

# Cliffrose Browse Yield on Bulldozed Pinyon-Juniper Areas in Northern Arizona<sup>1</sup>

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## Highlight

Where large pinyon and juniper trees were killed 4 to 6 years earlier by bulldozing, cliffrose browse yield was 3.5 lb/acre greater than on untreated sites. Most of the gain represented growth on cliffrose plants established before treatment.

Cliffrose (*Cowania mexicana* var. *stansburiana* (Torr.) Jepson) is a conspicuous shrub of the pinyon-juniper woodland (*Pinus edulis* Engelm. and *Juniperus* spp.) in the Grand Canyon region of Arizona. It was among the 5 most abundant items in contents of several sample series totalling more than 130 deer stomachs examined from winter ranges of the North Kaibab Plateau (Arrington, 1950; Rasmussen, 1941; Wright, 1950). Decisions to regulate hunting pressure in northern Arizona are based partly on periodic estimates of linear amounts of cliffrose twigs removed by mule deer (*Odocoileus hemionus* Rafinesque).

Woodland control by killing of pinyon and juniper trees may tend to increase or decrease cliffrose

browse, depending on destructiveness of tree control methods to cliffrose populations. This note compares some characteristics of cliffrose stands on untreated pinyon-juniper sites with those where the tree control method and natural abundance of cliffrose were expected to favor maximum production of cliffrose browse.

## Procedure

Observations were made on winter deer range on the west side of the North Kaibab. Cliffrose stems were counted in 1961 on 1000 circular plots of 0.01 acre each (diameter 23.6 ft) arranged in a series of 20 rectangular grids each containing 50 plots and encompassing 4 acres. Grids were systematically spaced on the ridges where cliffrose stands occurred. There were 10 grids on untreated pinyon-juniper areas and 10 where all but the smallest trees (< 2 ft tall) were killed 4 to 6 years earlier by bulldozers, a method known as "pushing." Dozer operators had been instructed to avoid killing cliffrose.

Oven-dry weights of browse within reach of deer were determined for each of 3 height classes of cliffrose, namely, <2, 2 to 5, and >5 ft. Current annual twig growth was clipped to the 5-ft height on 260 plants systematically selected at the grids described above. The yield/acre figure was derived from mean weight

of clippings per plant of each height class and the stand density of that class. Clipping was done from 29 Aug. to 1 Sept. 1961. Twigs less than 1 cm long were not collected.

## Results and Discussion

On areas of pushed pinyon-juniper, estimated production of cliffrose browse was 2.7 times that of untreated sites (Table 1). However, this large relative difference amounted to only 3.5 lb/acre. Little of the apparent browse increase resulted from cliffrose reproduction following pinyon-juniper control. Shrub seedlings which may have been established after trees were killed apparently had not attained a height of 2 ft by 1961. The sample plot populations of large shrubs, 2 ft high or taller, were no denser on areas where trees were pushed than on untreated ones. Precise counts of smaller plants on the large plots were difficult. It was nevertheless obvious that small cliffrose plants were common on both site types and that they produced less than 10% of the browse (Table 1).

Subsurface sprouting from cliffrose roots after aerial crown destruction was not seen on the North Kaibab nor among stands examined elsewhere in Arizona. Some plants had bud calluses on stems at the soil surface similar to those described for bitterbrush (*Purshia tridentata*

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Table 1. North Kaibab cliffrose stands and browse yields.

Height Class	Pushed Pinyon-Juniper Sites lb/acre	g/plant	Standing Pinyon-Juniper Sites plants/acre	lb/acre	g/plant	plants/acre
<2 ft	0.07	0.52±0.22	62	0.15	0.87±0.60	77
2-5 ft	3.33	9.61±2.80	157	1.09	3.10±1.50	159
>5 ft	2.21	16.20±4.45	62	0.91	4.64±1.93	89
Total	5.61	—	281	2.15	—	325

(Pursh) DC) (Blaisdell and Mueggler, 1956). Sprouting from that basal bud zone was seen occasionally among cliffrose plants sustaining crown damage.

The increased growth on shrubs present before treatment was presumed largely due to reduced competition from trees. The pruning effect of accidental damage by bulldozers stimulated growth on some cliffrose plants. It was unlikely that the difference between sites (Table 1) was due to animal use. Counts of droppings, accumulated on the sample grids during an unknown period up to 1961, showed no difference between areas in either deer or cattle presence.

Cliffrose yield estimates for pushed and untreated areas both tended to be conservative, since clipping was done a month before end of the potential growing season. Elsewhere, more than half of the annual twig elongation has occurred during the last month of the growth season of some years (Neff, 1964). Mean length of current annual twigs on the North Kaibab varied greatly from year to year. The mean for 1961 was below the midpoint of the range reported for annual measurements 1956-1964 (Russo, 1964; Project Personnel, 1965). Relationship, if any, of mean twig length to production on a weight/acre basis is not known, but

extreme annual variation may also characterize the latter. Field estimates of browse on the shrubs in 1948 indicated 17 lb/acre production for cliffrose on untreated pinyon-juniper sites (Kimball and Watkins, 1951).

Considered by itself, the cliffrose yield after pinyon-juniper pushing represented a gain in the deer food supply within cliffrose occupied portions of the range. The browse requirement for deer was estimated at 15 lb/acre for the entire winter range, based on a population of 10,000 deer and a minimum intake of 2.6 lb/deer/day (Russo, 1964; Smith, 1950). It appeared that cliffrose in 1961 supplied only a fraction of that requirement even on sites of greatest yield. Sagebrush (*Artemisia tridentata* Nutt.), juniper, grasses, forbs, and in one year pinyon were major items in deer ruminations on Kaibab winter range (Arrington, 1950; Rasmussen, 1941; Wright, 1950). Thus, any cliffrose improvement is difficult to evaluate for deer apart from availability of and deer preferences for other foods altered by the pinyon-juniper treatment.

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