

LONG TERM VEGETATION CHANGES ON THE "ISLAND"

RESEARCH NATURAL AREA

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SUMMARY

This study on the "Island" was undertaken primarily to determine vegetation change over a thirty year period. While only a few differences could be statistically tested, the major differences noted include 1) an increase in western juniper cover, 2) an increase in shrub cover, and 3) a more even mix of grass species rather than the dominance of bluebunch wheatgrass and cheatgrass as noted by Driscoll (1964a), and 4) a higher litter cover.

INTRODUCTION

The study of ecosystem dynamics and successional change requires the repeated measurement of plant communities. Opportunities to build on past data sets are few, especially in relatively undisturbed areas. The purpose of the study was to document the vegetation of the "Island", a near pristine Research Natural Area (RNA) in the central Oregon's *Juniperus occidentalis* Zone. The "Island" RNA is a walled 250 acre mesa, elevation 2400 ft, located within the Cove Palisades State Park between the confluence of the Deschutes and Crooked rivers, approximately four miles northwest of Culver, Oregon. Other than stories of two summers of use by sheep in the 1920s (Driscoll 1964a), mule deer and small herbivores have been the main grazers. Charcoal and strip areas dominated by grasses and sprouting shrubs bear evidence of small patch fires. In 1964 Round Butte Dam was built, and the Crooked and Deschutes river canyons were partially filled to form Lake Billy Chinook which now surrounds all but the southern end of the "Island".

Vegetation composition was first documented by Driscoll (1964a, 1964b). Our study compared present day vegetation cover data for shrubs, grasses and forbs in 1992 and 1993 to that of Driscoll in 1960 and 1961, some 30 years prior. We also examined western juniper (*Juniperus occidentalis*) cover over a 50 year time period using aerial photos of the "Island" RNA available for each decade back to the mid 1940s.

Climatic data records dating from 1949 through 1994 from the Metolius Weather Station, 6 miles NE, show an average annual precipitation of 10.5 in. with annual temperatures ranging from a mean max. of 62 °F to a mean min. of 31 °F.

Woody vegetation on the "Island" consists primarily of western juniper, Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyominensis*), and antelope bitterbrush (*Purshia tridentata*). Major grasses include bluebunch wheatgrass (*Agropyron spicatum*), Idaho fescue (*Festuca idahoensis*), Thurber needlegrass (*Stipa thurberiana*) and Sandberg bluegrass (*Poa sandbergi*). Forbs are rather sparse. Plant associations described by Driscoll (1964a) include the major *Juniperus occidentalis*/*Artemesia tridentata*/*Agropyron spicatum* (Juoc/Artr/Agsp) association

and the minor *Juniperus occidentalis*/*Purshia tridentata*/*Agropyron spicatum* (*Juoc/Putr/Agsp*) association.

METHODS

The macroplot size and layout described by Poulton & Tisdale (1961) and used by Driscoll (1964a) was used in this study. Raw data, field notes, and the exact locations of their macroplots which had been marked with metal stakes were unavailable (personal communication with Richard Driscoll, 1992 and Ed Dealy, field assistant, 1992). However the two plant associations were easily relocated. We used the same restrictions in plot location as in the original study (Driscoll, personal communication 1992). Our study measured vegetation in both plant associations during two summers, 1992 and 1993, using 14 macroplots.

The *Juoc/Artr/Agsp* macroplots were located throughout the central longitudinal area of the "Island" and in the southern two-thirds latitudinal area. The *Juoc/Putr/Agsp* association was located on 35 acres in the northeast section of the "Island" and four macroplots were set up within it. We were also interested in other smaller areas where bitterbrush was found. Driscoll (1964a) made no mention as to the presence of these communities. Three macroplots were established, one each in the southeast, southwest, and west central areas of the "Island" where bitterbrush also was present.

Percent foliage cover was estimated for all herbaceous species and percent surface cover was estimated for rock, mosses/lichens, bare ground, and litter on microplots. Shrub cover was measured by line intercept, and height and diameter of shrubs were measured on belt transects. Aerial photographs were used to determine canopy cover of western juniper trees at six time intervals over a fifty year period including 1944, 1951, 1961, 1975, 1985, and 1995. Enlarged greyscale photocopies were made of aerial photos, and a plastic line/dot grid placed over the sites to estimate percent cover of the larger and thus visible western juniper trees within each association (Moessner 1960, Driscoll 1964a).

Our results and those of Driscoll (1962, 1964a, 1964b) were compared for statistically significant differences using Student's t-test, but only for those categories and species for which Driscoll reported standard errors.

RESULTS

The 1949 through 1994 climatic data from the Metolius Station showed temperature patterns to be fairly consistent. However, precipitation patterns were very erratic over the 45 year period. The month of highest precipitation occurred in all months of the year. While there were small clusters of years with below average precipitation (10.5 in.) and other clusters with above average precipitation, the majority of those below were intermittent with normal years while those above showed no particular pattern. Period precipitation extremes varied from 17.5 in. during 1983 to 6.2 in. during 1985.

We used an October through September water year for comparison purposes which showed that precipitation in the year preceding and the two years during each study were 7.5, 7.1, and

11.8 in. respectively for the 1960s study and were slightly higher at 8.2, 9.1 and 14.1 in. respectively for the 1990s study. Seasonal precipitation patterns differed with more than two times as much in the spring and about three times as much in the summer during the 1990s study as compared to the 1960s study (Table 1).

Table 1. Precipitation at the Metolius, OR Weather Station for the year preceding and the two years of each field study for Oct.-Sept. water years*(inches).

	1960s			1990s		
	1958-'59	1959-'60	1960-'61	1990-'91	1991-'92	1992-'93
Oct-Mar "recharge"	5.6	5.5	9.0	3.0	4.8	8.3
Apr-Jun 'spring'	1.2	1.1	2.4	3.7	2.9	4.4
Jul-Sep 'summer'	0.7	0.5	0.4	1.5	1.4	1.4
Oct-Sep "water Yr"	7.5	7.1	11.8	8.2	9.1	14.1

• data from U.S. Weather Bureau (1994)

Recorded differences in vegetation between the 1960s study and the 1990s study indicate vegetation change has occurred (Tables 2). Statistical comparisons were made only for the percent cover of big sagebrush, bluebunch wheatgrass, and Sandberg bluegrass in the *Juoc/Artr/Agsp* association.

Cover for bluebunch wheatgrass and Sandberg bluegrass had changed with the former having lower cover values and the latter having higher cover values in the 1990s study versus the 1960s study. No significant differences in cover were found for western juniper and big sagebrush in the *Juoc/Artr/Agsp* association.

Total shrub cover appears higher in the 1990s study compared with the 1960s for both the *Juoc/Artr/Agsp* and the *Juoc/Putr/Agsp* associations. The major shrub involved was big sagebrush, however grey and green rabbitbrush (*Chrysothamnus nauseosus*, *C. visidiflorus*) and grey horsebrush (*Tetradymia canescens*) also made contributions. Total grass cover appears to have changed little in the two associations. However in both associations the cover of bluebunch wheatgrass and cheatgrass (*Bromus tectorum*) appears to have declined. Conversely, Sandberg bluegrass, Idaho fescue, and Thurbers needlegrass cover appears to have increased, providing a fairly even representation of the four perennial grass species.

Perennial forb cover was very low in both studies for both plant associations. Driscoll (1964a) mentioned a paucity of forbs, which appeared to be even more pronounced in our study. Annual forb species were numerous, but their cover appeared to be low and their constancy was variable from year to year (Driscoll 1964a). In our study they were identified as present only because of their scarcity.

Driscoll (1964) found striking differences in bare ground and litter cover between the two associations, with more bare ground found in the *Juoc/Artr/Agsp* plots (41% vs 19%) and more litter in the *Juoc/Putr/Agsp* plots (62% vs 31%). Assuming that Driscoll included rock cover with bare ground and moss/lichen cover with litter, we found similar relationships but a less dramatic difference between the two associations than was recorded in the 60's study. In the 90's study bare ground cover was generally higher on the *Juoc/Artr/Agsp* plots (35%) than on the

Juoc/Putr/Agsp plots (22%) while litter cover was higher on the *Juoc/Putr/Agsp* plots (57%) than on the *Juoc/Artr/Agsp* plots (46%).

Table 2. Cover values (%) for plant species and groups from macroplots on the Island for 1960-61 and for 1992-93 from the *Juoc/Artr/Agsp* association and from the *Juoc/Putr/Agsp* association. * and ^ indicate differences are significant ($p < 0.05$).

Plant Species	Juoc/Artr/Agsp		Juoc/Putr/Agsp	
	60's	90's	60's	90's
Wyoming Big Sagebrush	8.5	15.4		2.1
Bitterbrush	0.0	0.0	8.7	9.8
Grey Rabbitbrush	1.1	tr.	0.6	0.3
Green Rabbitbrush	0.0	tr.		0.5
Grey Horsebrush	0.0	0.0		0.4
Total Shrubs	9.6	15.4	9.3	13.0
Bluebunch wheatgrass	9.2*	3.4*	6.2	2.5
Idaho fescue	0.4	2.6	0.5	4.8
Thurbers needlegrass	2.0	2.9	1.1	4.6
Junegrass				0.1
Squirreltail	0.1	tr.	tr.	0.2
Sandberg bluegrass	1.3*	2.8*	0.4	3.9
Cheatgrass	1.7	0.1	12.4	2.6
Sixweeks fescue	0.6	0.4	0.3	0.6
Total Grasses	15.3	12.3	20.9	19.3
Western yarrow	0.1	tr.	0.6	0.1
Mtn. Dandelions	0.1	0.0		
Milkvetch	0.3	0.1	0.1	tr.
Nineleaf lomatium	0.6	tr.	0.1	tr.
Douglas phlox	0.1	0.0	0.1	tr.
Foothill death camas	0.0	0.0	0.1	tr.
Total Forbs	1.2*	0.1*	1.0^	0.1^

DISCUSSION

Canopy cover (%) of western juniper on the "Island" was measured using aerial photographs taken in 1944, 1951, 1961, 1975, 1985, and 1995. Tree cover for the *Juoc/Artr/Agsp* sites were not different from that of the *Juoc/Putr/Agsp* sites in any of the years measured. Nor was the percent cover on the "Island" generally different from decade to decade, but there was significantly more cover in 1995 when compared to 1944. Trees were unevenly clustered on the "Island" resulting in high sample variance especially in the *Juoc/Artr/Agsp* association which covers 21 acres. In general, tree cover appears to have increased gradually but steadily from 1944 to 1995 in both associations. Because of the method of using aerial photographs to measure tree cover, only larger trees were visible, thus it was likely that percent cover was underestimated.

When combining all of the macroplots on the "Island" into one unit and comparing the vegetation generally with Driscoll's (1964a) combined macroplot data, there appeared to be an increase over the 32 years in tree cover from 5% to 9.7%. Total shrub cover appeared to be higher, grass cover appeared to be lower, and forbs, a very minor component, appeared to have decreased, bare ground/rock cover stayed approximately the same, and litter cover (which includes moss/lichen) appeared to have increased more than 30% in the *Juoc/Artr/Agsp* association.

LITERATURE CITED

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