Changes in Cactus Numbers and Herbage Production After Chaining and Mesquite Control

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Jumping cholla (*Opuntia fulgida*) is a variable component of desert and semidesert ecosystems. Associated species include cane cholla (*Opuntia spinosior*) and staghorn cholla (*Opuntia versicolor*). Stands of jumping cholla are particularly objectionable to livestock users because they interfere with use of the range and with the handling of livestock. The nuisance attributes of jumping cholla are more objectionable than the decrease in perennial grass production that results from competition.

One feature of jumping cholla, at least in the more mesic parts of its range, is that stands are not permanent. Populations become established, increase, then decline almost to extinction from unknown causes (Fig. 1). The cycle may take 30 to 50 years. A buildup of insects and pathogens is one suspected explanation. A general decline in the vigor of the reproductive material is another. Jumping cholla seedlings are extremely rare, but reproduction from joints that fall to the ground can increase cholla numbers rapidly.

Cholla can be controlled with chemicals now on the market, but not economically. Range fires will kill from a third to a half of the existing cholla plants, but burning sometimes results in large numbers of young plants from stem joints that fall to the ground after the fire. Mechanical control by chaining or cabling may also establish large numbers of young plants. In some cases, however, the new cholla stands are short lived. Martin and Tschirley (1969) reported that jumping cholla numbers rose from 740 plants/ha. (plants per hectare) before cabling to over 14,820 plants/ha. one year later, but that plant numbers dropped below the pre-treatment level by the third year after treatment.

Results reported here were obtained from the IBP Validation Site on the Santa Rita Experimental Range. The Validation Site includes three areas of about 200 acres each. Vegetation on the first area was left undisturbed to serve as a check. The cholla and other shrubs on the second area were knocked down with a chain in June 1970 (Fig. 2). Velvet mesquite (*Prosopis juliflora* var. *velutina*) on the third area was controlled in the summer of 1970 by pouring diesel oil around the bases of individual mesquite trees.

The chained area is relatively flat, but with the general plain broken by several drainage channels. Sample plots were classified generally into (1)

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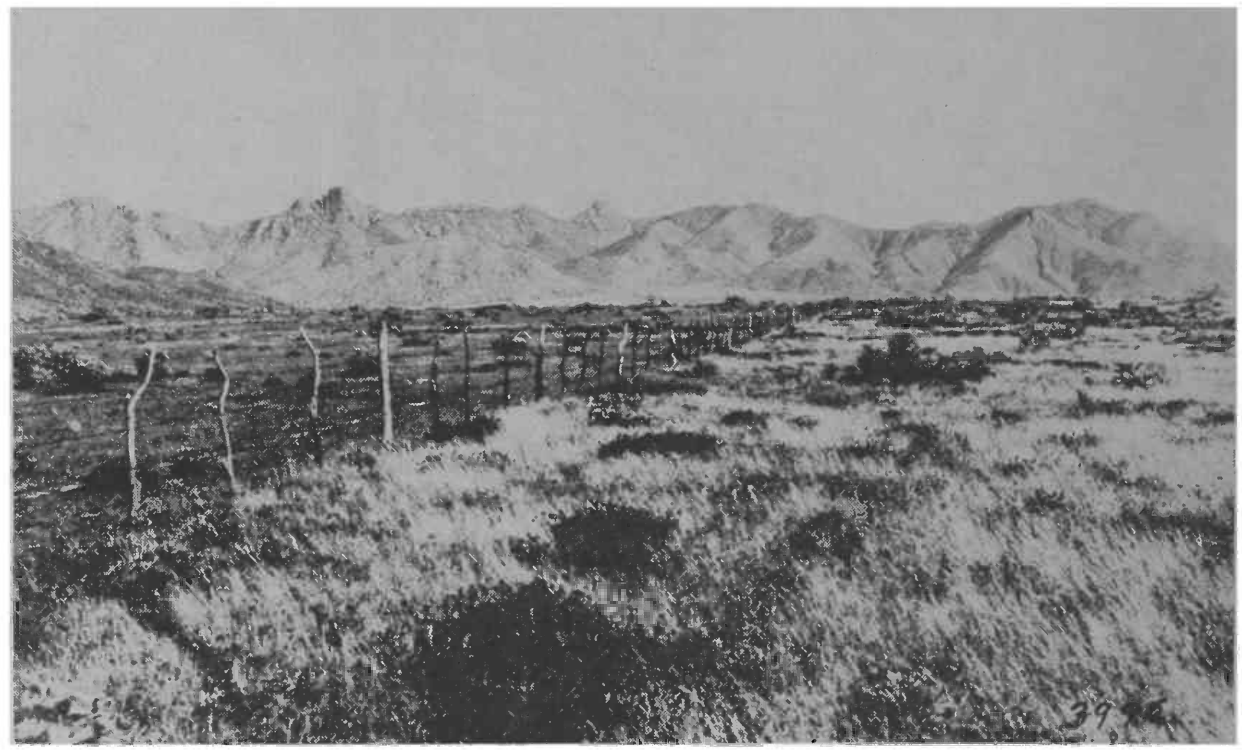
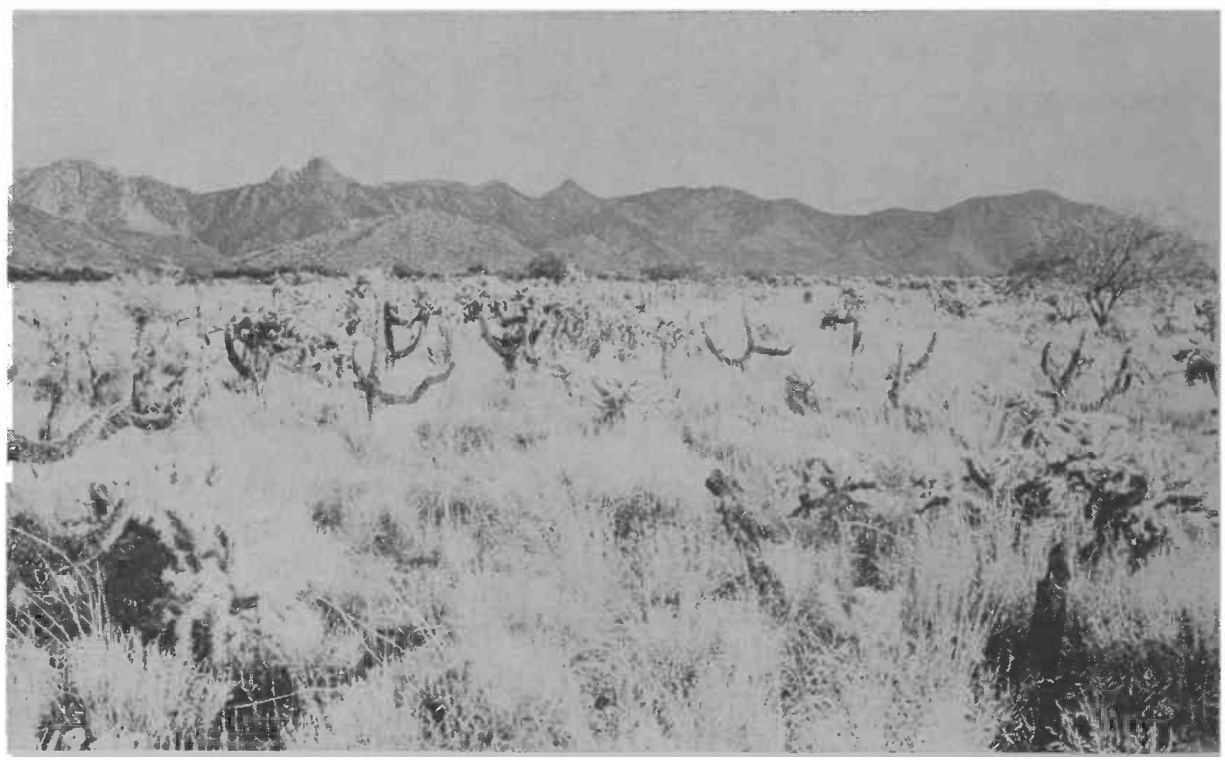
Table 1. Numbers of cactus plants per hectare in May 1970 before chaining (in June 1970) and in March 1974.

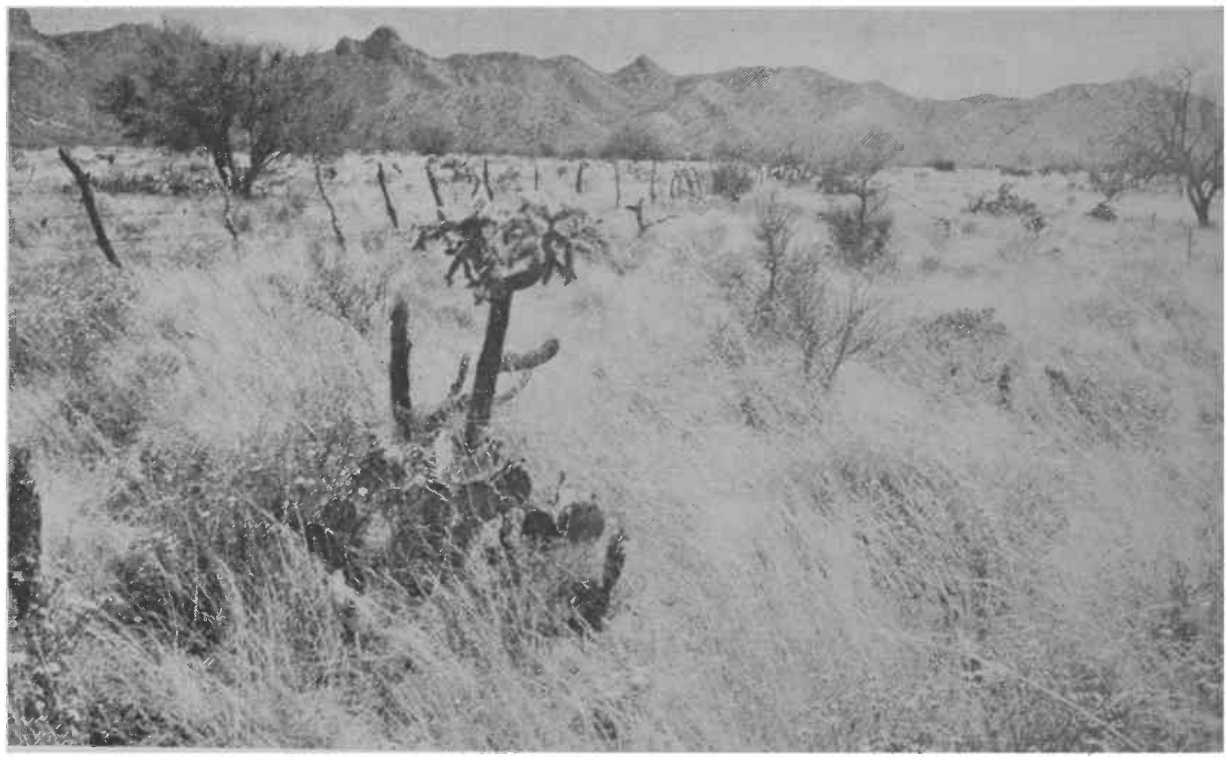
Kind of Site	*Staghorn Cholla*		*Jumping Cholla*		*Prickly Pear*		*Barrel*		*Hedgehog*	
	1970	*1974*	*1970*	*1974*	*1970*	*1974*	*1970*	*1974*	*1970*	*1974*
Upland	86	0	141	4	19	18	8	0	3	2
Mixed	100	4	58	15	81	30	19	6	0	0
Channel	35	0	51	0	32	60	5	2	0	0
Average[1]	77	1	98	6	38	33	10	2	1.5	1

[1] *Unweighted average of all plots on study area*

Figure 1. Natural changes in a stand of jumping cholla on the Santa Rita Experimental Range. Developing young stand of cholla in 1905 (top, right); a dense mature stand had developed by 1940 and started to decline (middle, right); most of the cholla pants had died of natural causes by 1962 (bottom, right).







upland, if the plot lay entirely on the flat, (2) channel, if most of the plot lay across or along a drainage, and (3) mixed, if the plot lay about half on the flat and the other half along the drainage.

Cactus on the chained area were counted before treatment in May 1970 from low-elevation aerial photographs. Resolution of the photographs was such that cactus plants as small as 6 inches tall could be detected if a side branch was present. Cactus plants were again counted in March 1974, this time by observers on the ground. This field count probably included some plants too small to have been detected on aerial photographs.

In the fall of 1971 following the second summer growing season after treatment, herbage production of annual and perennial grasses was determined on the chained area, on the mesquite-controlled area, and on the check plot where vegetation had not been disturbed.

There appeared to be some differences in the reaction of cactus species on the different kinds of sites, but plot-to-plot variations in numbers were too great to justify solid conclusions (Table 1). The March 1974 count showed only one staghorn cholla and 6 jumping chollas per hectare

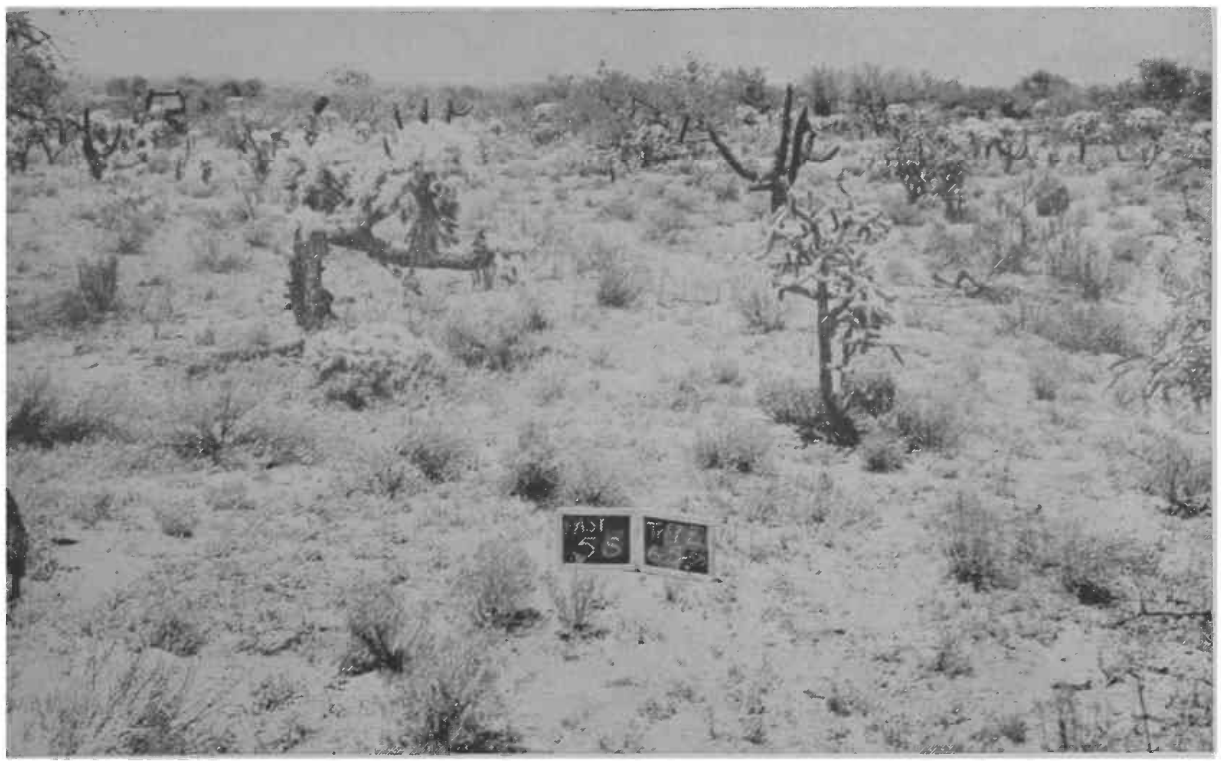


Figure 2. (Top, left) Typical vegetation on undisturbed parts of Santa Rita IBP Validation Site; (centear, left) appearance in July, 1970, immediately after chaining; (bottom, left) as it looked in March, 1974.

compared to initial numbers of 77 and 98, respectively. Barrel cactus (*Ferocactus wislizenii*) numbers in 1974 were only about one-fifth as great as in 1970 before chaining. On the average, pricklypear (*Opuntia engelmannii*) numbers were about the same in 1974 as in 1970. The apparent changes in pricklypear numbers on the mixed and channel sites are accounted for primarily by high counts on one or two plots, and therefore are not too meaningful. However, it did appear that more cactus were surviving in depressions where they may have escaped the chain, or near shrubs that may have caused the chain to ride over the cactus plants.

Martin and Tschirley (1969) also found that cholla cactus numbers three or four years after chaining were lower than before treatment. Results on pricklypear agreed to some extent also with observations on the Santa Rita to the effect that density and crown cover of pricklypear cactus is relatively stable. Chaining was very effective against cholla and barrel cactus, but had little overall impact on the pricklypear.

Herbage production of grasses on the chained area was higher in 1971 than on the adjacent untreated tract (Table 2). For annual grasses the difference was significant, 186 kilograms per hectare compared to 118 kg/hectare on the check area. The apparent increase in perennial grasses was not significant (235 kg/ha compared to 187 kg/ha). Total grass herbage was significantly higher on the chained area. A word of caution is in order, however, because chaining not only removed the cholla but moderate stands of mesquite and other shrubs as well as (Fig. 2). Consequently, only a part of the grass response can be attributed to the removal of jumping cholla.

The species composition of perennial grass herbage was similar on the chained and unchained areas (Table 3). The apparent differences in the table do not exceed the sampling error. The differences in cane bluestem and tanglehead for example, could

Figure 3. Many small gullies on the chained area have been almost healed by dense stands of perennial grasses that have become established in them.

very easily be the result of sampling error. On the other hand, the relatively large increase in Santa Rita threeawn and tall threeawns may be real responses.

Improvement in the perennial grass cover on the chained area has also retarded erosion. Once raw gullies are now lined with perennial grasses and several small headcuts have been stopped (Fig. 3). Cane beardgrass and tanglehead appear to be especially effective in this role.

Mesquite control did not increase the yield of annual grasses, but perennial grass production on the mesquite-free tract was more than twice that of the chained area. Total grass herbage production was likewise greater on the mesquite-free tract than on the cabled area.

The mesquite-free tract produced greater yields of bush muhly and dropseed than did either the chained area or the undisturbed tract. Yields of threeawns were only slightly less on the mesquite-free area, but their relative contribution was much lower because of the increased total herbage yield.

Changes in the density and age class distribution of cholla stands undoubtedly have impacts on associated populations of birds and small mammals. The white-footed woodrat, for example, arms its nest and runways with cholla joints. To some extent, then, the density of the woodrat population may depend on the density and age-class distribution of jumping cholla. Such a relationship has been reported for the woodrat and *Opuntia biglovii* in the Mohave Desert. Likewise, the populations of birds such as the cactus wren that nest in cholla would be expected to rise and fall with the fortunes of the cactus population.

Table 2. Herbage production (kg/ha) of annual and perennial grasses in 1971 on the chained and untreated areas.

	Chained	*Check*	*Mesquite-Killed*
Annual grasses*	**186a**	**113b**	**112b**
Perennial grasses*	**235b**	**187b**	**476a**
Total grasses*	**421b**	**305b**	**538a**

**Difference significant at 5% level*

Literature Cited

Martin, S. Clark and Fred H. Tschirley. 1969. Changes in cactus numbers after cabling. Prog. Agric. in Ariz. 21(1): 16-17.

Table 3. Species composition (percent) of perennial grass herbage from chained and untreated areas in 1971.

Species	*Chained*	*Check*	*Mesquite Killed*
Cane Bluestem ANDROPOGON BARBINODIS	**0**	**4.8**	**0**
Santa Rita Threeawn ARISTIDA GLABRATA	**36.1**	**29.6**	**18.0**
Tall threeawns ARISTIDA HAMULOSA or TERNIPES	**29.7**	**22.0**	**13.9**
Rothrock grama BOUTELOUA ROTHROCKII	**2.0**	**4.0**	**5.8**
Lehmann lovegrass ERAGROSTIS LEHMANNIANA	**1.2**	**3.5**	**0.8**
Bush muhly MUHLENBERGIA PORTERI	**6.2**	**6.9**	**26.2**
Plains bristlegrass SETARIA MACROSTACHYA	**2.4**	**3.8**	**0**
Dropseeds SPOROBOLUS spp.	**0.4**	**1.8**	**12.7**
Arizona cottontop TRICHACHNE CALIFORNICA	**19.3**	**23.6**	**21.8**
Tanglehead HETEROPOGON CONTORTUS	**2.7**	**0**	**0**
Other	**0**	**0**	**0.8**