

THE VEGETATION OF THE GOLDEN GATE HIGHLANDS NATIONAL PARK

B. R. ROBERTS,

*Department of Pasture Science,
University of the Orange Free State.*

Introduction

The Golden Gate Highlands National Park was established by the National Parks Board in the early 1960's and consists of a number of farms in the high mountain region between the villages of Clarens and Kestell on the border between the Orange Free State and Lesotho. The entire Park constitutes the upper catchment of the Little Caledon River. The Park encompasses the steep mountainous catchment from the highest points of the watershed at Rhebokkop (9283) and Generaalskop (8969) to the riverbed at 5,600 ft. The eastern boundary of the Park forms the watershed between the Orange and Vaal river systems.

The massive buttresses, clefts and gorges of the Cave Sandstone formation provide scenic grandeur unique in South Africa. This striking formation is overlain by basaltic lava to a thickness of 3,000 ft., forming a steep upper catchment of fertile and well-grassed hills and valleys. The geology of the area has been mapped and described in detail by Van Eeden (1937) and Visser (1955).

The climate of the Park becomes more temperate with altitude, the vegetation of the upper reaches displaying a definite temperate affinity. The average annual rainfall measured over a period of 45 years at Oldenburg is 845 mm (34 in.) (Weather Bureau, 1965), the greater proportion falling between the months of September and May. The average annual rainfall varies considerably within short distances in this region, being 716 mm at Clarens, 774 mm at Clifton and 987 mm at Caledonia, all of which are within 10 miles of Golden Gate. Winters are cold, with frost and snow of general occurrence from May to August. The growing season is thus short and adaptations of the vegetation to the long cold dormant season are everywhere in evidence in the higher-lying areas of the Park.

The entire basaltic region (see map) which includes all the area lying above 6,800 ft. has an unusually fertile soil. This soil type has been shown by Staples and Hudson (1938) to be amongst the most fertile in Southern Africa and supports a dense temperate grassland which completely stabilizes the steep slopes of the upper catchment as such against erosion. The Cave

Sandstone on the other hand produces a shallow sandy soil of low fertility (Roberts, 1966b) that is more susceptible to erosion losses. Underlying the Cave Sandstone, the Red Beds consisting of reddish-brown mudstone, produce a structureless powdery soil which is exceptionally prone to erosion. The Red Beds vary from 200 to 400 ft. in thickness and their unstable soils combined with the steep natural inclination of their exposed faces result in a poor vegetation and serious erosion problem in certain low-lying areas. The close proximity of this geological region to the homesteads and arable lands of the original farms that constituted the Park resulted in their being overgrazed and depleted of much of their original vegetation, thus aggravating the problem of erosion.

The Vegetation

The present survey covers that portion of the Park falling within the original boundaries of the farms Melsetter, Wodehouse, Gladstone, Glen Reenen, Wilgenhof and Golden Gate, a total of 4,986 morgen.

All specimens were collected during the summer and were identified by the National Herbarium, Pretoria, where a complete set of duplicate specimens is lodged. The numbers quoted are the author's collecting numbers as recorded in the herbarium of the Department of Pasture Science, U.O.F.S.. Unnumbered species are Liebenberg's (1965).

Published botanical work on the Golden Gate region is limited to the writer's brief sketch (Roberts, 1966a), Acocks' (1952) list of species collected near Ficksburg, Markötter's (1930) compilation of Thode's plant collections between 1891 and 1914 at Witzieshoek and Phillips' (1917) extensive list of plants of the Leribe plateau in Lesotho. Also akin to the Golden Gate vegetation are the high lying regions of the Natal Drakensberg as described by Killick (1963) and Edwards (1967) and the Lesotho Highlands as reported by Staples and Hudson (1938). Limited collections have been made at Golden Gate by Liebenberg (1965), who also produced an historical sketch of the area with reference to the animal population of earlier times.

The present survey does not permit the compilation of a detailed vegetation map of the Park, but is intended to provide a list of the more abundant species present. While the vegetation may more correctly be classified according to standard botanical taxa, for the purpose of this preliminary report the plants have been grouped according to easily recognizable structural categories. In the absence of other botanical references and in view of the need for a useful guide for the layman, this simple layout including common names is used.

The general distribution of vegetation formations is clearly seen on the aerial photographs of the Park. Virtually the entire Park carries a grassland vegetation, with the exception of certain deep valleys, protected gorges and crevices in the Cave Sandstone, where *Leucosidea* Forest or mixed *Leucosidea-Kiggelaria-Buddleia* Forest dominates. With the exception of *Leucosidea*

and *Protea*, which are apparently comparatively resistant to fire, trees and shrubs are limited to those areas where rocks and boulders afford them protection from fire. The abundance of bulbous plants (geophytes) indicates that fire has been a characteristic environmental factor since the earliest times (Bayer, 1955).

(a) *Trees and Shrubs*

The following woody plants are typical of the successional advanced communities in sheltered situations:

- Artemisia afra* Jacq. (Wildeals) 3312
- Asparagus africanus* Lam. (Katbos) 3219
- A. asparagoides* (L.) Wight (Krulkransie) 3230
- A. ramosissimus* Bak. 3229
- Buddleia corrugata* (Benth.) Phill. (Sagewood) 3242
- Canthium ciliatum* (Klotzsch) Kuntze 3397
- Clutea pulchella* L. (Lightning Bush) 3223
- Cussonia paniculata* Eckl. & Zeyh. (Cabbage Tree) 3405
- Diospyros whyteana* (Hiern.) F. White (Kraaibessie) 3398
- D. austro-africana* de Winter var. *rubriflora* (de Winter) de Winter 3456
- Euclea coriacea* A.DC (Berggwarrie) 3208
- Halleria lucida* L. (Tree Fuschia) 3396
- Kiggelaria africana* L. (Kershout) 3266
- Lasiosiphon burchellii* Meisn. 3205
- Leucosidea sericea* Eckl. & Zeyh. (Ouhout) 3445
- Maytenus undata* (Thunb.) Blakelock (Koko Tree) 3264
- Myrsine africana* L. (Cape Myrtle) 3238
- Printzia pyrifolia* Less. 3380
- Protea roupPELLIAE* Meisn. (Suikerbos) 3394
- Rhus dentata* Thunb. (Nanabessie) 3231
- R. discolor* E. Mey. 3057
- R. divaricata* Eckl. & Zeyh. (Kliptaibos) 3326
- R. pyroides* Burch. (Taaibos) 3089
- Rubus ludwigii* Eckl. & Zeyh. (Bramble) 3391
- R. rigidus* Sm.

(b) *Plants with temperate affinities*

The increasingly temperate affinities of the vegetation with increase in altitude is a phenomenon which has been reported by many writers in South Africa (Acocks, 1963; Killick, 1963; Edwards, 1967 and Roberts, 1963a and 1966) and there is little doubt that in the absence of veld burning fynbos (macchia) would increase and even dominate in many of the higher lying regions. The following woody temperate species are typical of the high altitude fynbos communities:

- Anthospermum tricostatum* Sond. 3121
- Cliffortia filicauloides* H. Weim. 3441

C. nitidula R.E. Fr. & T.C.E. Fr. var. *pilosa* H. Weim. 3193
Erica woodii H. Bol. 3083
E. algida H. Bol.
Erica sp. 3279
Nestlera acerosa (DC.) Harv. (Perdeboegoe) 3404
Passerina montana Thod. (Bakkerbos) 3359
Petalactella woodii N.E. Br. 3337
Stoebe vulgaris Levyns (Slangbos) 3031

These plants are associated with a wide variety of temperate herbs and grasses representing genera typical of the winter rainfall region of the western Cape, eg. *Helichrysum*, *Polygala*, *Senecio*, *Bromus*, *Pentaschistis*, *Festuca* and *Ehrharta*.

(c) Legumes

Leguminous plants that occur in the Park are largely low-growing species but include a number of woody subshrubs such as *Dichilus* and *Melolobium*. Wild clover (*Trifolium*) is very abundant on the upper slopes of Generaalskop (8,969 ft.). The following legumes have been recorded, occurring mainly as grassland herbs:

Argyrobolium tuberosum Eckl. & Zeyh. 3448
A. variopile N.E. Br. 3298
Calpurnia intrusa E. Mey. 3352
Cassia tomentosa Lam.
Dichilus strictus E. Mey. 3175
Dolichos linearis E. Mey.
Indigofera hedyantha Eckl. & Zeyh. (Aambeibossie) 3113
I. rostrata H. Bol.
I. tristis E. Mey. 3362
I. tristoides N.E. Br.
Lessertia sp. cf. *L. capitata* E. Mey. (Kleingansies) 3068
L. sp. cf. *L. pauciflora* Harv. 3212
L. perennans DC. (Blaasertjie) 3225
Lotononis cytisoides Benth. 3123
L. lanceolata Benth.
L. laxa Eckl. & Zeyh. 3349
L. magnistipulata Dummer. 3110
L. procumbens H. Bol.
L. woodii H. Bol.
L. sp. 3072
L. sp. 3174
Melolobium microphyllum Eckl. & Zeyh. (Heuningbos) 3088
Tephrosia capensis Pers.
Trifolium africanum Ser. (Wild clover) 3122
Rhynchosia caribaea DC.
R. totta DC.

In addition to the above, Markötter (1930 records the following genera in the nearby Witziesshoek area: *Dumasia*, *Elephantorrhiza*, *Eriosema*, *Pleiospora* (= *Phaenohoffmania* O. Kuntze).

(d) Succulents

Succulent plants are poorly represented in the Park, as is typical of most high rainfall regions. The only genus which is relatively common is *Crassula* of which eight species have been collected. Further study will no doubt reveal more succulents, many of which are inconspicuous. The following have been recorded:

- Aloe ecklonis* Salm-Dyck (Grass aloe) 3446
- Crassula compacta* Schonl. 3382
- C. anomala* Schonl. & Bak. f.
- C. harveyi* Schonl. 3059
- C. muscosa* L. 3202
- C. natalensis* Schonl. 3357
- C. rubicunda* E. Mey. 3442
- C. setulosa* Harv. 3145
- C. sarcocaulis* Eckl. & Zeyh. 3341
- Cotyledon orbiculata* L. 3422
- Delosperma* sp. 3435
- D. sutherlandii* (Hook. f.) N.E. Br.
- Euphorbia clavarioides* Boiss 3427
- E. striata* Thunb. (Melkgras) 3036
- Ruschia* sp.

(e) Bulbs

The Liliaceae, Iridaceae and Amaryllidaceae are abundant in all areas of the Park and include a variety of striking wild flowers such as *Agapanthus*, *Dierama*, *Gladiolus*, *Kniphofia*, *Watsonia* and *Zantedeschia*. Most of the bulbous plants occur as grassland geophytes while a few such as *Agapanthus* are limited to rocky situations and *Zantedeschia* is a streambank lily. The following bulbous species were collected in flower during mid-summer, many of which are described and illustrated by Eliovson (1960):

- Agapanthus campanulatus* Leighton (Agapanthus) 3098
- Albuca trichophylla* Bak. (Slangkop) 3137
- Aristea woodii* N.E. Br. 3139
- A. cognata* N.E. Br.
- Bulbine caespitosa* Bak. 3184
- B. abyssinica* A. Rich.
- Dierama igneum* Klatt (Dierama) 3379
- D. robustum* N.E. Br. 3120
- Drimia neriniformis* Bak. 3204
- Eucomis bicolor* Bak. (Pineapple flower) 3434

Galtonia candicans Decne (Berg lily) 3447
Gladiolus crassifolius Bak. 3119
G. dracocephalus Hook. f. 3393
G. edulis Burch. (Small Afrikaner) 3081
G. papilio Hook. f. 3029
Holothrix scopularia Reichb. f. 3173
Hypoxis costata Bak. (Kaffertulp) 3071
H. sp. 3101
H. sp. 3450
H. sp. 3026
Kniphofia triangularis Kunth (Red hot poker) 3387
K. sp. nov. (= Bruce's *K. basutica* Nat. Herb.) 3430
Moraea pubiflora N.E. Br.
Schizocarphus nervosus (Burch.) v.d. Merwe 3118
Scilla sandersonii Bak. (Brandui) 3271
Trachyandra asperata Kunth (Wildecknoflok) 3182
Tritonia ? sp. 3034
Vellozia viscosa Bak. 3218
Watsonia densiflora Bak. 3048
Zanthesdeschia oculata (Lindl.) Engl. (Arum lily) 3146

Markötter records six species of *Kniphofia* and seven species of *Gladiolus* from Witzieshoek.

(f) Sedges and Rushes

Members of the Cyperaceae and Juncaceae are typical of wet soils and are common constituents of streambank vegetation. Further study of these habitats should reveal a greater variety of sedges than the present list:

Bulbostylis collina (Kunth) C.B. Cl. 3010
B. trichobasis (Bak.) C.B. Cl. 3214
Cyperus obtusiflorus Vahl. var. *flavissimus* Boeck. 3214
C. rigidifolius Steud. 3140
C. schlechteri C.B. Cl. 3096
C. semitrifidus Schrad. 3039
Fuirena gracilis Kunth 3250
Juncus exsertus Buch. 3345
Mariscus congestus C.B. Cl. 3181
Pycreus macranthus C.B. Cl. 3180
Restio sieberi Kunth (Besemriet) 3389
Scleria woodii C.B. Cl. 3087
Scirpus diabolicus Steud. 3295

(g) Grasses

The 51 species of Gramineae collected in the Park include representatives of both the temperate and subtropical floras. Most of the grasses

are typical montane species e.g. *Bromus*, *Festuca* and *Danthonia* while others are distinctly hygrophylous types e.g. *Miscanthidium*, *Pennisetum* and *Paspalum*. *Hyparrhenia*, *Cynodon*, *Rhynchelytrum* and *Heteropogon* are typical of the less exposed lower-lying habitats. The following grasses were recorded:

- Agrostis barbuligera* Stapf. var. *longipilosa* Goossens & Papendorf 3280
A. bergiana Trin. 3253
A. lachnantha Nees (Bentgrass) 3178
Alloteropsis semialata (R. Br.) Hitchc. (Blackseed) 3051
Andropogon appendiculatus Nees (Bluegrass) 3168
A. filifolius (Nees) Steud. (Tweevinger) 3062
Anthoxanthum ecklonii (Nees) Stapf. (Sweet vernal) 3297
Aristida junciformis Trin. & Rupr. (N'gongoni) 3043
Brachypodium bolusii Stapf (False brome) 3065
B. flexum Nees 3332
Bromus speciosus Nees (Purple brome) 3166
Catalepis gracilis Stapf & Stent 3133
Cymbopogon plurinodis Stapf ex Burtt Davy (Turpentine grass) 3165
Cynodon hirsutus Stent (Fynkweek) 3316
Danthonia disticha Nees (Suurpol) 3156
D. drakensbergensis Schweick. (Besemgrass) 3388
D. purpurea (Thunb.) Beauv. (Haasgras) 3171
D. stereophylla J. G. Anderson 3152
D. stricta (Nees) Schrad. (Bokbaard) 3282
Digitaria flaccida Stapf (Kruisgras) 3014
D. monodactyla (Nees) Stapf (Eenvingergrass) 3013
D. sp. cf. D. pentzii Stent 3074
Ehrharta erecta Lam. 3236
Elyonurus argenteus Nees (Koperdraad) 3017
Eragrostis capensis (Thunb.) Trin. (Hartjiesgras) 3047
E. chloromelas Steud. (Krulhaargras) 3015
E. plana Nees (Taaipol) 3052
E. racemosa (Thunb.) Steud. 3049
Festuca caprina Nees (Bokbaardgras) 3365
Fingerhuthia sesleriaeformis Nees (Thimble grass) 3158
Harpechloa falx (L.f.) Kuntze (Caterpillar grass) 3042
Helictotrichon capense Schweick. 3179
H. hirtulum (Steud.) 3222
H. longifolium (Nees) Schweick. (Brandgras) 3169
H. turgidulum (Stapf) Schweick. (Oatsgrass) 3044
Heteropogon contortus (L.) Beauv. (Speargrass) 3053
Hyparrhenia hirta (L.) Stapf (Thatchgrass) 3155
Koeleria cristata (L.) Pers. (crested koeleria) 3063
Melica racemosa Thunb. (Haakgras) 3428
Microchloa caffra Nees (Elsgras) 3340
Miscanthidium erectum Stent & C. E. Hubbard (Tamboekie) 3164

Paspalum dilatatum Poir. (Paspalum) 3064
Pennisetum sphacelatum (Nees) Dur. & Schinz 3066
Pentstemon setifolia (Thunb.) McClean 3157
Rendlia altera (Rendle) Chiov. (Kleinrolblaar) 3281
Rhynchosyris setifolia (Stapf) Chiov. (Redtop) 3162
Sporobolus centrifugus Nees 3019
Stiburus alopecuroides (Hack.) Stapf (Pongwa) 3016
Themeda triandra Forsk. (Redgrass) 3060
Trachypogon spicatus (L.f.) Kuntze 3161
Tristachya hispida (L.f.) K. Schum. (Rooisaad) 3054

(h) *Herbs and Subshrubs*

A heterogeneous list of 148 herbs and small bushes which cannot be conveniently grouped with the other categories of plants has been recorded. The most well represented genera in this group are *Helichrysum* (20 spp.), *Senecio* (12 spp.), *Sutera* (4 spp.) and *Zaluzianskya* (4 spp.). Many of this group are showy wild flowers, e.g. *Ajuga*, *Clematis*, *Harveya*, *Helichrysum*, *Selago*, *Streptocarpus* and *Walafrida*. The following plants were collected in flower in January:

Alepidea amatymbica Eckl. & Zeyh. (Kafferkalmoes) 3372
A. setifera N.E. Br. 3377
A. longifolia E. Mey subsp. *angusta* (Duemm.) Weim. 3210
Ajuga ophrydis Burch. ex Benth. 3058
Anthospermum rigidum Eckl. & Zeyh. 3024
A. herbaceum L.f.
Aristea cognata N.E. Br. 3402
Asclepias fruticosa L.
A. sp. 3347
A. sp. 3189
Aspidoglossum interruptum (E. Mey.) Bullock
Aster muricatus Less. (Bloublommetjie) 3141
A. filifolius Vent.
A. petiolatus Harv. (Bergbloubos) 3286
Athrixia angustissima DC. 3207
Barleria monticola Oberm. 3215
Berkheya purpurea (DC.) Mast. (Bloudisseldoring) 3203
B. cirsiifolia (DC.) Roessl.
B. montana Wood & Evans
B. rosulata Roessl. 3112
B. rhapontica (DC.) Hutch. & Burt Davy
B. speciosa (DC.) O. Hoffm. subsp. *lanceolata* Roessl.
 (Skraaldisseldoring) 3243
Cenia microglossa DC. 4246
Cerastium arabis E. Mey. ex Fenzl emend. Moeschl. 3075
Chrysocoma tenuifolia Berg. (Bitterbos) 3426

- Cineraria aspera* Thunb. (Geelkransbessie) 3400
C. lobata L'Hérit. (var. *multiloba* M. R. F. Taylor) 3370
C. lyrata DC.
Cirsium vulgare (Savi) Ten. (Scotch thistle) 3437
Clematis brachiata Thunb. (Traveller's Joy) 3226
Commelina africana L. (Wandering Jew) 3030
Conyza pinnata (L.f.) Kuntze
C. podocephala DC.
Corycium nigrescens Sond.
Cotula sp. cf. *C. hispida* (DC.) Harv. 3350
Cycnium racemosum Benth. 3077
Cynoglossum hispidum Thunb. (Beestongblaar) 3128
C. lanceolatum Forsk.
Cyphia elata Harv. var. (Baroe) 3115
C. elata Harv. var. *stenophylla* E. Wimm. (Baroe) 3094
Dianthus basuticus Burt Davy (Bergangelier) 3200
Diascia integerrima E. Mey. ex Benth. 3274
Dielis reptans Benth. 3335
Euryops laxus (Harv.) Burt Davy (Stinkharpuis) 3190
Galium capense Thunb. (Tiny-tots) 3114
G. rotundifolium L. 3221
G. wittebergense Sond.
G. subvillosum Sond.
Gazania krebsiana Less. subsp. *krebsiana* (Botterblom) 3440
Gerbera ambigua Sch. Bip.
Geranium incanum Burm. f. (Bergtee) 3330
Gnaphalium luteo-album L. (Roerkruid) 3339
G. undulatum L. (Groenbossie) 3354
Gunnera perpensa L. (Rivierpampoen) 3425
Haplocarpha scaposa Harv. (Bietou) 3209
Harveya coccinea Schltr. (Rooi-inkblom) 3129
Hebenstreitia integrifolia L. (Katstert) 3095
Helichrysum adenocarpum DC. (Rooisewejaartjie) 3272
H. appendiculatum (L.f.) Less. (Sewejaartjie) 3170
H. aureo-nitens Sch. Bip. (Griqua tea) 3040
H. chionosphaerum DC. 3090
H. dregeanum Sond. & Harv. (Bergankerkaroo) 3117
H. aureum (Houtt.) Merrill (Geelsewejaartjie) 3344
H. hypoleucum Harv. 3291
H. miconiaefolium DC. (Kaffertee) 3328
H. nudifolium (L.) Less.
H. sp. cf. niveum (L.) Less. 3092
H. odoratissimum (L.) Less. (Hottentots kooigoed) 3278
H. oreophilum Klatt
H. rugulosum Less 3183
H. psilolepis Harv.

H. scapiforme Moeser. 3293
H. setosum Harv. 3305
H. splendidum (Thunb.) Less. 3355
H. squamosum Thunb. 3401
H. sutherlandii Harv. 3358
H. undatum (Thunb.) Less. var. *pallidum* (DC.) Harv. 3079
Heliophila sp. 3303
H. sp. 3069
Hermannia betonicaefolia Eckl. & Zeyh. (Asmabossie) 3196
H. coccocarpa Burt Davy 3325
H. erodioides (Burch. ex DC.) Kuntze
Ipomoea sp. 3216
Lasiosiphon kraussii Meisn. (Gifbossie) 3033
Lepidium sp. (Peperbossie) 3324
Limeum viscosum (Gay) Fenzl. subsp. *viscosum* var. *glomeratum* (Eckl. & Zeyh.)
 Friedr. (Klosaarbossie) 3373
Linum thunbergii Eckl. & Zeyh. 3322
Lithospermum vinereum DC. (Naelbossie) 3334
Lobelia filiformis Lam. var. *krebsiana* (Presl) E. Wimm. forma *rusticana*
 E. Wimm. 3138
Manulea bellidifolia Benth. 3299
M. benthamiana Hiern 3361
M. thodeana Diels 3336
Mentha aquatica L. (Kruistement) 3292
M. longifolia Huds. var. *capensis* Briq. (Balderjan) 3307
Monopsis scabra (Thunb.) Urb. (Wild violet) 3056
Monsonia biflora DC. (Naaldebossie) 3086
Muraltia alticola Schltr. 3041
Myosotis sylvatica Hoffm. (Forget-me-not) 3233
Nemesia capensis (Thunb.) Kuntze (Leeubekkie) 3317
N. coerulea Hiern 3206
N. melissaefolia Benth. 3249
Nidorella resedifolia DC 3134
Nolletia ciliaris (DC.) Steetz 3021
Oenothera tetraptera Cav. (Aandblom) 3333
O. stricta Ledeb. (Evening primrose) 3436
Pelargonium alchemilloides (L.) Ait. (Wildemalva) 3109
P. luridum (Andr.) Sweet. 3038
P. saniculaefolium Willd. 3275
P. sidifolium (Thunb.) Knuth
Peucedanum connatum E. Mey (Basteranyswortel) 3356
Phacocarpus pruinosis (E. May) Benth. 3439
Pharnaceum detonsum Fenzl
Phytolacca heptandra Retz (Inkbessie) 3329
Plectranthus grillatus Briq. 3239
P. fruticosus L'Hérit.

Polygala hispida Burch. 320i
P. hottentota Presl 3135
P. rehmannii Chod. 3032
Psammotropha mucronata (Thunb.) Fenzl var. *marginata* Adams. 3304
Ranunculus multifidus Forsk. (Botterblom) 3364
Rumex lanceolatus Thunb. (Tongblaar) 3331
Salvia stenophylla Burch. ex Benth.
Scabiosa columbaria L. (Scabious) 3027
Schitostephium crataegifolium (DC.) Fenzl (Bergkruis) 3187
Schizoglossum nitidum Schlecht. (Stinkmelkbos) 3150
S. pachyglossum Schltr.
S. stenoglossum Schltr. 3085
Sebaea sp. 3284
S. leiostyla Gilg. 3097
Selago galpinii Schltr. (Bergblouaarbessie) 3107
Senecio arabisifolius O. Hoffm. 3276
S. affinis DC.
S. burchellii DC. (Geelgifbossie) 3327
S. sp. cf. S. concolor DC. 3443
S. sp. cf. S. erubescens Ait. (= Mogg 849 Nat. Herb.) 3449
S. hastatus L.
S. harveianus MacOwan 3082
S. hieracioides DC. 3255
S. inornatus DC.
S. isatideus DC. (Blouvliebessie) 3300
S. othonnaeflorus DC. (Bietou) 3070
S. rhyncholaenus DC.
Silene burchellii Otth. (Geelgifbossie) 3321
S. capensis Otth. (Wilde tabak) 3288
Solanum nigrum L. (complex) (Nightshade) 3287
S. pseudocapsicum L.
S. retroflexum Dun. (Melkbossie) 3262
Sopubia cana Harv. 3020
Stachys dregeana Benth. 3103
Streptocarpus sp. (genus under revision) (Streptocarpus) 3429
Striga bilabiata (Thunb.) Kuntze
S. elegans Benth.
Sutera caerulea (L.f.) Hiern (Ruikbossie) 3078
S. aurantiaca (Burch.) Hiern
S. microphylla Hiern 3104
S. polelensis Hiern 3383
S. pristisepala Hiern 3144
Taraxacum officinale (Web) Wigg (Perdeblom) 3367
Thalictrum cafferum Eckl. & Zeyh. 3289
Thesium imbricatum Thunb. (Grootswartstorm) 3116
T. macrogyne A. W. Hill

- T. sp.* 3432
Turbina oblongata E. Mey. ex Choisy
Ursinia nana DC. 3195
U. saxatilis N.E. Br. 3386
Urtica lobulata E. Mey (Stinging nettle) 3269
Venidium arctoides (L.f.) Less. (Botterblom) 3245
V. microcephalum DC. (Gousblom) 3132
Veronica anagallisaquatica L. 3309
Vernonia natalensis Sch. Bip. 3384
V. hirsuta (DC.) Sch. Bip.
Walafrida apiculata Rolfe (Bitteraarbossie) 3076
W. densiflora Rolfe 3008
W. sp. cf. nachtigali Rolfe (Geilsiekteopslag) 3130
Wahlenbergia undulata (L.f.) A.DC. 3323
W. zeyheri Buek ex Eckl. & Zeyh.
Zaluzianskya alpestris Diels
Z. lychnidea Walp. (Drumsticks) 3050
Z. maritima Walp. 3313
Z. ovata Walp. 3366

(i) *Ferns and Lower Plants*

The Bryophyta have not been included in this study. The Pteridophyta are well represented and the following have been recorded:

- Adiantum thalictroides* Willd. (Maiden hair fern) 3258
Asplenium monanthes L. (Mother fern) 3237
A. trichomanes L. 3252
Cheilanthes hirta Sw. (Parsley fern) 3228
Cystopteris fragilis (L.) Bernh. (Brittle fern) 3227
Mohria caffrorum (L.) Desv. (Scented fern) 3125
Notholaena eckloniana Kuntze (Resurrection fern) 3127
Pellaea quadripinnata (Forsk.) Prantl 3148
Pleopeltis macrocarpa (Willd.) Kaulf.
Polystichum ammiifolium (Poir.) C. Chr. 3235
Pteris cretica L. 3247
Selaginella dregei (Presl) Hiern 3257
Woodsia montevidensis (Spreng.) Hieron. var. *burgessiana* (Gerr. ex Hook. & Bak.) Schelpe 3259

DISCUSSION

This study was undertaken with the object of gaining a better knowledge of the vegetation to act as a basis for recommendations concerning the suitability for grazing and carrying capacity of certain sections of the Park into which game have been introduced. The present study of vegetation of Golden Gate indicates that only certain sections of the Park are well suited to grazing by game on a large scale. However, the problems which

arise in establishing a game reserve in a sourveld grazing region, which is subject to severe winter conditions, are obvious and require closer study, particularly in the absence of carnivorous species. Liebenberg (1964) cites the writings of Arbousset and Dumas (1842), the French missionaries who travelled through the Golden Gate area. These writers state that reedbuck, klipspringer, springbuck and eland were abundant in the Maluti mountains and increased in number from year to year without ever migrating. These buck were preyed upon by lion, hyaena and leopard. In the nearby Butha Buthe area large herds of springbuck and red hartbeest are reported by these writers. Steytler (1932), however, writing on the history of Harri-smith, which lies some 50 miles north-east of Golden Gate, states that in the mid-nineteenth century the game migrated to the western Orange Free State in the summer and to the eastern Orange Free State in the autumn. In the winter they descended from the Orange Free State mountains into Natal. As a result of the large scale slaughter of game west of the Wilge River this portion of the province was termed "Riemland" after 1871. The vague and contradictory historical evidence on earlier game populations and migrations is difficult to interpret, but the writer has elsewhere (Roberts, 1965) postulated how natural fires, winter conditions, water supplies and palatability of the veld were probably nature's veld management agencies in maintaining both the game and plant populations.

Clearly a more detailed study of the productivity of the veld of the Park and the nutritive requirements of the grazing animals concerned is required if the ecosystem is to be stabilized in such a way that the beauty of the Park and the safety of this important catchment area is to be ensured.

ACKNOWLEDGEMENT

The author is grateful for financial assistance from the Department of Agricultural Technical Services and the National Parks Board of Trustees in this project. Assistance from Messers B. A. Bouwer, P. A. Henning and W. L. J. van Rensburg with field work and herbarium specimens is gratefully acknowledged, as is the co-operation of the staff of the Botanical Research Institute in identifying the specimens and checking the manuscript.

Much of the material was collected by Mr. L. C. C. Liebenberg.

BIBLIOGRAPHY

- ACOCKS, J. P. H. 1952. Veld types of South Africa. *Bot. Surv. S. Afr.* 28. U. of S.A.
- ARBOUSSET, T. & DUMAS, F. 1842. *Relation d'un Voyage d'Exploration nord-est de la colonie du Cap de Bonne Espérance.*
- BAYER, A. W. 1955. *The ecology of grasslands: in Grasses and Pastures of South Africa.* Johannesburg: C.N.A.
- EDWARDS, D. 1967. A plant ecological survey of the Tugela River Basin, Natal. *Bot. Surv. S. Afr.* 36. Republic of S. Afr.
- ELIOVSON, S. 1960. *South African Wild Flowers for the Garden.* Cape Town: Timmins.

- KILLICK, D. B. J. 1963. An account of the plant ecology of the Cathedral Peak areas of the Natal Drakensberg. *Bot. Surv. S. Afr.* 34. Republic of S. Afr.
- LIEBENBERG, L. C. C. 1964. Die grotere soogdiere wat vroeër dae voorgekom het in die omgewing van die Golden Gate Hooglandpark. *Koedoe* 7: 99.
- 1965. List of plants collected at Golden Gate. Unpublished National Parks Board, Pretoria.
- MARKÖTTER, E. I. 1930. 'n Plantgeografiese skets en die Flora van Witzieshoek, O.V.S., Oliviershoekpas, Natal en Koolhoek, O.V.S. *Ann. Univ. Stellenbosch* 8, Series A.
- PHILLIPS, C. P. 1917. A contribution to the Flora of the Leribe Plateau and environs. *Ann. S. Afr. Mus.* 16: 1-375.
- ROBERTS, B. R. 1963a. A contribution to the ecology of Cathcart and environs with special reference to slope exposure and soil pH. *J. S. Afr. Bot.* 29: 153-162.
- 1963b. Ondersoek in die Plantegroei van die Willem Pretorius-wildtuin met spesiale verwysing na veldbenutting. *Koedoe* 6: 137-166.
- 1965. Veld Management — the conerstone of conservation. *Leaflet No. 19, Dept. Agric. Tech. Serv., S. Afr.*
- 1966a. Observations on the temperature affinities of the vegetation of Hangklip Mountain near Queenstown, C.P. *J. S. Afr. Bot.* 32: 243-260.
- 1966b. Conservation of the Vegetation of the Orange Free State. *Vlth A.E.T.A.T. Symposium, Uppsala.*
- 1966c. The Ecology of Thaba'Nchu — a statistical study of vegetation/habitat relations. Ph.D. Thesis. Univ. Natal.
- STAPLES, R, and HUDSON, W. K. 1938. *An Ecological Survey of the mountain area of Basutoland.* Herts., England: Garden City Press.
- STEYTLER, 1932. *Die geskiedenis van Harrismith.*
- VAN EEDEN, O. R. 1937. The Geology of the country around Bethlehem and Kestell. *Geol. Surv. Mem.* 33. Union of S.A.
- VISSER, D. J. L. 1955. The Geology and Archeology of the Little Caledon River Valley. *Geol. Surv. Mem.* 47. U. of S.A.
- WEATHER BUREAU 1965. Climate of South Africa, Part 9. W.B. 20, Department of Transport, Rep. of S. Afr.