Pocket Gophers on Seeded Utah Mountain Range[1]

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Highlight

Observation of two comparable areas of mountain rangeland seeded to grass the same year showed that uncontrolled populations of pocket gophers were very destructive. Protection of seeded areas resulted in good stands of grass and forbs. No ideal measure for controlling pocket gophers has yet been developed.

In 1959 we reported results of a 6-year study (1952 through 1957) on the effect of pocket gophers (*Thomomys talpoides*) on seeded mountain rangeland in the Monte Cristo area of Cache National Forest, Utah. The present paper chiefly reports observations during the 8-year period following the original study. Study areas, transects, and methods were the same for both periods, but different degrees of gopher control were used in the later period.

Recent Literature

A few pertinent reports have appeared since our earlier article. Marston and Julander (1961) reported serious gopher damage to several important tall forb species along the Wasatch Front in northern Utah. Richens' 2-year study (1965) on the native range that surrounds the two seeded areas we studied evaluated the effect of 1, 2, 3, and 4 years of control on the size of the gopher population. Treatment the first year reducecl population by about 48 percent, but additional years of treatments failed to reduce it significantly. Richens found high positive correlation between counts of mounds and winter casts with numbers of gophers as determined by saturation trapping. He devised an index for estimating the number of gophers per acre from counts of mounds or casts.

In Colorado, Reid et al. (1966) also reported that mounds were a good index to size of population. Average number of mounds raised per gopher in a 48-hour period was 9.9 at Grand Mesa and 9.7 at Black Mesa. Feeding trials in Colorado also showed that a pocket gopher consumes about 80 grams, fresh weight, of plants in a 24-hr period (Colorado Cooperative Pocket Gopher Project Committee, 1960).

Keith et al. (1959) reported that spraying a forb-grass cattle range in Colorado with 2,4-D resulted in an 87% reduction of pocket gophers, an 83% reduction of perennial forbs, and a 37% increase in production of grass. As a result, the diet of pocket gophers changed from 82% forbs and 18% grass to approximately equal amounts of both. About two-thirds of the gophers' diet during summer months was above-ground plant material.

Methods and Treatment

Stand indexes (frequency)[3] were determined for perennial grasses on ¼-ft² plots on seeded Areas I and II. For perennial forbs and tarweed (*Madia glomerata* Hook.) 1-ft² plots were used, which also gave frequency counts of gophers' winter casts; but current summer mounds were counted on 0.1-acre plots to determine relative gopher populations.

On Area I, gophers were closely controlled from the year of seeding (1952) through 1962. From 1963 through 1965, though, the landowner only partially controlled gophers, and some invaded the area. On Area II, gophers were uncontrolled from 1952 through 1957; but from 1958 through 1962 they were effectively controlled by poisoning with

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[3] Stand index is frequency on ¼-ft² plot for grasses and 1-ft² for forbs.

Table 1. Stand index of grasses and perennial forbs on seeded range at Monte Cristo (Utah) in selected years of gopher control.

Area	Treatment and period	1952	1953	1955	1957	1959	1962	1965
	GRASSES							
I	Gophers controlled (1952–62)	80	71	96	89	84	90	
I	Partial control (1963–65)							81
II	Gophers uncontrolled (1952–57)	70	33	61	16			
II	Gophers controlled (1958–62)					74	78	
II	Gophers uncontrolled (1963–65)							45
	PERENNIAL FORBS							
I	Gophers controlled (1952–62)	24	23	22	28	50	75	
I	Partial control (1952–57)	21	10	9	10			
II	Gophers controlled (1958–62)					17	40	
II	Gophers uncontrolled (1963–65)							61

whole oats treated with 1080 and supplemental trapping in conjunction with control on a large surrounding area of native range; then from 1963 through 1965 they were uncontrolled. To summarize treatments: Area I had 11 consecutive years of close control followed by 3 years of partial control; Area II had no control for 6 years, close control for the next 5, then 3 years with no control.

Both study areas were protected from grazing until 1957. From 1957 to 1965 they were grazed moderately by sheep in late summer.

Our first study (1952–1957) showed that on Area I, where gophers were closely controlled, an excellent stand of seeded grasses developed and was maintained. On Area II, where gophers were not controlled, an excellent stand of seeded grasses emerged but was subsequently depleted by gophers. Gophers damage grass stands in five ways. (1) They undermine plants and destroy their roots and sometimes pull small plants into their tunnels. (2) In winter and early spring they eat, or otherwise destroy, root crowns and stem bases of well established plants. (3) Their mounds and winter casts cover and often kill young plants. (4) Winter casts partially seal the soil against water infiltration. (5) Gophers burrow tunnels, which excessively aerate the soil and thus aggravate summer drought (Julander et al., 1959)

Table 2. Gopher mounds per acre and percent frequency of winter casts on seeded Areas I and II in selected years.

Area	1952	1953	1955	1957	1959	1962	1965
	Mounds						
I	8	96	24	20	18	35	760
II	125	495	777[1]	1,410	25	54	1,210
	Casts						
I	—	3	4	3	4	2	36
II	—	71	87	83	16	3	42

[1] Interpolated from original data to represent same length of season as other years.

Results

Stand Index

Grasses.—On Area I, where a good stand of seeded grasses prevailed, the stand index for grasses remained high throughout the study (Table 1). Yearly fluctuations in frequency of grass plants appeared to be due primarily to varied growing conditions; but the decrease in frequency of grass plants in Area I after 1962 was apparently due largely to increased gopher activity as indicated by the fact that mounds and casts accounted for considerable bare ground in 1965, and established plants are not readily subject to drought. In 1965 there were 760 mounds per acre—a spectacular increase from the number usual during the decade of close control (Table 2). Likewise the frequency of winter casts increased from the usual 3 or 4% to 36% in 1965.

On Area II the stand index for grass from 1952 to 1957 dropped markedly. The rise to 61% in 1955, caused by a good seed year, was wiped out by 1957. The grass stand in 1957 was poor, and gopher damage was severe (Julander et al., 1959). Except for a few patches, the seeded grasses had been destroyed by 1957, and native species (notably *Agropyron trachycaulum* (Link) Malte, and *Bromus carinatus* Hook. & Arn.) were the chief survivors. When gophers were closely controlled (1958–62) the stand index increased rapidly, and a fair stand of both native and seeded grasses became established. Then when gophers were uncontrolled for three seasons (1963–65), the stand index dropped sharply. Gophers reinvaded Area II rapidly and the number of mounds per acre increased phenomenally (Table 2).

Perennial forbs.—Stand index for perennial forbs remained low on both controlled and uncontrolled plots from 1952 to 1957 (Table 1). Many of the forbs present at the beginning of the study were destroyed in the seeding treatment. Some increase of the better species was evident in 1957 on Area I; from 1958 through 1962 this stand index increased rapidly. Several desirable tall forbs (e.g., *Aster foliaceus* Lindl. and others) invaded both seeded

Table 3. Yields (lb/acre, air dry) of seeded and native grasses, in selected years, Areas I and II, under varied intensities of gopher control.

Grass type	Area I					Area II				
	1955	1957	1959	1962	1965	1955	1957	1959	1962	1965
Seeded	1,170	1,275	1,110	1,079	634	265	81	358	530	267
Native	35	15	160	58	16	135	31	257	297	55
Total	1,205	1,290	1,270	1,137	650	400	112	615	827	322

areas. The gain in forb stand index on Area I was maintained during the 3 years of partial control, and in 1965 the vegetative stand had the appearance of a mixed grass-tall forb type.

On Area II the forb stand index increased while the gophers were uncontrolled (1963–65), but this increase was made mainly by some of the less desirable perennials including *Achillea millefolium* L., *Potentilla* spp., and *Erigeron flagellaris* A. Gray. This increase may have been permitted by a simultaneous decrease in grasses. At the same time, the more desirable forbs decreased. Consequently, in 1965 the stand on Area II appeared as a rather poor mixed grass-low forb type, which had much lower forage value than Area I.

Forage Production

Grasses.—On Area I, grass production continued high throughout the 11-year period when gophers were closely controlled (Table 3); it averaged about 1,200 pounds per acre air dry. More than 90% of the production was from seeded species. However, production decreased noticeably in 1965 after 3 years of only partial control of gophers. This decrease appears to have been due partially to considerable gopher activity (Table 2) and possibly to increased competition with forbs. Total herbage of grasses and perennial forbs was still fairly high in 1965 (more than 1,000 lb per acre, air dry) and consisted mainly of good forage species.

On Area II (uncontrolled), the large gopher population rapidly reduced grass production from 1952 through 1957. Under subsequent protection from gophers, 1958 through 1962, grass production increased from a low of 112 lb per acre in 1957 to 827 lb in 1962. Both seeded and native grasses increased, but seeded species made greater gain (Table 3). During reinvasion by gophers in 1963–65, grass production decreased to 322 lb per acre —only half the production on Area I. Native species decreased more than seeded species in production but not in percent frequency. Seeded species produced more grass per plant than the natives.

Perennial forbs.—Perennial forbs contributed little to the herbage produced on Areas I and II from 1952 to 1957. Many of them were destroyed during the seeding operation, and their reinvasion required several years even on the controlled area. From 1957 to 1965, production of perennial forbs increased greatly on Area I (Table 4). Furthermore, the increase was by the more desirable forbs. *Geranium fremontii* Torr. and *Aster foliaceus* Lindl. were not completely eliminated in tilling the ground for seeding, and they were the first to show increase. Some of the more palatable species (*Senecio serra* Hook., *Lupinus* spp., *Polemonium foliosissimum* Gray, and *Ligusticum porteri* Coult. & Rose [the latter not on production plots]) were not present on either area before seeding. These

Table 4. Yield (lb/acre, air dry) of perennial forbs at Monte Cristo by forage classes in selected years of varied gopher control treatment.

Forage class	Area I					Area II				
	1955	1957	1959	1962	1965	1955	1957	1959	1962	1965
Poor species:										
Achillea, Potentilla, Erigeron and others	25	14	90	71	29	10	0	36	130	32
Better species:										
Geranium and *Aster*	70	120	156	316	211	50	87	97	191	97
Senecio, Lupinus, and *Polemonium*	0	0	124[1]	65[2]	169[3]	0	0	0	26[1]	13[1]
Total	95	134	379	452	409	60	87	133	347	142

[1] Includes *Senecio serra*; *Lupinus* was present on the Area but not on sample plots.
[2] Includes *Senecio, Lupinus,* and *Polemonium*; *Ligusticum* was present on this Area, but not on sample plots.
[3] Includes *Senecio* and *Lupinus*; *Polemonium* was present on this Area but not on sample plots.

Table 5. Percent occurrence of tarweed on 1-ft² plots, Areas I and II, in selected years.

Area	1952	1953	1955	1957	1959	1962	1965
I	28	18	2	0	5	0	2
II	20	65	47	72	88	56	90

species apparently invaded from adjacent aspen areas in 1958 or 1959, and increased substantially thereafter. During partial gopher control in 1962–65 some of them decreased, but in 1965 the yield of palatable forbs was still 380 lb per acre compared to only 120 lb in 1957. Furthermore, while the more palatable forbs had increased, the species having lower palatability decreased.

Production of perennial forbs on Area II remained low until after 1959, the second year of control (Table 4). Apparently the forbs reinvaded this Area much more slowly than Area I, probably because gopher occupation had modified soil and water conditions (Julander et al., 1959). After 5 years of gopher control, though, some of the tall desirable forbs mentioned previously were growing on the Area, and substantial recovery was evident. Then after 3 years of no control (1962–65), production of all classes of perennial forbs on this Area decreased considerably. By 1965 the main herbage contributors on Area II were *Geranium fremontii* Torr. and *Achillea millefolium* L.

Tarweed

Tarweed was abundant on both study areas before they were seeded, but was practically eliminated by spring cultivation in the seeding operation. Tarweed is an unpalatable aggressive annual and readily invades areas bared by gopher mounds and casts and by dead plants. Frequency of its occupation indicates, to some degree, the condition of seeded stands.

On Area I tarweed grew in openings not completely occupied by grasses for the first 2 years (Table 5). As the grass stand and the tall forbs increased and more fully occupied the soil, tarweed was sharply reduced for the remainder of the study period. On Area II tarweed increased as the grass stand deteriorated from 1952 to 1957. By the end of the gopher control period (1958–62) grasses and tall forbs had increased and by 1962 had crowded out much of the tarweed. After heavy reinvasion by pocket gophers (1963–65) in Area II, tarweed again became abundant.

Gopher Control and Populations

Effectiveness of gopher control on Area I has already been noted. On Area II it was effective during the 1958–62 control period. In 1958 we estimated the kill at 90%. Poisoning during subsequent years, supplemented by trapping, kept the population low through 1962. Then when control was relaxed in 1963, gopher population on Area II returned to about the 10-year average for untreated areas. Richens (1965) found a dense population (27 to 39 per acre) on native range adjacent to our study areas.

Table 6. Mound counts per acre on open herbland and aspen native range adjacent to Areas I and II, in selected years.

Type	1957	1958	1959	3-yr avg	1960	1961	1962
Open herbland	1,693	1,730	1,503	1,642	410	1,113	3,677
Aspen	1,333	1,593	1,127	1,351	613	1,827	4,037

Other records on native range indicate that gopher populations build up rapidly following control or die-off. Richens reported a rapid buildup in 1961 and 1962 on control areas after 1 and 2 years of nontreatment. Mound counts on the native range near our study areas showed a drastic die-off of gophers in 1960 on noncontrolled areas, but no cause was apparent. During 1961 the population built up again to near the 3-year average; 2 years later the population had more than doubled the 3-year average, as indicated by mound counts (Table 6).

Discussion and Conclusions

Pocket gophers destroy vegetation, and large populations may completely destroy seeded grass stands. They also destroy some valuable tall succulent forbs or may prevent their becoming established; this is evident by noting the difference between presence of such plants on controlled areas and their absence from noncontrolled seeded areas.

The population of 27 to 39 gophers per acre that Richens found at Monte Cristo in 1961 and 1962 might consume 4¾ to 7 lb fresh weight of vegetative material per day. At this rate, in a year they might consume 435 to 670 lb of air-dry plant material per acre. This represents a large percentage of total annual production of some depleted ranges. Since roots, root crowns, and regenerative organs (corms, bulbs, rhizomes) make up a good share of gophers' year-round diet, their foraging may be more destructive than foraging of surface-feeding animals.

Effective economical means for controlling pocket gophers remain a problem. Richens suggested improvements in present methods of poisoning. The recently developed burrow-builder (Ward and Hansen, 1960) has been effective on farmlands and on limited areas of grass and forblands where soil conditions are favorable.

We have questioned how such dense populations of pocket gophers could build up on nearly pure seeded grass areas at Monte Cristo. The answer may be that at Monte Cristo several corm and fleshy-rooted forbs had nearly 100% frequency in the grass stands. These plants completed their life cycle before grasses started rapid growth, and their underground parts supplied considerable gopher food.

Spraying to kill such plants would have to be done in very early spring, and it may be desirable to investigate the possibility of reducing gophers by this practice. Spraying to destroy other forbs may be desirable on some areas, but could not be used on deer or sheep ranges or on some cattle ranges where forbs are important forage plants. For many areas of rough, brushy, steep, and timbered rangelands inhabited by pocket gophers, the problem of efficient gopher control as a practical range improvement practice awaits development of some more effective method.

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