducks at one time. They tend to inhabit the more open water areas of the marshes (Fig. 22) and lakes or ponds during the winter.

No breeding records, or even summer resident records have been made in the Willamette Valley, its status here being that of a winter resident.

Lophodytes cucullatus

Hooded Merganser

The hooded merganser breeds from southeastern Alaska across southern Canada to Maine, south to Georgia, Iowa, Wyoming and Oregon. In Oregon it is a permanent resident, more common west of the Cascades in the Willamette Valley.

The breeding range of this species makes it difficult to classify it as either austral or boreal. Even though

the species does breed over considerable of the deciduous forest area of the eastern United States, more of its range is to the north, and it does not winter very far south. Therefore I am placing it in the boreal list.

Over its range its habitat seems to be ponds and slow-moving streams. Deciduous trees predominate in the vicinity of these ponds and streams. I have observed the hooded merganser 23 times in the Willamette Valley, distributed through the months as follows:

January - 1	May - 6	November - 1
February - 3	June - 5	December - 1
March - 3	July - 1	
April - 1	October - 1	

With the exception of one pair observed on a small lake atop one of the foothill spurs on the east side of the valley near Abiqua Creek, Marion County in March, 1944, all of these birds have been observed on the floor of the valley along slow-moving streams, or ponds and swamps. In the Willamette Valley these areas support a river bottom habitat of deciduous species of maple, ash, willow, and oak, all species which furnish suitable nesting sites for this merganser.

From the list of the number of times I have observed the species each month, it can be seen that this merganser scatters out, and is seen infrequently from mid-summer to late winter. In late winter more birds are seen, and pairs

are seen in March. Nesting seems to take place in April for these birds are very secretive and seldom seen during this time. Then, in May they are seen commonly with their families of young. Young have been seen attended by the parents as early as May 10, and as late as June 25. Young birds, regardless of sex, possess a plumage similar to the adult female, and they retain this until the fall of the second year. This condition makes sex identification difficult, except when a pair of adult birds is observed with small young. There is no question about the adult male plumage, however.

In summary, the hooded merganser is a bird that is chiefly boreal in its distribution, but is more or less confined to deciduous tree areas along pond and stream borders where its living and nesting requirements are met.

CATHARTIDAE

Cathartes aura

Turkey Vulture

The turkey vulture breeds from extreme southern Canada south to the Gulf of Mexico and Mexico. It is a common summer resident in Oregon.

The turkey vulture is an austral bird, for its breeding range is entirely southern; it does not breed in the high mountains, and the origin of the New World Vultures is southern.

This vulture is one of the earliest migrants to arrive in spring, my earliest record being February 15. Most often they do not arrive until the end of the first week in March, however. The latest record I have is October 28, though most of the birds leave by late September. I have recorded it 161 times in the following valley habitats:

	Fir	Fir-Oak	Oak-Ash-Open	Open	Total
February		1			1
March		1	13	8	22
April	3	9	20	3	35
May	3	8	18	5	34
June	2	4	7	4	17
July		2		3	5
August	2	8	9	3	22
September	1	6	11	4	22

chart continued:

	Fir	Fir-Oak	Oak-Ash-Open	Open	Total
October			3		3
Total	11	39	81	30	161

The majority of these habitats were recorded as feeding habitats, as I have seen the vulture very seldom at other activities. Its tendency to stay to open areas (Fig. 19) would seem to indicate that it hunts its food more by eyesight than by the sense of smell, for the latter sense would be equally effective in wooded as well as open areas.

Nests are supposed to be situated on rocky cliffs, and other sites on the ground, but I have never found a nest. Gullion (49:30) records a nest on the south side of Spencer Butte in Lane County, in July, 1942.

During the spring migration, these birds move northward in small flocks, circling low over the countryside. Mr. Ben Pruitt saw 280 of these birds pass by one point in one and a half hours at Thurston. In the fall, small flocks are similarly observed circling southward.

In summary, the vulture inhabits the open areas of the Willamette Valley, seldom getting into the forested areas, except on feeding flights. It is a common summer resident, and must nest commonly here, although only one nest site has been found.

ACCIPITRIDAAccipiter gentilis

Goshawk

The goshawk breeds from the northern limits of timber south to the northern United States, and along the mountains to California, New Mexico, and Maryland. It is a permanent resident of the Blue and Cascade Mountains in Oregon. It is a rare winter visitor to the Willamette Valley.

This bird has been placed on the boreal list because of its northern breeding range, and restriction to the forested areas. Grinnell and Miller give its winter habitat as lowlands in which it "frequents broken woodland principally" (45:98).

I have never observed the goshawk in the Willamette Valley, but Gordon Gullion has seen it four times in the Eugene-Fern Ridge area (49:32). The dates he observed it were January 21, February 1, May 31, and December 28. The May 31 observation is very late for the valley, because the species breeds in April and May in the high Cascades.

The area in which the birds were seen is open grassland, and scattered oak groves, with a small amount of fir and pine on the hills. No further information can be given on the winter habitat of the goshawk because of the deficiency of recorded observations.

Buteo lagopus

Common Rough-legged Hawk

The common rough-legged hawk breeds over North America south to southern Canada. In Oregon it is a migrant and winter resident in the eastern part of the State. Gabrielson and Jewett say it is a rare straggler to western Oregon.

The entirely northern breeding range of this bird indicates it is a boreal bird. Grinnell and Miller say that its habitat is "Open, usually level, grassland or bare plains" (45:103).

I have observed this species seven times in the valley area, all in open field or grass-like prairie habitats (Fig. 19), or over the local swamp area. The earliest I have seen them is September 20, but the rest have been during the winter months of December, January, February, and March. Jewett recently reported one taken January 9 at Jennings Lodge in Clackamas County (55:13).

It seems that this hawk has the same winter habitat in the valley as reported for the California area.

FALCONIDAEFalco mexicanus

Prairie Falcon

The breeding range of the prairie falcon is in western North American from southern British Columbia and Saskatchewan south to Mexico. In Oregon it is a permanent resident east of the Cascades, and is recorded as a straggler in western Oregon.

The breeding range and habitat of this bird indicates without a doubt that it should be placed on the austral list. Grinnell and Miller say of its habitat: "dry open terrain, either level or hilly. Breeding headquarters, cliffs affording nesting niches" (45:109).

The prairie falcon has been reported, or collected from a few parts of the Willamette Valley in the more open areas. Gullion has seen this bird north of Eugene on February 5 and April 4 (49:37). All records are for the winter and early spring months, which gives no evidence that it ever occurs here as a breeding bird.

I have observed large falcons on two different occasions over the prairie-like areas south of Corvallis during the winter, but I could not be certain whether they were this species, or duck hawks.

This bird has been observed so seldom in the valley that nothing definite can be said of its winter habitat.

TETRAONIDAEDendragapus obscurus

Sooty Grouse

The sooty grouse breeds west of the Rockies from southeastern Alaska south to southern California. In Oregon three subspecies are found. The Oregon sooty grouse (D. o. fuliginosus) is a permanent resident in timbered sections throughout the Willamette Valley.

Gabrielson and Jewett (38:36) classify it as a boreal bird. Its extreme western, and coniferan distribution indicates it can be placed on the boreal list. Grinnell and Miller state that its habitat is the "Edges of Douglas fir and white fir woods" (45:113).

As for my own material, a relatively small proportion of my field trips have been in the heavier coniferan areas, and consequently I have not recorded this grouse as frequently as I should have. I have seen it just 24 times during only 7 months in the following habitats:

	Fir	Oak-Fir	Total
March	1	1	2
April	4	1	5
May	7	1	8
June	2		2
July	1		1
August	3		3
December	2	1	3

chart continued:

	Fir	Oak-Fir	Total
Total	20	4	24

This list shows that the sooty grouse is closely associated with a habitat containing fir or other conifers (Fig. 10). They were not seen in any other type of habitat. However, they do occur in small brush areas in clearings in the forest. Mr. Willet Griffie, of Portland, reports that their nests are usually found in brush areas of the fir forests. I have found no nests, myself. On June 14, 1946 I observed an adult and 6 young along the North Santiam River, in the deciduous vegetation not over 100 yards from fir forests. More observations were recorded in April and May because this is the season when the birds can be easily heard. They are relatively quiet most of the year. I have no explanation for their absence from my records for five months of the year.

In summary, the sooty grouse is strictly a coniferous forest inhabitant, but is frequently found in brush areas associated with those forests.

PHASIANIDAEColinus virginianus

Bobwhite

The bobwhite originally bred in southeastern North America. Introduced in many parts of the State of Oregon, it is a permanent resident in the Willamette Valley.

Because of the bobwhite's original breeding range I have placed it on the austral list. Gabrielson and Jewett say that "this species thrived best in Upper Sonoran localities in eastern Oregon..." (38:221). It is a bird of the brush and cultivated farmlands over much of the territory in which it is found.

I have just 49 records of it in the following habitats in the Willamette Valley:

	Fir	Brush	Open	Total
January		1		1
February				0
March			2	2
April		2	4	6
May		5	11	16
June	1	3	5	9
July		2	3	5
August	1		1	2
September			1	1
October			2	2

chart continued:

	Fir	Brush	Open	Total
November		1		1
December		1	3	4
Total	2	15	32	49

The two listings of the bobwhite under a fir habitat are really a little misleading, for the birds were actually in small patches of brush found in the forest. The largest percentage of the records show clearly that the bird is an inhabitant of the brush and open country, namely the fence rows and the farmlands.

Charles Cutress has given me data on three nests he found in mid- and late June at Milwaukee and Corvallis. They contained from 14 to 17 eggs and were in a clover field; in a small clump of brush in a pasture; and at the base of an old fir stump in a pasture. I found one nest in June in a grass and brush fence row at the edge of a bulb field in June, at Woodburn, Marion County.

Few birds are observed during the fall and winter months, principally because they are very quiet. They are most often heard in late spring and summer. Nesting occurs mainly in June in the Willamette Valley.

The preferred habitat of the bobwhite seems to be open fields associated with brushy fence row cover in the valley.

Lophortyx californica

California Quail

The California quail originally bred from southern Oregon into Lower California, but it has been introduced in many areas in recent years. The authorities are uncertain which subspecies is present in Oregon. Introductions and reintroductions have been so numerous that the stock is well-mixed. At any rate the California quail has a permanent resident status in the Willamette Valley.

I have placed this bird on the austral list because all the subspecies normally range in only the southwestern United States. Gabrielson and Jewett (38:34) classify it as a sonoran bird. Throughout the range, brushland, interspersed with open areas, seems to be the habitat of this quail.

The California quail is more common in the valley than the bobwhite, for I have seen it nearly twice as often. My 93 records of this quail have been made in the following habitats during the months indicated:

	Fir	Oak	Brush	Open	Total
January		1	2		3
February		1	2		3
March		2	7	2	11
April	1	4	5	1	11
May	1	2	20	1	24

chart continued:

	Fir	Oak	Brush	Open	Total
June	1	2	4	1	8
July	1		5	1	7
August			9		9
September	1		4	1	6
October	1		3		4
November		2	1		3
December		1	3		4
Total	6	15	65	7	93

These quail were recorded most often during spring, their period of greatest activity, few birds being seen during the late fall and winter months. Very few birds were associated with fir forests. This is to be expected for the chart shows a strong tendency to brush areas.

The egg-laying season is reported as April and May, but I have seen coveys of very small young too late in the year (September 4 and 22) to have been hatched earlier than August. Perhaps these were second nestings.

The "whip-poor-will" call of these quail may be heard at almost any hour from dawn to dusk. The careful observer can locate a covey in the farmland areas of the valley by spotting the solitary lookout stationed on a fencepost near the flock. Often these flocks are seen in the gravel roads, picking up grits, I presume. Other times I have seen them utilizing the gravel roads for dust-baths, par-

ticularly in the winter, for dirt in the fields seldom dries out much during this period.

Another habit of these quail is that of sunning and preening in oak and ash trees in the early morning hours. In one instance, April 15, I saw 9 pairs, well-separated, but in the same oak tree at seven in the morning, sunning and preening.

The California quail is a permanent resident in the Willamette Valley, occupying brush areas most of the time. It seems to be more common than the bobwhite, another introduced quail.

SCOLOPACIDAENumenius phaeopus

Hudsonian Curlew

The species of this curlew breed across the northern border of the northern hemisphere continents. The Hudsonian curlew breeds on the arctic coast of Alaska and MacKenzie. It winters from Louisiana and California southward. In Oregon, it is recorded as a migrant, only. Gabrielson and Jewett (38:251) state that all the records are for the coastal counties, there being no records for the interior of the State.

I have placed this bird on the boreal list because of its extreme northern breeding range. In California the wintering birds are found on "sandy sea-beaches, tidal flats, marshes where vegetation is low; also wet meadows interiorly, especially where adjacent to shallow bodies of water" (45:140).

To date there have been just two records of this curlew in the valley, both at Fern Ridge Reservoir in Lane County. I first saw the curlew on August 8 in an area of cat-tails and spike-rush (Fig. 23). On June 13, Gordon Gullion observed a single bird on a flat flooded area at the south end of the reservoir. Both of these dates best those on record at the present time.

Very little can be said of this birds habitat in

Oregon except that these two individuals were observed in about the only suitable habitat in the valley - extensive mud flats and short aquatic vegetation. The spring record is very late, for the birds are reported as nesting in the arctic throughout June, and up to July 10.

The Hudsonian curlew is a rare migrant in the valley, both in the spring and fall.

Totanus melanoleucus

Greater Yellow-legs

The greater yellow-legs breeds across North America south to southern Canada. In Oregon and the Willamette Valley it is a common fall and spring migrant, and an uncommon winter resident.

This bird has a boreal breeding range. In California the habitat is, typically "shores of fresh-water ponds or margins of shallow rain-pools, whether in naturally marshy districts or far from such;..."(45:143).

I have 23 records of the greater yellow-legs in the valley.

February - 1	May - 2	September - 1
March - 4	July - 1	October - 1
April - 11	August - 1	December - 1

I have seen this bird as early as February 25 and as late as May 6 in the spring; and in the fall I have seen them as early as August 29 and as late as October 28. The

records for July and December are those of Gordon Gullion (49:46). My records show the typical pattern of the bird's occurrence in the Willamette Valley, the bird being absent during the breeding season, and during the mid-winter months. Gullion's records show that a few birds may winter here, as well as spend the summer in suitable habitats.

The birds are usually seen in shallow water areas containing short vegetation (Fig. 25). I have seen them at two locations in the valley - Fern Ridge Reservoir and the local swamp. The greatest abundance occurs in April. The most I have seen is between 100 and 125 birds in one afternoon at the local swamp.

This is another of the boreal birds that winters south of the boreal regions of the continent. It is restricted in its distribution by the absence of marshy areas, and not by the absence of boreal vegetation. In the Willamette Valley, the greater yellow-legs has been recorded for 4 months in the spring, and 3 in the fall, with one mid-summer and one mid-winter record. Their greatest abundance is during the spring migration period.

Limnodromus griseus

Dowitcher

The local race of the dowitcher, the long-billed dowitcher (L. g. scolopaceus) breeds from the western half of the arctic coast of North America south to central Canada.

In Oregon it is a spring and fall migrant.

I have placed it on the boreal list because of its extreme northern breeding range. In California its winter habitats are the "Sandy, surf-swept sea-beaches; tidal mud-flats; open marshlands, fresh or alkaline; muddy margins of rain-pools" (45:148).

I have seen dowitchers at only two locations in the valley, Fern Ridge Reservoir, and at the local swamp. I have recorded them on February 8, April 10, May 6, and 15, June 11, and September 28, for a total of seven times (on the September date it was recorded at both places). Gullion (49:49) records it for Fern Ridge on January 12, May 5, July 28, and October 5. These dates are considerably different than my own records. The June and July records indicate that perhaps a few individuals spend the summer in the valley, though there is no record of breeding taking place. The January record of Gullion's shows that this species will winter in the valley.

Regardless of the dates of their occurrence, this species is usually observed on mud-flats, or in shallow water areas that may be clear of vegetation, or grown to short vegetation, their preferred habitats.

Capella gallinago

Common Snipe

The common snipe breeds from Alaska, across Canada to Newfoundland, and south over the northern United States. In Oregon it is a permanent resident, breeding and wintering wherever suitable habitat is found. It is more common in western Oregon in winter, than it is in eastern Oregon. It is an abundant winter resident and quite rare breeding species in the Willamette Valley.

The Wilson's snipe (C. g. delicata) is a subspecies of the European snipe (C. g. Gallinago), and together they have a holoarctic or northern distribution. This fact, together with the northern breeding range of the Wilson's snipe causes me to place it on the boreal list. Grinnell and Miller (45:150) give its habitat as "Fresh-water marshes, grassy borders of slow-moving streams, wet meadows, and weedy margins of irrigating ditches on farm-lands. Vegetational cover is required, plus wet earth or sod soft enough to permit the birds to probe for invertebrate animal life".

I have recorded this snipe 108 times during all twelve months here in the valley. The number of times I observed it in each month is shown in the following list:

January - 9; February - 24; March - 19; April - 19;
May - 8; June - 1; July - 1; August - 2; September - 6;

October - 5; November - 7; December - 7.

In all instances I have observed this snipe associated with some type of aquatic habitat on the main valley floor (Fig. 25). There has been brush in the area very seldom. The snipe is usually in great abundance in marshy fields during the winter months. I have flushed upwards of 45 birds from one field in December. They remain in the valley in numbers as late as mid-April, after which their abundance rapidly diminishes. Snipe have been heard winnowing in May and June around our local swamp. I have seen only one occurrence of a summer resident bird, and that was in the month of June in fields adjacent to the local swamp.

The snipe is a boreal bird that is not influenced by the presence or absence of coniferous timber, but needs open wet habitats for its feeding and nesting activities.

It adheres closely to these habitats.

LARIDAEChlidonias niger

Black Tern

The breeding range of the black tern is interior North America from central Alaska, across Canada to central Manitoba and south to northern Ohio, Nebraska, Utah and California, east of the Cascade-Sierra Range. Although it breeds in the marshes of eastern Oregon, its status in the Willamette Valley is that of a rare migrant.

The black tern has been placed on the list of boreal avifauna, principally on the basis that the greatest portion of its breeding range is within the geographical area ordinarily possessing a majority of boreal forms. However, in the southern part of its breeding range, it is found within areas where austral forms predominate. The important habitat requirement seems to be a marshy environment, whether north or south.

Gabrielson and Jewett (38:307) do not mention it having occurred in the Willamette Valley. During the last three years this species has been seen a few times in spring and early summer. Gullion (49:51) observed three of them at Fern Ridge on July 13 (1946); one on June 12 (1947) and 4 on June 13 (1948). Dumas reported them at the local swamp on May 3 (1947) and I saw one there on May 15 (1948).

These last two records are within the normal period of migration for this species east of the mountains, but the 3 records by Gullion appear to me to be too late for migrant records. They might very well have been in summer residence at Fern Ridge, as with the white pelicans, another bird typical of the Klamath marshes. This Fern Ridge habitat has developed during just the past eight years, so it seems possible that the black tern may be recorded as a breeding species within a few years.

COLUMBIDAEZenaidura macroura

Mourning Dove

The mourning dove breeds from extreme southern Canada south over all the United States, into Mexico. Our local race, the western mourning dove (Z. m. marginella) breeds from the western half of southern Canada and in the western United States to Minnesota and Oklahoma, and south to Mexico. In Oregon it is a summer resident, and is present in small numbers as a winter resident. This condition holds true for the Willamette Valley. Livezey (63:37) lists it as a spring and summer resident in oak areas.

Gabrielson and Jewett (38:35) have classified it as a sonoran bird. The breeding range of this dove covers the southern half of the continent, and even in the northern parts it nests in deciduous trees, brush, or on the ground, so I have placed it on the austral list of birds. Grinnell and Miller (45:185) give its habitat in California as "Characteristically, an open type of deciduous woodland, or interspersed grassland and sparse chaparral".

I have 132 records of the mourning dove made in every month in the Willamette Valley, in the following habitats:
(on following page)

	Fir	Oak-Fir	Oak	Open	Total
January		1		1	2
February			1	4	5
March		1		5	6
April	1	7	2	8	18
May	5	12	3	18	38
June	1	5		8	14
July	1	2	1	5	9
August		11	2	8	21
September		3	2	4	9
October		2		2	4
November			2	1	3
December				3	3
Total	8	44	13	67	132

The occurrence of these birds in fir areas was infrequent. This is as it should be, for those birds so recorded were not nesting there, but possibly present because of readily available food, or because of the high perches found in a fir forest. These birds are often seen perching in such areas. All records were made in these areas during the breeding season only, so food may have been a factor. The same thing can be said for the occurrence of a great many birds in the oak-fir areas, although it is the presence of the oak and open areas, rather than the firs that draw the birds to the oak-fir areas. An

interesting point to note is that the mourning doves occurred in the oak-fir habitat most in the breeding season, and with one exception, not at all in the winter. Oak, by itself was not much of an attraction to the birds, or else my field trips failed to take me into enough pure oak areas to make this figure accurate. More birds were seen in open areas, that is, farmlands, etc., than in the other three habitats combined. Birds were seen most frequently in all of these habitats during the month of May, for nesting begins in April and young birds are then present to build up local populations.

I have nest dates from early April into mid-August. Nest habitats vary considerably. One nest found April 11 was in the crotch of a young ash tree at the edge of an open pond. The nest was 6 feet above the water and contained 2 eggs. Young left this nest on May 3. Another nest found April 24 on the top of a 2 $\frac{1}{2}$ -foot Douglas fir stump in an abandoned pasture area composed of young Douglas fir, white oak, sweetbriar, and poison oak, contained 2 young birds, one of which was dead. A third nest located in an ash at the edge of a slough coursing through a pasture area, was 10 feet above the water and contained 2 eggs (May 9). A fourth nest was found on August 13 within 25 feet of the site of the nest just mentioned second above, on another Douglas fir stump. It contained one

young bird about ready to leave the nest. Charles Cutress has also found two nests on Douglas fir stumps at 2 feet and 7 feet, in May and June at Barlow, Clackamas County. From this discussion of nesting sites of the mourning dove, it can be seen that they are highly varied.

The young acquire a near-adult plumage soon after leaving the nest, and can be best distinguished by their lesser size. These young ones give a person the impression during the late spring and summer months that the countryside is swarming with mourning doves. This is because the birds tend to stay along fence rows where rank herbaceous vegetation provides an ample supply of seeds, and because they seem to spend considerable time in the gravel roads, and at the edges of the highways picking up grit, and dusting themselves. In reality, then, the habits of these doves tend to "stuff" the tally sheet because they are present along the roadways where they are easily seen.

Populations drop off rapidly by the end of September, and there are usually not too many birds seen during the winter - just occasional pairs or very small flocks. The largest winter flock I have seen was of 60 or 70 birds in an old prune orchard near Monitor, Marion County, on February 9.

In summary, the mourning dove is an abundant spring and summer breeder, and a much less abundant winter

resident in pairs or small flocks in the Willamette Valley.

It stays in the open farmlands and pasture areas most of the time, moving into brush and small trees during the nesting season.

TYTONIDAETyto alba

Barn Owl

The barn owl is world-wide in its distribution but none of the 33 subspecies occur in the more northern part of the north temperate areas of either Eurasia or North America. Our own subspecies, the North American barn owl (T. a. pratincola) breeds from Oregon, Colorado, the Great Lakes, and Massachusetts south into Central America. In Oregon it is an uncommon permanent resident, more common in western Oregon.

The barn owl is placed on the austral list, for it reaches the northern limit of its breeding range on the Pacific Coast in Oregon. Grinnell and Miller give excellent habitat requirements for the barn owl in California. These requirements "include three essential factors: (1) grassland, hay fields, or open hillsides that are productive of small to medium-sized mammals in sufficient abundance for food; (2) thick-foliaged trees, or brush thickets, or buildings for day-time roosting; and (3) cavities for breeding, such as pot-holes in cliffs, holes in earth banks, holes in tree-trunks,..." (45:189).

I have recorded the barn owl only four times, once in late April and three times in early May. Gullion reports its occurrence at Thurston nearly every month from 1946 to

1948 (49:54). Dave Marshall flushed one from a fir on Rocky Butte near Portland on February 6. Bill Telfer saw one in the Columbia River bottomlands on July 27. The most unusual place I found this owl was in a thicket of spirea growing in the water of the local swamp. When I flushed the bird, the redwings immediately gave chase. Charles Cutress reports a nest he found at Milwaukee on March 24, 1943. The nest hole was at a height of 40 feet in a snag, and it contained 5 eggs.

Gabrielson and Jewett state that these "birds seem to be most numerous in the southern Willamette Valley" (38: 331), but from the above-mentioned observations it can be seen that observers have seen it infrequently anywhere. This bird can find its three main habitat requirements, as mentioned above, fulfilled in many parts of the valley. They are probably more abundant than present observations indicate.

STRIGIDAESpeotyto cunicularia

Burrowing Owl

The eighteen subspecies of burrowing owls range from the northern United States and southwestern Canada south over the northern half of South America, and also on some island of the West Indies. The local race, the western burrowing owl breeds from British Columbia, Manitoba, and Minnesota south into Central America. In Oregon it breeds in eastern Oregon and in the Rogue River Valley. It is a straggler over the rest of western Oregon.

Because of its southern breeding range, I have placed this owl on the austral list. In California the habitat is "Open, dry, nearly or quite level, grassland; prairie; desert floor" (45:203). Gabrielson and Jewett classify it as a Sonoran bird (38:35).

Records of this bird in the Willamette Valley are quite scattered. All observations have been in open grassland areas. I have seen them on February 22, March 6 and 10, 1943, the last two dates being of the same bird at the same place (Fig. 19). During the winter of 1947-48 Gullion recorded one on November 16 and February 13 just south of Meadowview, a few miles north of Eugene, along U. S. 99 highway (49:56). Jewett (53:9) reports it from the Portland area. Dave Marshall saw one bird on Sauvie's Island

on December 30. All of these observations were made during the winter period; and only one bird was seen at any one time. No breeding records have ever been made here in the valley.

In summary, the burrowing owl is a straggler during the winter months. It occurs in suitable open grassland habitat at different localities through the valley, but seemingly more often in the southern part.

Strix occidentalis

Spotted Owl

The spotted owl breeds in western North America from southern British Columbia south in the mountains through Colorado and Texas to Lower California. Our subspecies, the northern spotted owl (S. o. caurina) ranges through the Pacific Coast region from southern British Columbia to San Francisco Bay, California. In Oregon it is an uncommon permanent resident west of the Cascades.

Gabrielson and Jewett (38:36) classify it as a boreal bird. I have placed it on the boreal list because throughout its range it stays within the heavier coniferous forests. The more southern subspecies stay in the coniferous forests of the mountains, even in Lower California.

I mention this bird on the basis of one observation which I made on January 27, 1947, in a dense forest area not far from Butte Creek in Marion County. This is the

only one I have seen. One was reported from the hill area near Dundee on January 16, 1937 (23:132), this being the most recent published report of its occurrence.

The spotted owl "is probably much more common than these records indicate" (38:348). Finding one of these owls in the vast areas of its secretive habitat, the dense forests, is like finding a needle in a haystack.

Strix nebulosa

Great Gray Owl

Of the three subspecies found in the holoarctic region, only one, the American great gray owl (S. n. nebulosa) is found in North America. Here it breeds from the tree limit south to Ontario, and in the mountains to Montana and California. It is a rare permanent resident in Oregon.

I have placed this bird on the boreal list because of its northern breeding range. Throughout its range its habitat is the coniferous forest.

I have seen the great gray owl twice. One of these was a definite record made on June 12, 1941 in old fir woods in Clackamas County, 5 miles east of Woodburn. The other record is a rather indefinite one, for it was during the fall of 1936 that a friend and I were returning from a hunting trip about dusk. We were walking through a field on the east side of a dense fir forest when we both saw

this huge owl sail out from the woods and land in the field ahead of us. Although neither of us knew much about birds at the time, the huge wingspread and body size of this owl was so firmly impressed on my memory that I am certain it could have been no other species of owl.

This owl, like the northern spotted owl, is rarely seen because it inhabits the coniferous forest, and is nocturnal in habits. It may be more abundant than my records and the three records listed by Gabrielson and Jewett (38:349) seem to indicate.

Asio flammeus

Short-eared Owl

There are 9 subspecies of short-eared owls in the world (73:169-70) of which our own subspecies (A. f. flammeus) is the only one that is widespread. It is found over the northern half of Eurasia, and breeds in North America south, locally to California, Colorado, Kansas, Indiana, Ohio, and New Jersey. In Oregon it is a permanent resident, with an increased abundance during the winter.

The type subspecies is widely distributed in the northern parts of the northern hemisphere, and the breeding range in North America is primarily northern, so I have placed this owl on the boreal list; though it is certainly not associated with coniferous forest. It is a meadow or

open country inhabitant, that occurs in suitable areas of near-austral fauna and habitat.

I have seen this owl eleven times during seven consecutive months of the year: December through June. Their winter abundance seems to vary from year to year, being common throughout the valley one winter, and perhaps rarely seen the following winter. The peak of their winter abundance seems to be in February and early March. Where the permanent residents "hide out" during the period from July through November, I do not know. Gullion reports finding a young bird, unable to fly, on June 14 (49:57).

The short-eared owl has been seen in open habitats here in the valley. These open habitats may be fields, pastures, or marshy ground near swamps and reservoirs (Fig. 19, 23). I have never seen it in brush areas. In summary, I think that this owl is a sporadic winter resident, and rare breeding bird in the grasslands and fields of the Willamette Valley.

TROCHILIDAESelasphorus rufus

Rufous Hummingbird

The rufous hummingbird breeds in western North America from southeastern Alaska and southern Yukon south to Montana and central California. In Oregon it is a common summer resident. It has the same status in the Willamette Valley.

The hummingbirds have a southern origin, but the semi-northern breeding range of this species confuses the issue. However, when I checked up on the habitat occupied by this bird, I was able to make the decision. I placed it on the austral list. In California, the habitat is "All sorts of terrain providing melliferous flowers, from, according to month, lowland stream bottoms, through foothill brushland and heavy chaparral, to mountain ridges nearly or quite at timber line" (45:221). Even in the high mountains they retain their identity with the more open and brushy habitats. Livezey lists it as a spring and summer resident in the oak areas near Corvallis (63:37).

I have recorded the rufous hummingbird 97 times in the Willamette Valley during every month from February through September. The earliest date I have seen them is February 9 (1943) and the latest, September 17 (1941 and 1942). The greatest abundance of these birds in the valley is dur-

ing April and May.

The habitat occurrence of the rufous hummingbird in each month is shown on the following chart:

	Fir	Oak-Fir	Oak	Brush	Open	Total
February				1		1
March	1	1	2	9	2	15
April	1	7	3	12	5	28
May	3	6	6	15	2	32
June	2	1	2	2	3	10
July	2	2		2	1	7
August				3		3
September		1				1
Total	9	18	13	44	13	97

From this chart it can be seen that the rufous hummingbird appeared very few times in the pure fir area; twice as often in the oak-fir areas; not very often in the pure oak and open areas; and predominantly in the brushy areas. This dictation of their habitat is governed principally by the presence of preferred flowering plant species, either of an herbaceous or shrubby nature, the latter types being selected most often.

I have observed courting activities as early as March 23 and as late as June 28 at various locations here in the valley. All the nests I have found have been in the month of May, and Gabrielson and Jewett indicate that this month is the height of the breeding season (38:364). One nest

was on the shaded northwest side of an ash tree at a height of 15 to 20 feet. Other nests have been in shaded locations at varying heights in shrubby plants such as huckleberry and indian peach. Gordon Gullion and Charles Cutress have told me of nests found on horizontal limbs of Douglas fir and red cedar trees, at heights up to 20 feet.

After the breeding season their numbers are greatly reduced, and from my experiences in the high Cascades in August, it seems probable to me that they follow the flowering season from the valley up the mountain slopes, where they occur by the hundreds in open valleys and rocky brush-covered slopes along the crest of the mountains.

In summary, the rufous hummingbird is an inhabitant of the brushy areas, principally, most abundant in the spring, with numbers much reduced in late summer, possibly because they move into the mountains, following the advancing flowering season.

PICIDAEHylatomus pileatus

Pileated Woodpecker

The range of the pileated woodpecker extends from northern British Columbia, southern Mackenzie, and southeastern Quebec south to Florida, Texas, and California (but absent from the Rocky Mountain region) (11:170). Our local subspecies, the western pileated woodpecker (H. p. picinus) breeds from British Columbia and Montana, south into California. It is a permanent resident in the forests of Oregon.

The habitat, and generally northern breeding range of this bird verifies its being placed on the boreal list. Gabrielson and Jewett classify it as a boreal bird (38:36). It inhabits the coniferous forest throughout its range.

I have just 31 records of this species for the Willamette Valley, but this is only because a small percentage of my field trips have been into the more pure coniferan areas. The bird can still be found without too much difficulty in most forest areas. I have seen the bird every month except December associated the following number of times with these habitats:

(see the following page)

	Oak	Fir-Oak	Fir	Total
January	1	1	1	3
February			3	3
March	1		1	2
April		2	4	6
May		1	5	6
June			2	2
July		2		2
August		1	3	4
September			1	1
October			1	1
November			1	1
Total	2	7	22	31

This chart shows that the pileated woodpecker is closely associated with a fir habitat, the only two records outside the fir habitat occurring in the winter season when these birds have some tendency to roam. During the nesting season, especially, they are seldom seen outside the coniferous habitat, or clearings associated with the forest (Fig. 10).

Nesting is supposed to take place in May in this area. I have found only two nests of this woodpecker. A nest hole was found on April 12 at 35 feet on the southwest side of a barkless Douglas fir snag standing on a fire-swept hillside near Abiqua Creek, in Marion County. On May 31 I visited this nest site again and the female bird entered

the cavity while I watched. I do not know whether there were eggs or young in the nest, but young must have been present after such a long period of nest occupation. The second nest which I found was a few miles from the location of the first one. On July 29 it contained young. The parents were busy carrying food to this nest hole near the top of a 60-foot Douglas fir snag. The hole opening was on the southwest side, again. A pileated woodpecker hole can be told from others because it is normally shaped as a pointed ellipse, averaging 5 inches high and 3 to 3½ inches wide. Gordon Gullion found a nest near Eugene on June 2 in a dead cottonwood. The nest was at a height of 25 feet, and contained 2 nearly-fledged young.

My winter records are so few that I can say very little of their habits, other than that they do stay in the fir forests most of the time. In the State of Washington I have observed this woodpecker clinging to the branch tips of a madrone (Arbutus Menziesii) feeding on the fruits of this tree in early winter. This habit of feeding has been reported by Bent (11:194) when they were observed on dogwood trees. During the winter they must get into river bottom areas sometimes, for I have found alder snags riddled by their workings. Others have seen their workings on dead cottonwoods, as well.

In summary, this boreal bird is a permanent resident of the coniferous forest and will seldom occur outside the forests.

Balanosphyra formicivora

Acorn Woodpecker

Bent (11:211) gives the range of the acorn woodpecker from Oregon, northern Arizona, and New Mexico south through Texas and California at least as far as Colombia in South America. The local subspecies, the California acorn woodpecker (B. f. bairdi) breeds from southwestern Oregon south to southern and Lower California. In Oregon it is a permanent resident from the Umpqua river south. Gabrielson and Jewett (38:374) list one record for Lane County in the Willamette Valley.

This woodpecker is very definitely an austral form, and is classified as sonoran by Gabrielson and Jewett (38:34). In California, its habitat is "Woodland, or mixed woods, usually of scattering type, composed of, or at least including, oak trees of one kind or another"(45:232).

I have personally seen the California acorn woodpecker in the Willamette Valley just once - on June 11. It flew across a country road from a grove of oak, and lit on the top of a telephone pole where I observed it for some time. This location was near the southeast corner of Fern Ridge Reservoir in Lane County. Gordon W. Gullion, of

Eugene, has spent more time afield in the southern part of the valley, and consequently he has become well-acquainted with this bird in that area. He states they are a permanent resident, especially associated with the black oak areas along the north base of the Calapooya range west of Eugene. From here they range northward into the Fern Ridge area, occurring in groves of oaks scattered throughout the area. The furthest north he has seen them is on Richardson Butte, just northwest of Fern Ridge Dam. Gullion has observed courtship activities as early as May 28, and has seen 3 young accompanied by their parents on July 13, and a family group of 6 on August 17. The most he has seen in any one day afield is 12 individuals. He estimates the total populations between 30 and 50 individuals.

Whether this bird is expanding or contracting its range in this valley is difficult to decide. At least superficially it would seem that this woodpecker is expanding its range, because when the Birds of Oregon was published in 1940, only one observation had been recorded in the valley.

The California acorn woodpecker is an austral woodland bird that has found a suitable habitat niche in the southern Willamette Valley, and if conditions continue favorable in that area, may well spread to other suitable sites in the valley.

Asyndesmus lewis

Lewis's Woodpecker

The Lewis woodpecker breeds from southern British Columbia and southwestern South Dakota south into New Mexico, Arizona, and California. It is a summer resident in every part of the State of Oregon, and although there seems to be some migration, it winters regularly in the larger river valleys, such as the Willamette Valley.

This bird is placed on the austral list because of its southerly breeding range. In California its habitat is "Deciduous woodland or coniferous forest; in either case, of scattered or broken formation.....Following destruction of mature, solid forest, when most other woodpeckers have disappeared, the Lewis Woodpecker comes in" (45:233).

I have recorded this woodpecker 36 times during every month except June in two habitats:

	Oak	Open	Total
January	2	1	3
February	3	3	6
March	1		1
April	3		3
May	5	2	7
July	2	2	4
August	4		4
September	3	1	4

chart continued:

	Oak	Open	Total
October	1		1
November	2		2
December		1	1
Total	26	10	36

This woodpecker stays completely away from the fir forests, although its feeding activities may take it into mixed fir-oak area sometimes. I have seen it in old Douglas fir snag patches that have been burned over, but these areas are classified as open, for the snags are scattered, and there is little or no vegetation covering the ground. This woodpecker's principal habitat is the oak woodlands (Fig. 23), and scattered oaks found throughout the valley. When found in the open areas, they are usually in quest of food, taking insects on the ground, or from the air. In mid-August I have seen them accumulate at seepages or other sources of water on the ground. They often utilize the telephone poles along the roadways as perches from which they sally forth to catch an insect, returning to their perch like a flycatcher. It has been interesting to me to see the way the Lewis woodpecker will dominate other birds, taking perches away from such species as the sparrow hawk, the flicker, the Gairdner woodpecker and the varied thrush.

In the winter, these birds often occur in bands of 25 to 50 birds on certain oak-covered hills, where they keep residence until the spring courting activities develop. I have never found a nest of this woodpecker. Mr. Willet Griffie of Portland told me that the nests are always in deciduous trees. Currier (21:356) describes snags in the Columbia River bottomlands that contained up to 4 or 5 separate nesting pairs of this woodpecker.

In summary, the Lewis woodpecker is a permanent resident in the Willamette Valley, more common during the spring and summer months, found in typical woodland or open habitats at all times of the year.

Sphyrapicus varius

Yellow-bellied Sapsucker

All the subspecies of this species breed over most of boreal North America. The subspecies that breeds in the Willamette Valley is the northern red-breasted sapsucker (S. v. ruber). It is confined to a range from Alaska south to western Oregon, being replaced to the south by another subspecies. This sapsucker is a permanent resident in the Willamette Valley, coast mountains, and Cascade foothills on the east side of the valley. There seems to be a lesser abundance during the winter months.

Gabrielson and Jewett (38:39) consider this sapsucker

as typical of the Canadian life zone. Livezey (63:37) found it a winter resident in the oak areas in the vicinity of Corvallis. Buchanan (17:41) did not find this species in any habitat except the Cottonwoods along the Willamette River south of Corvallis during the winter. A summary chart of the number of times I have observed this species in various habitats follows:

	Fir	Fir-Oak	Oak	River Bottom	Urban	Total
January			1		2	3
February		3			3	6
March	2	5	2	1		10
April	3	2		1		6
May	5	2		4		11
June	1	3				4
July	2			1		3
August		3		1	1	5
September	1	3				4
October		1	1		2	4
November	3					3
December	1	2			3	6
Total	18	24	4	8	11	65

Certain things may be observed from the data on this chart. The bird occurred in urban areas at times other than the breeding season, showing a tendency to roam upon the completion of family duties. The same can be said for

the occurrences in the pure oak areas. Much of the habitat classified as "river bottom" contains fir groves intermingled with maple, alder, cedar, etc., so that in reality, the three habitats in which this species occurs most consistently contain fir. However, so far as nesting sites are concerned, this sapsucker is not too particular about the tree species in which it has a nest cavity. Charles Cutress has found nests in alder and bigleaf maple, and Mr. Willet Griffie has located nests in willows. Gordon Gullion found a nest at a height of over 100 feet in an isolated Douglas fir at the Cottage Grove Reservoir in 1946. In my own experience I have found nests in Douglas fir, ash, and red cedar, all in semi-open locations. These nests were at heights from 20 to 32 feet. Most of the nesting activity takes place from mid-May to mid-June, with quite a few nestings earlier, but very few later than this period. In late summer, from August through September, this species is often observed in groups of 5 to 10 birds, mostly young of the year, fearlessly playing and chasing each other through the ash, alder, and maple of semi-open river bottom areas. During these activities they make so much noise that an observer can hardly overlook them.

In summary I might say that this sapsucker has conformed to the requirements of a boreal species during most of the year. It wanders more during the fall and winter.

TYRANNIDAETyrannus verticalis

Western Kingbird

The western kingbird breeds from southern British Columbia and Manitoba south to Texas, Mexico, and Lower California. It is a resident and breeding species in eastern Oregon and the Rogue River Valley, and is less common elsewhere west of the Cascades according to Gabrielson and Jewett (38:390).

It is a typical austral bird, and is so entered on the austral list. Gabrielson and Jewett (38:35) classify it as a sonoran bird. Grinnell and Miller give its habitat in California as "Dry open situations, but where one or two trees of some sort, living or dead, provide out-look posts and roosting and nesting sites. In lieu of trees, derricks, windmills, telephone or power poles, or even fence-posts are used for the same purposes. Expansive fly-way seems to be a requisite, as also much open ground within view. Woodland must be of far-scattered trees, to harbor this kingbird;"(45:250).

Gabrielson and Jewett (38:390) list records of this bird from 6 counties in the Willamette Valley, one of which is a nesting record for Benton County. In my own experience, the western kingbird is a rare bird in the valley area. I have seen it just twice - on May 17, and on

August 5, although I have made special trips of several hours into likely habitat for this bird at various points in the southern part of the valley. Both times I saw the bird it was perched in the top of a tall tree that more or less towers above the surrounding trees, this point disagreeing with the perch requirement mention by Grinnell and Miller, which I quoted previously. Gullion (47:46) recorded one on the outskirts of Eugene, in January, in a walnut orchard. He considers the bird a spring transient in the Eugene area. It has been recorded in April and May at Thurston, Lane County, by Mr. Ben Pruitt (49:56). No nesting records are available from the records of recent observers, and chances are small that they will for when the western kingbird is seen, it is always a single bird - no pairs.

In summary, there is abundant suitable habitat for the western kingbird in the Willamette Valley, and it should be recorded more often than it is.

Sayornis nigricans

Black Phoebe

The black phoebe breeds from northern California, southern Nevada, Arizona, and southwestern Texas south into Central and South America. It had not been reported from Oregon until Jewett published a note in 1942 of a bird collected at Mercer, Lane County on June 1, 1936 (52:37). Up

to 1947 it had been recorded from the Willamette Valley once by Johnson in 1880 (38:605).

This phoebe is definitely an austral bird. Grinnell and Miller give its habitat in California as "Typically, close vicinity of running water where more or less shaded by riparian trees or by high banks or canyon walls" (45:254).

For my experience with the black phoebe in the Willamette Valley I will quote our published article (33:212): "At 11:15 a.m., on May 24, 1947, while on the South Santiam Highway, in Linn County, we saw a Black Phoebe (Sayornis nigricans) near Dobbin Creek. Dobbin Creek enters the South Santiam River from the south, a half mile east of the town of Cascadia, in the western foothills of the Cascade Mountains. The mountains are here forested principally with Douglas fir, but the immediate vicinity of the point of observation is a flat, open, and quite dry grassland bench above the south bank of the river". This single bird was on a well-shaded perch - a lower branch of an alder growth on the west steep bank at the edge of the creek. It was preening and we could see that its feathers were wet, as if it had just been bathing, or perhaps feeding over water and hitting it occasionally while catching the insects. Bent mentions something of this phoebe's habits. "Rarely seeking the tree-tops, the black phoebe usually perches instead on the shaded lower branches..."

..It is fond of taking up its station at the edge of a pool and daring out over the water, occasionally bathing by dipping its lower parts beneath the surface in passing"(12:161) The habits of this one bird that we observed, and the particular little niche in which we found it, even in an area of coniferous forest, illustrates remarkably well how important a certain combination of habitat factors is to any particular species of bird.

In summary, the black phoebe is a very rare straggler from northern California, that occasionally enters the Willamette Valley.

Sayornis saya

Say's Phoebe

The Say's phoebe breeds from Alaska, Mackenzie, and Manitoba south to Oklahoma, New Mexico, Mexico, and Lower California. In Oregon it is a summer resident throughout the State, except along the coast. It is sometimes a winter resident. In the Willamette Valley it is a very uncommon summer bird, being present in winter in about equal proportions.

Bailey classifies this phoebe as a sonoran bird (9:15), although it ranges extremely far north of the range of most sonoran birds, southern Canada being the usual northward limit. Nevertheless, I have placed it on the

austral list, for the largest area of its breeding range is southerly, and its habitat throughout its range is that of an austral bird. Bent has the following to say about it.

"Say's Phoebe is a bird of the open country, the prairie ranches, the sagebrush plains, the badlands, the dry, barren foothills, and the borders of the deserts, where it can forage widely over the stunted vegetation, or perch on some low bush or tall weed stalk to watch for its insect prey. But it is also found in the mouths of canyons or rocky ravines, perched on some commanding boulder as a watch-tower. It has no special fondness for watercourses, or for rich agricultural lands, and is seldom seen in heavily timbered regions" (12:167). In California, the habitat is given as "Open, sunny, arid terrain, with only occasional bush-tips, weed-tips, rocks or just clods to use for look-out perches; in areas invaded by human culture, fence-posts and wires, and corners of buildings, thus serve. For breeding, support-providing niches in rock walls or in undercut banks of firm earth or gravel must be available. Again, human-constructed buildings, especially as unoccupied and weathered, offer adequate substitute for "natural" nest sites. A requisite in any case is that the nest be in a position to be sheltered from the sun through the mid-day hours" (45:255).

I have observed the Say's phoebe 11 times in the

Willamette Valley: January 21, February 14, 15, 16, and 17, March 3, and 14, May 22 and 30, and August 9, and 20. Mr. Ben Pruitt reports it at Thurston from February 25 to April 24. Gordon Gullion saw one at Irving, north of Eugene, March 30. The habitats in which I observed the birds varied from wire lines along the highway, and wire fences at the Oregon State College sheep barns, to low bush perches adjacent to the local swamp - but all very open habitats. Five of my observations were made at the swamp, four of these in February. The birds are evidently attracted to this site because of the abundance of insect food present, even in the winter months. I have not found any nests of this species in the valley, though I did observe a very immature bird in a pasture area along the east side of the local swamp on August 9. Mr. Arthur Einarsen, of Corvallis, told me that a pair nested two seasons (1941 and 1942) under the tile roof on the north side of the Women's Building on the college campus. I have never seen more than one bird at any one place at any one time. Nestings of this species in the valley must be quite rare.

Although I have observed the Say's phoebe feeding from wire lines along the highway, and perches up to 10 feet high in small ash at the edge of the swamp, one characteristic of this bird is its feeding from low perches and on the ground. I have observed this several times at the

local swamp. Grinnell and Miller mention this habit: "This phoebe has the lowest airway "beat" of all of our flycatchers; indeed, much of its insect food is retrieved from within a foot of the ground, when not from the actual ground surface.... The look-out perches, significantly, are low; and lacking such, a bird is wont to "build" an effective inspection post a meter or less aloft, by the device of hovering" (45:255).

In summary, the Say's phoebe is found in varied types of open habitat in the valley during the winter and spring, being less abundant during the summer and fall.

Nuttallornis borealis

Olive-sided Flycatcher

The olive-sided flycatcher breeds from the northern limit of trees south to North Carolina, Tennessee, northern Wisconsin, northern Minnesota, Colorado, Arizona, and Lower California. It is a common summer resident in the forested areas of Oregon.

It is listed as a bird of the Canadian zone (38:39). It has a northern breeding range through the coniferous forest areas, so I have placed it on the boreal list. Grinnell and Miller give its habitat as "Typically, coniferous forest of mature but of open or interrupted stand. Lofty perches are required, for forage take-offs and singing posts; such perches are often provided by dead tips

or uppermost branches of otherwise living trees that are the tallest in the vicinity, overlooking lesser growth such as young trees or expanses of green chaparral" (45: 264).

I have recorded the olive-sided flycatcher just 38 times during 5 consecutive months in 3 habitats. This low number of observations is misleading, for during the summer this flycatcher occurs in almost all areas of coniferous forest. As with other purely coniferous birds I have discussed, the number of times recorded is low because I have taken a relatively small number of field trips into such areas. This flycatcher's habitat occurrence in the three habitats follows:

	Fir	Fir-Oak	River-bottom	Total
April		3		3
May	9	7	2	18
June	6	2		8
July	3	3		6
August	1	2		3
Total	19	17	2	38

The majority of times these birds were associated with a habitat containing fir. It was in the fir trees in most instances that I observed it in the fir-oak areas. The two records in the river-bottom habitats were made of birds

calling from tall cottonwoods. These were the only exceptions to the coniferan habitat. Their characteristic post is the top of a tall fir or snag in the forest areas (Fig. 11), where they first announce their presence to the observer. This perch seems to be used for look-out, calling, and feeding activities throughout the spring and summer. The earliest I have seen this bird is April 4; the latest, August 26. The bird is probably present into mid-September in the valley, but during the last period of its stay in the valley it becomes relatively quiet, calling infrequently.

This flycatcher nests fairly late. Ben Pruitt and Gordon Gullion found a bird brooding on a nest in a Douglas fir on West Point Hill in eastern Linn County on June 19. Although I have found no nests I saw 3 young attended by the adults in Avery Park, Corvallis, on August 25. The young could fly, but were not very adept at procuring their own insect food. The only other young of this species that I have seen were near the summit of the Cascades at Jorn Lake on August 10. They were half-grown, about equal in size to those I saw in Avery Park.

In summary, this flycatcher is a typical boreal bird that is seldom found outside the coniferous forest sections of the valley.