

Effect of goats upon native rodents and european rabbits in the chilean matorral

Efecto de las cabras sobre roedores nativos y conejos europeos en el matorral chileno

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SUMMARY

The abundance of native rodents and European rabbits was sampled in two matorral patches subjected to different degrees of disturbance by Spanish goats. Native rodents are more abundant in the undisturbed patch, whereas rabbits are less common there than in the disturbed one. Likely consequences for vegetation renewal are briefly discussed.

Keywords: Goats, Rodents, Rabbits, Matorral, Chile.

RESUMEN

La cabra española es un herbívoro introducido en Chile. El ramoneo por ganado caprino reduce la cobertura arbustiva del matorral; tal reducción afecta a los pequeños mamíferos que habitan los parches del matorral ramoneados por cabras. Mientras los roedores nativos son más abundantes en parches no ramoneados, los conejos europeos son más abundantes en los parches ramoneados. Los cambios en la abundancia de los pequeños mamíferos pueden afectar la renovación del matorral.

Palabras clave: Cabras, Roedores, Conejos, Matorral, Chile.

The Spanish goat (*Capra hircus* Linnaeus, 1758) was introduced into Chile during the XVI century, and promptly grew into large domestic herds (Gay 1847). At present, goats are bred in broad areas of north-central and central Chile, and feed on the native vegetation (Fuentes & Hajek 1979, Simonetti & Fuentes in press). As in other parts of the world where they have been introduced (see Spatz & Mueller-Dombois 1973, Coblenz 1978, Hamman 1979), goats in Chile have had a severe impact upon the native vegetation. Browsing by goats may modify both shrub cover and species composition of the matorral—the dominant vegetation in central Chile—(Simonetti & Fuentes in press). Disturbance by goats also favors the dominance of some ruderal herbs (Walkowiak & Simonetti 1981).

Native rodents and the introduced European rabbit (*Oryctolagus cuniculus* (Linnaeus, 1758)) use the matorral vegetation as source of food and refuge (Simonetti &

Otaíza 1982, for a review). It is likely to expect that changes in the matorral vegetation due to goat browsing may have coupled variations in small mammals distribution and abundance (Simonetti & Otaíza 1982). The results of a preliminary survey to determine whether such effects exist are reported here.

METHODS

The species composition of the small mammal assemblages in the matorral changes according to the degree of openness of the vegetation and season of the year, independently of disturbance (Jaksic et al. 1981, J.A. Simonetti & E.R. Fuentes, unpublished results). To avoid biases, the small mammal census was conducted in two adjacent patches on a same south-east facing slope, in an area close to Lago Peñuelas (approx. 33°10'S, 71°30'W). The trapping was conducted in spring (October-November 1981), when the lowest

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level of rodent abundance occurs in the undisturbed matorral (J.A. Simonetti & E.R. Fuentes, unpublished results).

The first site sampled is heavily used by goats, as assessed by counting of fecal pellets in plots of 1 m² randomly set in the field (see Neff 1968); this is the browsed patch. The second one, located ca. 600 m apart, is separated by a fence, and is rarely used by goats; this is the unbrowsed patch.

Rodent abundance was surveyed by live-trapping. In each one of the two patches, a grid containing 5 by 4 stations (each with one medium-sized Sherman trap), at 5 m interval, was operated during 8 nights. Rodents were marked and released; the minimal number of rodents known to be alive was used as a measure of the rodent abundance (Hilborn et al. 1976). The level of rabbit activity was determined by counting fecal pellets in plots of 1 m² randomly distributed in the field (Simonetti & Fuentes 1982). Shrub and herb cover were measured along 20 m linear transects.

RESULTS

The activity levels of goats (as estimated by counting of fecal pellets) differ significant-

ly between the two patches ($P < 0.01$ Mann-Whitney U test; Sokal & Rohlf 1969, Table 1). Three individuals of two species of rodents were captured a total of 13 times in the browsed patch (trapping success 8.1%), whereas 31 individuals of three species were captured a total of 67 times in the unbrowsed patch (trapping success 41.9%; Table 1). Of these, 12 of the *Akodon longipilis* (Waterhouse, 1837) were juveniles and one female was pregnant; only one of the *Akodon olivaceus* (Waterhouse, 1837) caught in the unbrowsed patch was juvenile, and none of the females was pregnant. A single *Phyllotis darwini* (Waterhouse, 1837) was caught in the unbrowsed patch, and was a reproductive male (Table 1).

The level of relative activity of rabbits (as estimated by counting of fecal pellets) is significantly higher in the browsed than in the unbrowsed patch ($P < 0.01$ Mann-Whitney U test; Table 1). Shrub and herb cover also differ significantly between these patches ($P < 0.01$ Mann-Whitney U test for both): there is less shrub cover but more herbs in the browsed patch than in the unbrowsed one (Table 1).

TABLE 1

Abundance of mammals and vegetation in a browsed and an unbrowsed patch of matorral in central Chile. n is sample size, MNK is the minimum number of native rodents known to be alive and, TC is the total number of captures.

Abundancia de mamíferos y vegetación en dos parches de matorral en Chile central. n es el tamaño muestral, MNK es el número mínimo de roedores y, TC es el total de capturas.

VEGETATION	UNBROWSED			BROWSED				
	\bar{x}	2SE	n	\bar{x}	2SE	n		
Shrub cover (%)	65.7 ± 14.2		6	8.9 ± 6.1		6		
Herb cover (%)	14.3 ± 13.3		6	90.1 ± 7.8		6		
MAMMALS								
<i>Capra hircus</i> (feces/m ²)	0.8 ± 0.6		86	22.5 ± 5.6		59		
<i>Oryctolagus cuniculus</i> (feces/m ²)	12.0 ± 5.0		87	29.2 ± 10.0		59		
			<i>adults</i>			<i>adults</i>		
	MNK	TC	♂	♀	MNK	TC	♂	♀
<i>Akodon longipilis</i>	25	51	8	5	2	6	1	—
<i>Akodon olivaceus</i>	5	12	2	2	1	7	—	1
<i>Phyllotis darwini</i>	1	4	1	—	—	—	—	—

DISCUSSION

The results of this brief survey show that a high activity level of goats is associated with low shrub cover and rodent species number and abundance. There is also an increase in both herb cover and activity level of rabbits.

The observed pattern of rodent abundance in the less shrub-covered patch does not agree with those previously known in the Chilean matorral. Open patches usually hold more individuals, and sometimes more species, than those with high shrub cover (Fulk 1975, Jaksić et al. 1981, J.A. Simonetti & E.R. Fuentes, unpublished results). This difference may be accounted by the extremely low shrub cover of the browsed patch: 9% versus 20-60% in the other surveys (Fulk 1975, Glanz 1977, Jaksić et al. 1981). In others words, native rodents may be more abundant at medium shrub cover levels than at either higher or lower ones.

Shrub cover *per se* is an important feature of the habitat for native rodents as well as for rabbits in the Chilean matorral. On the one hand, shrub cover is important in predator avoidance; native rodents are spatially restricted to the neighborhood of shrubs as a response to predation risks in the open spaces between bushes (Glanz 1977; see Simonetti & Otaíza 1982, for a review). Goats would make less suitable for native rodents some matorral patches by reducing shrub cover. Alternatively, the same pattern could be produced by an avoidance of high herb cover by the native rodents; apparently this is not the case (Glanz 1977).

On the other hand, rabbits use more patches with low (10-40%) than high (> 60%) shrub cover (Jaksić & Soriguer 1981). In this case, by reducing shrub cover, goats favor rabbits by creating open and hence more suitable patches.

The observed changes in small mammal abundance may have important consequences for the matorral vegetation. Rabbits alone or coupled with goats kill a high proportion of seedlings of native shrubs growing both under the canopy and in the open spaces between large shrubs.

Native rodents, such as *Abrocoma bennetti* Waterhouse, 1837, and *Octodon degus* (Molina, 1782) feed upon those seedlings growing close to their refuges, and no mammalian herbivore has a detectable effect on shrub seedlings in the open spaces (Fuentes & Simonetti 1982, Simonetti & Fuentes in press). The improvement of habitat conditions for rabbits due to browsing by goats may result in an increased pressure against matorral renewal.

From the above evidence, it is plausible to propose that shrub cover reduction due to browsing by goats affects native rodents (decreasing their abundance) and rabbits (increasing it). The long term effect of these changes are unknown at present. Experiments are needed to evaluate the possible causality observed between goat activity and abundance of small mammals, and also to unravel whether shrub reduction *per se* and/or another coupled change as food availability or microclimate, accounts for the observed pattern.

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