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IMPACT OF THE 1975 WALLSBURG FIRE ON ANTELOPE BITTERBRUSH (*PURSHIA TRIDENTATA*)

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Abstract.— Antelope bitterbrush (*Purshia tridentata*) is a preferred browse species that is susceptible to decreases in population density due to fire. The reduction in density of this species due to fire was determined by sampling areas within and adjacent to the burn. The 1975 burn caused a significant reduction in the population density of bitterbrush. It was also determined that rate of growth was lower for plants within the burn.

In the summer of 1975 a fire burned several hundred acres of mule deer winter range in Wasatch County, Utah. The burned area includes the area from the junction of the Wallsburg road southeast to the crest of the west Daniels Canyon ridge and to the northeast along Highway 40 to near the Midway Junction. Deer Creek Reservoir is just across the highway to the northwest of the burned area.

The study plots are near the northeast corner of the burn in an area where a population density of bitterbrush was great enough to permit quantitative analysis of the response of this species to fire. Burned and unburned areas were studied along with some islands that escaped burning. Bitterbrush (*Purshia tridentata*) was selected as an indicator species because of its status as a preferred browse plant on mule deer winter ranges.

Any factor that causes significant changes in the structure of the plant communities on winter ranges is of concern. One of the most significant agents known is fire. Fire has occurred naturally since time began and is a major factor in determining the structure of many plant communities. In other communities, man-caused fire has introduced an agent of change that has modified vegetation over large areas.

In a situation where prefire structure is so important, the impact of fire on structure of the plant community should be known. Will plants be killed? How long will the impacts last? Will value of the area as mule deer winter range be completely lost? Can deer move to another winter range? These and other questions occur and need to be answered if the impacts of fire are to be understood.

The area chosen for study has been burned several times in the last one hundred years. Fire has occurred at irregular times and over different portions of the area. This has led to a mosaic of vegetation types and age structures. The 1975 fire was much larger than most of the past fires and affected a significant portion of mule deer winter range in the area. With passage of four years, the inception of the postfire plant succession should be identifiable.

Three major hypotheses were formulated to determine some of the relative impacts of the 1975 fire. First, the density of bitterbrush had been significantly reduced by the fire. Secondly, use by mule deer is less in the burned area. Third, the shift in deer use has

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had a detrimental effect on surviving bitterbrush plants.

LITERATURE REVIEW

Literature pertaining to bitterbrush is extensive, with over 200 references identified. The following references support the results of the study.

Purshia tridentata (antelope bitterbrush) is highly desirable as browse on deer winter range (Bissell et al. 1955, Giunta et al. 1978, Hoskins and Dalke 1955, Julander 1952, Leach 1956, Longhurst et al. 1952, Mace 1957, Reynolds 1960, Smith et al. 1954, Smith 1952). Since bitterbrush is so highly preferred, it can be used as an indicator species for use on an area by game animals and game winter range conditions.

There have been numerous articles written about the impacts of fire on bitterbrush (Blaisdell 1950, 1953, Blaisdell and Mueggler 1956, Countryman and Cornelius 1957, Ferguson and Basile 1966, Komarek 1965, Miller 1963, and Pechanec et al. 1954). They have determined that browse production of bitterbrush plants that have been burned has lagged behind unburned control plants for several years. Blaisdell (1950) also showed that relative densities of bitterbrush in burned and unburned areas differed significantly. Nord (1965) developed data that demonstrates the existence of fire-resistant ecotypes where most plants in the population resprout after fire. Blaisdell (1953) and others have shown that variables of fire intensity, fuel loading, and soil moisture affect resprouting. Even nonsprouting types will have some survivors, particularly where the fire does not burn intensely.

RESULTS

The following data were collected from six 100 ft² quadrats in the burned and adjacent unburned area. Two of the quadrats were at the lower edge of the burn in the sagebrush-bitterbrush type and four near the middle of the burn in the oak-sagebrush type. The relative density of live bitterbrush plants is shown in Table 1.

There is a striking difference between the number of living plants in the burned and unburned areas. None of the burned plots had any surviving old plants because the fire was intense enough to kill the tops of all bitterbrush plants. It appears the fire may have been hotter at the lower part of the burn because there were no relic bitterbrush plants. In the midslope plots, relics were found for most shrubs of various species.

All the young bitterbrush plants in the burned area were from resprouting crowns. There were young plants in all the unburned plots, indicating the species is successfully reproducing in the study area.

In Table 2, the data collected on the current-year twig growth are presented. Twenty twigs per plant on 20 plants (200 twigs in burned areas and 200 in unburned) were measured to determine if there was any difference in current-year growth. The difference in twig growth was found to be statistically significant at the 90 percent level. In other words, the burned plants were growing at a slower rate.

For each of the six plots, mule deer fecal pellet groups were counted. All pellet groups were counted without regard to pellet age. Clearly, the unburned areas have received heavier use than the adjacent burned areas, as shown in Table 3.

TABLE 1. Relative density of bitterbrush plants on six plots.

Quadrat	Burned	Slope location	Bitterbrush plants			
			New	Old	Dead	Total
1	Yes	Mid	2[2]	0	22[1]	24
2	Yes	Mid	6[2]	0	22	28
3	No	Mid	6	15	1	22
4	No	Mid	9	15	1	24
5	Yes	Lower	2	0	0	2
6	No	Lower	3	10	0	13

[1]Includes relics probably killed by fire.
[2]Includes resprouting after fire.

TABLE 2. 1979 length of twigs on 20 bitterbrush plants.

Unburned area plants		*Burned area plants*	
Plant number	Average twig length (inches)	Plant number	Average twig length (inches)
1	9.5	1	9.2
2	9.3	2	7.75
3	9.4	3	9.55
4	7.05	4	7.6
5	10.15	5	6.95
6	10.05	6	7.45
7	9.8	7	8.45
8	6.55	8	9.1
9	8.45	9	6.8
10	9.9	10	7.15
$\bar{x}$	9.02	$\bar{x}$	8.0

DISCUSSION

There are several obvious differences between the burned and unburned plant populations. It is evident the fire had a detrimental impact on the density of bitterbrush plants and production of this component of the plant community. A relatively low percentage of the bitterbrush plants were able to resprout and, therefore, most burned area plants were eliminated from the community.

Sagebrush was also largely absent in the burned areas, but in adjacent unburned areas it was a significant part of the community. The marked change in the community species composition caused by the fire is still very much in evidence. Also the size of the browse plants has been altered to the point that much of the burned area vegetation would be totally covered by several inches of snow. This physical barrier would limit use of the burned area even though considerable forage may occur there.

Another obvious factor is the difference in occurrence of fecal pellet groups between burned and adjacent unburned areas. Since the measurements were taken in adjacent areas, the reason for the significant difference seems easiest to explain on the basis of physical availability of browse during the winter. If there are no significant differences in nutritive value or availability, one would expect essentially equal use near the boundary of the two areas. The difference in use must occur because of an absolute difference in the amount of browse available, which was probably compounded by snow coverage.

TABLE 3. Number of mule deer fecal pellet groups for each of six plots

Plot	Slope position		Number of pellet groups
1	Mid	Burned	8
2	Mid	Burned	3
3	Mid	Unburned	28
4	Mid	Unburned	36
5	Low	Burned	4
6	Low	Unburned	16

All the bitterbrush plants that were examined during this study exhibited substantial twig growth and appeared to be vigorous and healthy. Growth form of the old plants in the unburned areas showed a fairly open form that indicates little use by sheep and/or deer. These plants did not exhibit the clubhead form indicative of sustained heavy use; neither was there evidence of browsing on large-diameter twigs.

Growth of the bitterbrush plants in unburned areas was greater, as has been documented in other areas by Blaisdell and Mueggler (1956). This difference in the growth rate is expected to continue for several years. In terms of total production of bitterbrush forage, the burned area has lapsed considerably since the fire and will most likely continue to do so for a long time. The density of plants has been reduced, as well as the size of plants. There are fewer plants of smaller size in the burned areas than were there prior to the fire. Since no evidence of new seedlings could be found, it is reasonable to conclude the burned area production will lag for many years.

Deer herd populations are often directly tied to winter range availability and condition because it is the element most often in shortest supply. It is not known whether this is the case with the mule deer using the study area. There is need for concern because deer numbers are increasing and winter range in the area is decreasing due to changing land use. Both of these trends cannot continue indefinitely without deer numbers reaching the limit of available winter range.

CONCLUSIONS

It is easy to conclude that the 1975 fire was detrimental to bitterbrush, but it is not

easy to conclude that the numbers of deer have been reduced because of it. This is due to populations of deer being within the capacity of the remaining winter range. The area is neither producing the winter forage for deer that it was prior to the burn nor are deer numbers anywhere near historic high levels.

If this area is indeed a critical winter range when population numbers are larger and other factors holding populations down are temporary, additional concerns arise. Thought should be given to introducing a fire-tolerant ecotype of bitterbrush with the hope of hybridizing this trait into the community, and effective means of reducing fire occurrence and spread should be developed.

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