

Habitat preferences and abundance relations of small mammals in the Natal Drakensberg

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Small mammals were studied in a South African montane region at elevations ranging from 1 500 to 3 000 m. The distribution and habitat preferences of eight rodent and two insectivore species are dealt with. The relative abundance of small mammals in 18 habitats (recognized on the basis of vegetation type, altitude, and burning treatment) is detailed and discussed. Small mammal numbers, species richness, and diversity in the different habitats are compared and related to habitat complexity.

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Klein soogdiere is in 'n Suid-Afrikaanse berggebied tussen 1 500 en 3 000 m bo seespieël bestudeer. Die verspreiding en habitatvoorkeur van agt knaagdier- en twee in-sektivoorspesies word behandel. Relatiewe getalle van klein soogdiere in 18 habitatte (gebaseer op plantegroei-tipe, hoogte bo seespieël, en veldbrandpatroon) word uiteengesit en bespreek. Klein soogdiergetalle, spesiegetalle, en verskeidenheid in die verskillende habitatte word vergelyk en met habitatkompleksiteit in verband gebring.

S.-Afr. Tydskr. Dierk. 1982, 17: 202–209

Only two short papers on small mammals of the Natal Drakensberg (Meester, Lloyd & Rowe-Rowe 1979; Mentis & Rowe-Rowe 1979) have been published, both dealing briefly with the recolonization of grassland after fire. Little was known of what small mammals occur in the area, the relative abundance of different species, and the ecological niches which they occupy. We therefore report on our findings in Giant's Castle Game Reserve in the Natal Drakensberg, providing baseline data which we believe will contribute to a better understanding of the ecosystem and to its conservation management.

Study area

Giant's Castle Game Reserve (GCGR), 29°08' to 29°23'S and 29°23' to 29°37'E, occupies an area of 36 000 ha between 1 380 and 3 350 m above sea level. The Drakensberg escarpment runs approximately south-north along the western boundary of the reserve at an average altitude of 3 000 m, dropping sharply to 2 200 m. A number of rivers flow approximately west-east from the escarpment, and have incised steep-sided valleys descending from 2 200 m to 1 380 m. Between the river valleys high ridges have remained, extending eastwards from 2 200 m to 1 800 m. The geology has been described by King (1972) and details on Drakensberg soils are contained in van der Eyk, MacVicar & de Villiers (1969).

Summers are mild to cool and winters cool to cold. The warmest month is January and the coldest is July (mean daily maxima and minima 23° C and 13° C; and 14° C and 4° C respectively). Minimum temperatures at grass level are much lower than those recorded in the Stevenson screen: at 1 860 m mean daily minimum temperatures during January and July are 8° C and –8° C respectively (Killick 1963). The rainfall is seasonal, occurring mainly from October to April. Mean annual rainfall measured at 1 760 m during the study was 1 092 mm increasing with altitude to ca. 1 700 to 1 800 mm at the base of the escarpment. Snow falls mainly between April and September, but can precipitate above 2 500 m during any month.

GCGR is vegetated predominantly by fire-climax grassland, with patches of forest, scrub, and woodland. There is no published description of the vegetation of the reserve. It is, however, similar to that at Cathedral Peak, described by Killick (1963), where three main vegetation belts were recognized. The belts, and the major com-

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munities which we recognized within each (based on Killick 1963) are:

(i) Montane Belt (up to 1 800 m)

Predominantly *Themeda triandra* grassland, with patches of tall grassland, *Protea* woodland, *Greyia-Cussonia* grouped-tree woodland/grassland, scrub (*Leucosidea*, *Philippia*, or *Buddleja-Leucosidea*), boulder-bed scrub (on river levees), and climax *Olinia* forest.

(ii) Sub-alpine Belt (1 800 to 2 750 m)

Predominantly homogeneous grassland with *Themeda* grassland up to 2 200 m and temperate grassland on the escarpment above 2 200 m. Limited patches of scrub develop in fire-inaccessible areas.

(iii) Alpine Belt (above 2 750 m)

Festuca grassland and *Erica-Helichrysum* heath.

Fire is used in the management of GCGR. The burning policy during the study period (January 1978 to May 1981) was one of biennial burning in which the reserve was divided into 28 burning compartments, 14 of which were burnt each year, except firebreaks which were burnt annually. Forests are protected from fire and forest margins and dense scrub or thicket patches are only partly burnt, or burnt occasionally. Three grassland areas, at 1 500 m, 1 860 m, and 2 200 m were also protected from fire.

Methods

Sampling was done by removal trapping, using a combination of aluminium live traps and plywood-based snap traps, set *ca.* 15 m apart, baited with a mixture of peanut butter and rolled oats, and checked once daily. The term 'trap night' is used to describe a trap which was set for a 24 h-period. Thirty traps were set for four days and four nights, i.e. 120 trap nights per sampling session in each habitat. Most of the habitats were sampled every six months to give full two-year coverage to biennial burns.

The habitats sampled and the sampling effort in each are listed in Table 1. Habitats were recognized on the basis of vegetation type, altitude, and whether burnt or protected. All habitats sampled were in the southern half of the reserve. The Alpine Belt was not sampled in GCGR, but data collected at the summit of Sani Pass, outside the reserve, are included.

Three measures of abundance were used, viz. trap success, species richness, and diversity. Trap success (or per cent success) is the number of small mammals captured/100 trap nights. Species richness is the number of species collected, and diversity was calculated using the Shannon-Wiener index (Poole 1974):

$$H' = - \sum_{i=1}^s P_i \log_e P_i$$

H' is diversity where s is the number of species, and P_i the proportion of the number of individuals belonging to the i^{th} species.

Data on herbage production were obtained from Scotcher, Clarke & Lowry (1980) or collected at the time that a habitat was being sampled. The method employed involved clipping all herbage within a quadrat to a height of *ca.* 30 mm above ground level, oven-drying it, and calculating the above-ground standing crop in g/m^2 .

Table 1 Small mammal habitats sampled in GCGR, arranged approximately in order of ascending altitude

Vegetation type	Altitude (m)	Aspect	Fire regime	Times sampled	Total trap nights
Montane belt					
<i>Themeda</i> grassland	1 500	N	Biennial autumn	5	600
<i>Themeda</i> grassland	1 540	S	Protected	4	480
Grouped-tree woodland	1 540	W	Biennial autumn	5	600
<i>Protea</i> woodland	1 660	W	Biennial autumn	4	480
Boulder-bed scrub	1 720	NE	Biennial autumn	4	480
<i>Themeda</i> grassland	1 740	E	Annual spring	5	600
Scrub	1 760	NE	Occasional burn	2	240
Scrub	1 760	SE	Protected	1	120
Tall grassland	1 800	NE	Annual spring	3	360
Forest	1 800	S	Protected	4	480
Sub-alpine belt					
<i>Themeda</i> grassland	1 900	NE	Biennial spring	5	600
<i>Themeda</i> grassland	1 860	E	Protected	1	120
<i>Themeda</i> grassland	2 200	NE	Biennial spring	4	480
<i>Themeda</i> grassland	2 200	NE	Protected	4	480
Temperate grassland boulder-bed	2 300	NE	Biennial winter	6	720
Temperate grassland	2 300	E	Biennial winter	4	480
Temperate grassland	2 700	NE	Biennial winter	2	240

Results and Discussion

Distribution and habitat preferences

Two shrews (*Mysorex varius* and *Crociodura flavescens*) and eight small rodents (*Rhabdomys pumilio*, *Otomys irroratus*, *O. sloggetti*, *Dendromus melanotis*, *D. mesomelas*, *Mus minutoides*, *Graphiurus murinus*, and *Praomys natalensis*) occur in the reserve.

Distribution in relation to vegetation type and altitude is illustrated in Figure 1 for all species except *P. natalensis*, which was incidentally captured at only two localities: outside a dwelling in the rest camp (at 1 760 m) and in the ranger's house at Injasuti (at 1 920 m) in the north-west of the reserve.

M. varius enjoys the widest distributional range, occurring in all vegetation types and at all altitudes (see Table 2).

R. pumilio, the most abundantly caught species, occurs in all habitats from 1 500 to 2 700 m except forest, but is absent from the *Erica-Helichrysum* heath on the summit.

O. irroratus occurs in all grassland and scrub habitats

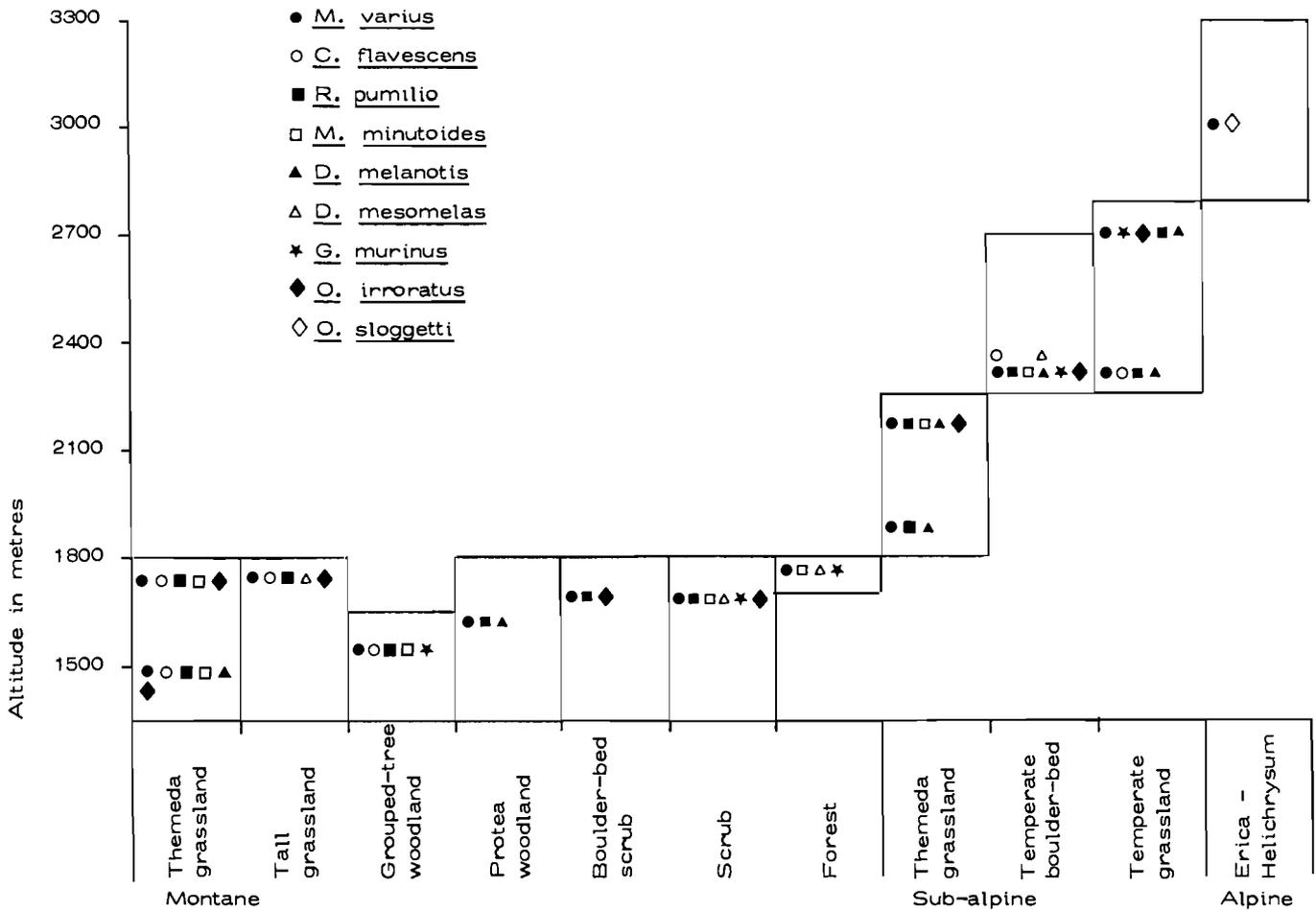


Figure 1 Distribution of small mammals in GCGR by altitude and vegetation types. The blocks indicate altitudinal ranges of the vegetation types.

from 1 500 to 2 700 m. Although not captured in *Themeda* grassland at 1 900 m nor in grouped-tree woodland, this rodent's feeding signs were seen in these habitats.

Three other species, nowhere abundant but widely distributed, are *D. melanotis*, limited to grassland, mainly in the Sub-alpine Belt; *M. minutoides*, recorded in grassland, scrub, and forest; and *C. flavescens* which was collected in grassland at all altitudes except 2 700 m.

Three species appear to have rather specialized habitat requirements: *D. mesomelas* was recorded in forest, scrub, temperate grassland boulder-bed, and tall grassland; *G. murinus* was limited to scrub, forest, and rocky habitats; and *O. sloggetti* occurred only in the *Erica-Helichrysum* heath.

There appears to be very little published information on the habitat preferences of South African small mammals. Concerning the shrews, Roberts (1951) made the broad statements that *Mysorex* 'appears to occur only in moister areas, especially in forests or scrub' and that *Crocidura* 'may occur in any sort of habitat'. *M. varius* has been recorded in a wide variety of habitats (Lynch 1975; Rautenbach 1976, 1978a; Bond, Ferguson & Forsyth 1980) including grassland and fynbos. *C. flavescens* has been recorded in a number of vegetation types (Meester 1963; Rautenbach 1978a). Characteristics of this shrew's main habitat requirements recognized by Rautenbach (1978a) are dense cover and high rainfall.

Brooks (1974) described *R. pumilio* as a broad-niche species. In southern Africa it occurs in habitats ranging

from moist grassland to Kalahari dune veld (Smithers 1971; Lynch 1975; Nel & Rautenbach 1975; Perrin 1980; Bond *et al.* 1980). *R. pumilio* is essentially a grassland species, and occurs in fynbos or *Acacia* scrub only where there is good grass cover (Bond *et al.* 1980; Smithers 1971). Grass cover in woodland and scrub communities in the Drakensberg is good, therefore accounting for this rodent's almost even distribution over these habitats and grassland.

O. irroratus was generally believed to be a species which occurred in grassy or vlei situations close to water. Davis (1973), however, pointed out that this was not the case, but that the rodent enjoys a much wider distribution, occurring throughout grassland, although being more abundant in moist habitats. In GCGR, for example, *O. irroratus* was trapped on ridge tops and on the escarpment at considerable distances from water.

Preferred habitats of the other GCGR species are similar to those described by Roberts (1951): *O. sloggetti* occurs at high altitudes amongst rocks and forbs; *G. murinus* is found mainly among rocks and trees; *M. minutoides* occurs in almost any habitat; *D. mesomelas* is associated with rank scrub or grass vegetation; and *D. melanotis* is merely described as being more terrestrial than *D. mesomelas*.

The two main components in the habitat preference of the arboreal *G. murinus* appear to be trees or rocks, where it nests either in holes in trees or in rock crevices. In GCGR it was collected in forest; grouped-tree woodland, which, although essentially grassland, includes groups of trees around rocks; *Buddleja-Leucosidea* scrub, which includ-

Table 2 Relative abundance of small mammals (number/100 trap nights) collected in various habitats in GCGR. Burnt areas are suffixed by B and fire protected areas by P. Arranged in ascending order of altitude

Vegetation	Altitude (m)	Fire	<i>M. varius</i>	<i>R. pumilio</i>	<i>O. irroratus</i>	<i>D. melanotis</i>	<i>M. minutoides</i>	<i>C. flavescens</i>	<i>D. mesomelas</i>	<i>G. murinus</i>	<i>O. sloggetti</i>	Total
Montane Belt												
<i>Themeda</i> grassland	1 500	B	0,3	3,3	0,8	0,2	0,2	0,2	—	—	—	5,0
<i>Themeda</i> grassland	1 540	P	4,2	5,8	—	—	—	0,4	—	—	—	10,4
Grouped-tree woodland	1 540	B	0,8	6,3	—	—	0,2	0,7	—	0,3	—	8,3
Protea woodland	1 660	B	0,2	0,2	—	0,2	—	—	—	—	—	0,6
Boulder-bed scrub	1 720	B	5,8	9,2	1,7	—	—	—	—	—	—	16,7
<i>Themeda</i> grassland	1 740	B	1,0	4,2	0,3	0,2	0,2	0,3	—	—	—	6,2
Scrub	1 760	B	1,7	5,0	0,8	—	0,8	—	0,4	0,8	—	9,6
Scrub	1 760	P	5,8	11,6	—	—	—	—	—	—	—	17,5
Tall grassland	1 800	B	3,6	5,3	2,2	—	—	0,3	0,3	—	—	11,7
Forest	1800	P	1,5	—	—	—	0,2	—	0,4	3,8	—	5,8
Sub-alpine Belt												
<i>Themeda</i> grassland	1 900	B	2,0	6,7	—	0,3	—	—	—	—	—	9,0
<i>Themeda</i> grassland	1 860	P	5,8	3,3	—	0,8	—	—	—	—	—	10,0
<i>Themeda</i> grassland	2 200	B	6,3	4,0	0,4	2,1	0,4	—	—	—	—	13,1
<i>Themeda</i> grassland	2 200	P	5,8	1,0	0,2	0,6	—	—	—	—	—	7,7
Temp grassland boulder-bed	2 300	B	5,6	3,5	0,8	1,3	0,1	—	—	0,6	—	11,8
Temperate grassland	2 300	B	6,4	2,3	—	0,8	—	0,2	—	—	—	9,8
Temperate grassland	2 700	B	8,8	2,9	0,4	0,8	—	—	—	0,4	—	13,3
Alpine Belt												
<i>Erica-Helichrysum</i> ^a	3 000	B	10,0	—	—	—	—	—	—	—	1,7	11,7

^aData from top of Sani Pass

ed rocks and large shrubs; temperate grassland boulder-bed (a rocky drainage line on the escarpment); and at the upper limit of temperate grassland, where one was trapped near large rocks at the base of a basalt cliff. Smithers (1971) found that the species had a wide habitat tolerance ranging from dry to moist in Botswana, but was always associated with trees, and Rautenbach (1976) collected *G. murinus* from a treeless rocky area.

Smithers (1971) was more specific in his description of the preferred habitat of *D. melanotis* than was Roberts (1951), stating that it preferred thick stands of tall grass. In GCGR *D. melanotis* was recorded in grassland up to 33 months after fire, but was not found in tall grassland, rank fire-protected grassland, and scrub or forest habitats. *D. mesomelas* on the other hand was collected in forest, scrub, and tall grassland.

As *P. natalensis* was collected only near dwellings it is difficult to comment on its habitat preferences in GCGR. At Cathedral Peak, 40 km north of GCGR in the Natal Drakensberg, the species was collected in *Themeda* grassland (shortly after fire), tall grassland and scrub, but did not occur above 1 500 m (Meester *et al.* 1979; D.T. Rowe-Rowe 1977 unpublished). Small mammal sampling in GCGR was not done below 1 500 m, but G.R. Hughes (pers. comm. 1981) collected *P. natalensis* in the north-east section of the reserve at 1 380 m. It is an adaptable

species with wide habitat tolerances (Meester *et al.* 1979), but has so far not been recorded in natural habitats above 1 500 m in the Drakensberg.

Relative abundance of species

Either one of two species (*R. pumilio* or *M. varius*) was dominant in catches from all habitats except forest and protea woodland. In the Montane Belt, *R. pumilio* was the dominant species in grassland, woodland, and scrub but was replaced by *G. murinus* in forest (Table 2, Figure 2). At the lower altitudinal limit (1 900 m) of the Sub-alpine Belt *R. pumilio* was dominant in burnt grassland but not in fire-protected grassland at the same altitude, where *M. varius* was caught in greater numbers. At all higher altitudes *M. varius* was dominant, and the numbers of *R. pumilio* captured decreased along the altitudinal gradient until lowest proportions were recorded at the upper limits of temperate grassland (Figure 2).

The decrease in relative importance of *R. pumilio* with increase in altitude is probably related to the decreasing amount of grass cover with increase in altitude (Figure 3). Decrease in total above-ground standing crop was most marked from 2 200 m onwards and corresponds to the smaller numbers of *R. pumilio* in the catch. A similar pattern was observed at Cathedral Peak (D.T. Rowe-Rowe unpubl. 1977): *R. pumilio* was not recorded in temperate

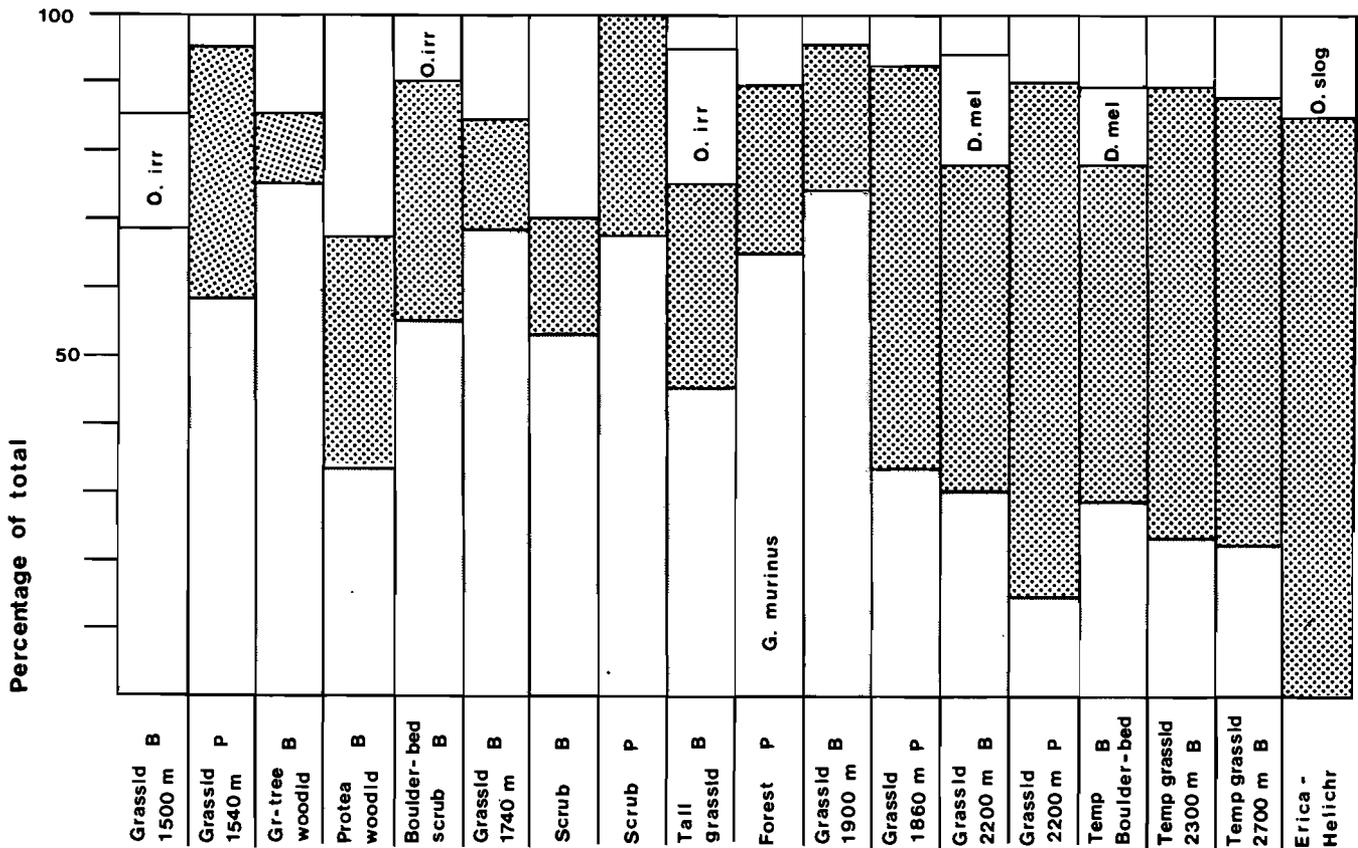


Figure 2 Percentage contribution by *R. pumilio* (shaded), *M. varius* (stippled), and other species (open bars) to the total number of small mammals caught. If any one species made a significant contribution to 'other species' it is listed in abbreviated form in portion of the open bar. Habitats are arranged in ascending order of altitude from left to right.

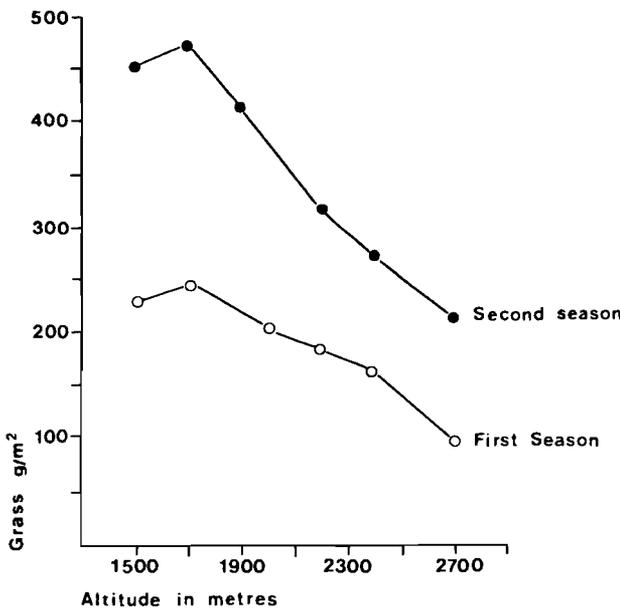


Figure 3 Above-ground standing crop of herbage, expressed in g/m² (dry mass) between 1 500 and 2 700 m, at the end of the first and second growing seasons in biennially burnt grassland. (Incorporating data from Scotcher *et al.* 1980.)

grassland on the escarpment slope, where *M. varius* was the dominant species, but in almost all grassland and scrub habitats at lower altitudes *R. pumilio* was dominant.

Food abundance possibly contributed to the success of *M. varius* at higher altitudes. A preliminary survey of ar-

thropods in GCGR has indicated that they are more abundant on the escarpment than at lower altitudes (R. Miller pers. comm. 1982), particularly the prey most commonly eaten by *M. varius* (Rowe-Rowe & Meester in press). The arthropod survey was done during summer, however, and it is not known whether this situation obtains throughout the year.

R. pumilio is diurnal (Brooks 1974), and although an omnivore, is mainly granivorous (Brooks 1974; this study). It is therefore largely dependent on grass for cover and a source of food. *M. varius* on the other hand is nocturnal and insectivorous (Roberts 1951; Goulden & Meester 1978), and does not appear to rely heavily on good grass cover (this study), therefore accounting for its ability to exist in habitats which are unsuitable for *R. pumilio*.

The relative importance of *O. irroratus* is possibly under-represented in the sample. Davis (1973) commented on the difficulty of trapping the species and so too do Bond *et al.* (1980). Signs of *O. irroratus* (faeces and feeding signs) observed in grassland, woodland, and scrub suggested a higher proportion of the species in small mammal communities than indicated in overall trapping success. Similarly, the relative abundance of *O. sloggetti* is probably an under-representation of its relative abundance in the Alpine Belt. Numerous individuals were seen on rocks and in the summit vegetation at Sani Pass, and the species has been seen at the top of Bannerman Pass (GCGR), above Organ Pipes Pass (Cathedral Peak), and near the summit of Mont-aux-Sources.

With the exception of *D. melanotis* in the upper

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Themeda grassland/lower temperate grassland habitats, other species did not contribute significantly to the overall sample.

R. pumilio made the greatest numerical contribution (44,1%) to the overall sample, and *M. varius* was the most ubiquitous and second most abundant (38,7%). All other species contributed only 17,2% to the GCGR total sample.

Small mammal trap success, species richness, and diversity

The small mammal trap success, species richness, and diversity in all habitats sampled are illustrated in Figure 4.

In the Montane Belt greater small mammal trap success was recorded in protected grassland than in burnt *Themeda* grassland, but species richness and diversity were higher in the two burnt grassland habitats. Tall grassland proved to be one of the richest habitats, scoring highly in trap success, species richness, and diversity.

The two woodland habitats differed markedly. Grouped-tree woodland yielded a fairly high trap success (8,3%) and species richness, whereas protea woodland yielded the lowest trap success of all habitats sampled (0,6%). Diversity of the protea habitat was higher than that of grouped-tree woodland, but this was because only three animals representing three species were captured, and the diversity index therefore expresses an even representation of species. The importance of protea woodland as a small mammal habitat in GCGR may nevertheless be regarded as low.

At Cathedral Peak also (Rowe-Rowe unpubl. 1977), protea woodland yielded only 2% trap success made up of one species (*M. varius*), and at another locality in the Drakensberg (Royal Natal National Park) A.K. Lee (pers.

comm. 1976) recorded a trap success of 1,7% in protea woodland and trapped only *R. pumilio*. Protea woodland develops on shallow soils overlying rock (Edwards 1967), and where sampled in GCGR the soil was of a Mispah form (van der Eyk *et al.* 1969) with underlying hard rock. Characteristics of this soil are that it has a shallow A-horizon, and is infertile, lacking in organic matter. The shallow soil is very hard and appears to be unsuitable for small mammals.

Boulder-bed scrub (on river levees) and fire-protected scrub yielded higher trap successes than did occasionally burnt *Buddleja-Leucosidea* scrub, but it was in the last-mentioned habitat that greater species richness and diversity were recorded. The fire-protected scrub developed from grassland which had been protected for 16 years and consisted mainly of a fairly uniform stand of *Philippia* bushes and grass. The only two mammal species captured were typical of grassland (Table 2). The boulder-bed scrub is burnt biennially in autumn and is also a fairly uniform habitat consisting of grass and predominantly *Leucosidea* bushes. The patch of *Buddleja-Leucosidea* scrub sampled was more complex. Fire occasionally sweeps throughout it, but usually only the margins are burnt, with the fire penetrating only portions of the habitat. The vegetation is a mixture of grass and scrub (*Leucosidea*, *Philippia*, *Buddleja*, *Cliffortia*, *Euclea*), interspersed with fairly large bushes such as *Bowkeria* and a few forest trees such as *Olinia* and *Podocarpus*, and the complexity of the habitat is further increased by the presence of large rocks. It is understandable therefore why the small mammal population is the most diverse in GCGR, being a mixture of forest and grassland species.

Trap success in the forest itself was lower than in any of

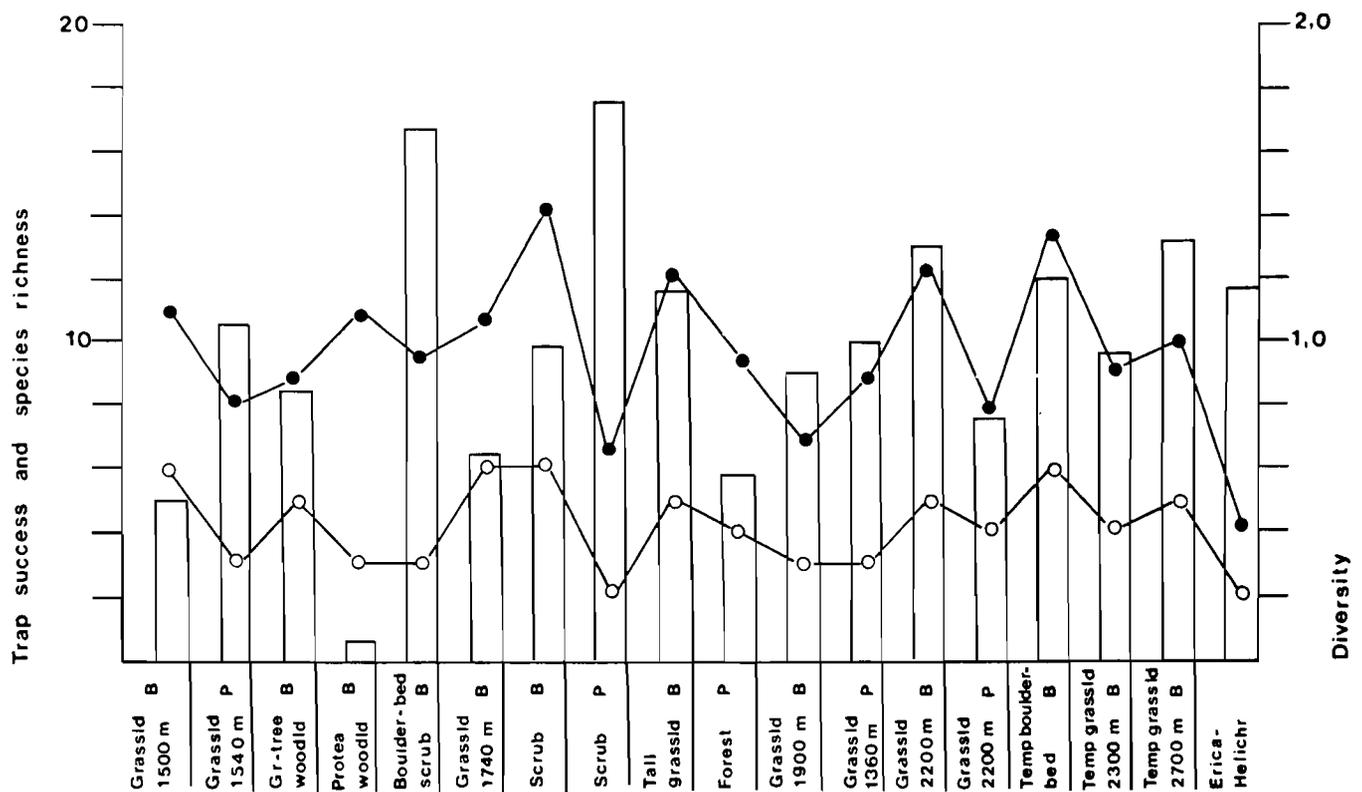


Figure 4 Small mammal abundance relations in various habitats in GCGR. Abundance (histogram) expressed as captures/100 trap nights, species richness (o), and diversity (●) (calculated from number of individuals of each species).

the scrub habitats, and all but one grassland habitat. Trap success and species richness of biennially burnt *Themeda* grassland and 16-year-old grass at the lower limit (1 900 m) of the Sub-alpine Belt were similar. Diversity of the burnt grassland was lower, however, due to the preponderance of *R. pumilio*, which made up 80% of the catch. At the upper limit (2 200 m) of sub-alpine *Themeda* grassland the biennially burnt habitat yielded greater trap success, species richness, and diversity than did the unburnt 2 to 4-year-old grass at the same altitude. The effects of the absence of fire on small mammal abundance relations and vegetation are discussed in more detail by Rowe-Rowe & Lowry (1982).

The higher abundance relations in burnt *Themeda* grassland at 2 200 m than those in burnt *Themeda* grassland at 1 900 m are probably related to vegetation complexity — Scotcher & Clarke (1981) found a more even representation of grass species at 2 200 m than at 1 900 m, and twice as many forbs at the upper than the lower altitude.

The boulder-bed habitat in the temperate grassland was richer in trap success, number of species, and diversity than was the open grassland on either side of it. Whereas open temperate grassland is a very homogeneous habitat, the boulder-bed is heterogeneous — it is rocky and, although predominantly grassland, contains a fair number of forbs and some stunted bushes.

Dueser & Brown (1980) concluded that increased habitat complexity promotes increased small mammal species richness. The two most complex habitats sampled in GCGR were the *Buddleja-Leucosidea* scrub and the temperate grassland boulder-bed, and it was in these habitats that highest small mammal diversity and species richness were recorded.

The proportions of *M. varius* and *O. sloggetti* in the Alpine Belt sample are, as already stated, probably not a good representation of these mammals' proportions in the community, and true diversity of this habitat is possibly higher than recorded.

Small mammal diversity in different habitats in the Drakensberg appears to be related to succession, increasing from the pioneer stage, reaching an asymptote during an intermediate stage (such as in the *Buddleja-Leucosidea* scrub in GCGR), then declining again in the climax stage.

Although measures of diversity are useful in providing information on evenness of species representation (Pielou 1969; Poole 1974; Routledge 1979), they do not altogether indicate the importance of the habitat in the ecology of the area. Some habitats having low diversities but high densities may, depending on the dominant small mammal species and type of cover, be important to avian and terrestrial predators; whereas some other habitats may have high diversities and play a minor part as a source of prey, but perhaps a major role as a reservoir for a number of species. These aspects are discussed in more detail in a separate paper on the influence of fire on small mammal populations (Rowe-Rowe & Lowry 1982).

Trap success, species richness, and diversity of GCGR and Cathedral Peak (D.T. Rowe-Rowe unpubl. 1977) are similar. Overall trap success in GCGR was 9,4%, nine species were collected (excluding *P. natalensis*), and diversity was 1,34. At Cathedral Peak trap success was 10,1%, 10 species were recorded, and diversity was 1,39. GCGR

and Cathedral Peak are similar in respect of altitude, topography, vegetation, climate, and burning regime.

Montane small mammal faunas (Bond *et al.* 1980; Nel, Rautenbach & Breytenbach 1980; Rautenbach & Nel 1980; this study) are poorer in species richness and diversity than those of ecologically more complex lowveld areas (Bourquin, Vincent & Hitchins 1971; Pienaar 1964). Trap success and species richness in the predominantly *Themeda* grassland of GCGR are also lower than in the *Themeda* grasslands of Uganda (Cheeseman & Delany 1979; Neal 1970). Abundance relations in GCGR therefore conform to the generally accepted principles that species richness is related to latitude, longitude, altitude, and habitat complexity (Nel 1975; Pianka 1966; Rautenbach 1978b; Simpson 1966).

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