

# The biomes of the eastern Cape with emphasis on their conservation

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## ABSTRACT

The four major phytochoria of southern Africa, the Cape, Tongoland-Pondoland, Karoo-Namib and Afromontane regions, converge in the complex transition zone of the eastern Cape. The area is rich in species and communities with a complex vegetation in which are represented all the major vegetation formations of southern Africa — Cape Fynbos, Cape Transitional Shrublands, Subtropical Thicket, Karoo, Savanna, Afromontane Forest, Grasslands and Littoral Strand Vegetation. Our results support previous findings that, although species-rich and of great diversity, the flora has fewer endemics (205 or 5.6%) than the Cape (73%) or Karoo-Namib (35%). The communities with the largest proportion of endemics (30%), and threatened plants (18%) are those of the Subtropical Thicket. On the basis of these data and an index of conservation status, the Subtropical Thicket was determined to be highest on the priority list for conservation in the eastern Cape. Subtropical Thicket is being cleared at an increasing rate and is most vulnerable due to changing farming practice.

## UITTREKSEL

Die vier hoofplantegroei-streke van suidelike Afrika, die Kaap, Tongaland-Pondoland, Karoo-Namib en die Afromontaanse gebiede kom saam in die komplekse oorgangsonne van die oos-Kaap. Die gebied is ryk aan spesies en gemeenskappe met 'n komplekse plantegroei wat verteenwoordig word deur al die hoofbiome van suidelike Afrika — Kaapse Fynbos, Kaapse Oorgangstruikveld, Subtropiese Ruigte, Karoo, Savanne, Afromontaanse Woud, Grasveld en Strandplantegroei van die kus. Ons resultate ondersteun vorige bevindings dat alhoewel die flora spesieryk is en uit 'n groot verskeidenheid bestaan, dit minder endemiese taksons (205 of 5,6%) as die Kaap (73%) of Karoo-Namib (35%) het. Die gemeenskappe met die grootste persentasie endemiese taksons (30%) en bedreigde plante (18%) is dié van die Subtropiese Ruigte. Op grond van hierdie gegewens en 'n indeks van bewaringsstatus, is vasgestel dat die Subtropiese Ruigte voorkeur moet geniet met betrekking tot bewaring in die oos-Kaap. Meer diepgaande studies van die Subtropiese Ruigte word voortgesit terwyl dit in 'n toenemende mate vernietig word en as gevolg van veranderende boerderymetodes uiters kwesbaar is.

## INTRODUCTION

Early studies on the vegetation of South Africa (e.g. Pole Evans 1936, Adamson 1938) did not illustrate the great diversity of the vegetation of the eastern Cape. In 1953 Acocks published his *Veld Types of South Africa* which, along with the revised edition of 1976, has become the standard guide for most vegetation studies in this country. Acocks had a clear overview of the vegetation patterns of southern Africa and emphasized the complexity of the vegetation in the eastern Cape with which he was most familiar. Over the last decade in studies on natural ecosystems, many authors have stressed the importance of the biome as a functional unit and we therefore saw the need to re-examine the classification of the vegetation of this region using this concept.

Acocks (1953) considers both botanical composition and practical veld utilization in defining his veld type as 'a unit of vegetation whose range of variation is small enough to permit the whole of it to have the same farming potentialities'. His vegetation map was based on species composition, distribution and abundance in plant communities throughout the country and has proved of great value to both academic and applied ecologists. Acocks developed his concept of veld types on the basis of supposed historical relationships, dynamics of the vegetation and present day utilization of farming practices. This re-

sulted in grouping of unrelated types into a single veld type and unsatisfactory grouping of units above the level of veld type. Consequently, criticism has arisen from a number of authors, particularly those working in the eastern Cape. Martin & Noel (1960) indicated that a new vegetation classification must be formed which would fit an 'international' framework. Tinley, in Heydorn & Tinley (1980) suggested that this classification should relate to the biome concept on a continental basis and Cowling (1983a) stressed the need for a syntaxonomic hierarchical classification of vegetation units. This type of change in Acocks's (1975) classification of vegetation units has also been stressed by agriculturalists concerned with functional farming units (Tainton 1981, Roux & Van der Vyver in press). At a recent symposium on the eastern Cape, Lubke *et al.* (in press) stressed the need to critically re-evaluate certain veld type concepts and provide broader vegetation units which are meaningful to both the pure and applied ecologist.

An international classification of plant formations has been developed by the UNESCO working group on vegetation classification and mapping (Ellenberg & Mueller-Dombois 1967). More recently a more natural concept than the formation, which includes the whole complex of organisms naturally living together as a sociological unit, has been defined as a biome (Willis 1973). In this paper we have related the biome concept to the internationally recognized classification of plant formations. This approach has formed the basis of the national ecosystem programmes in South Africa (Anon. 1975).

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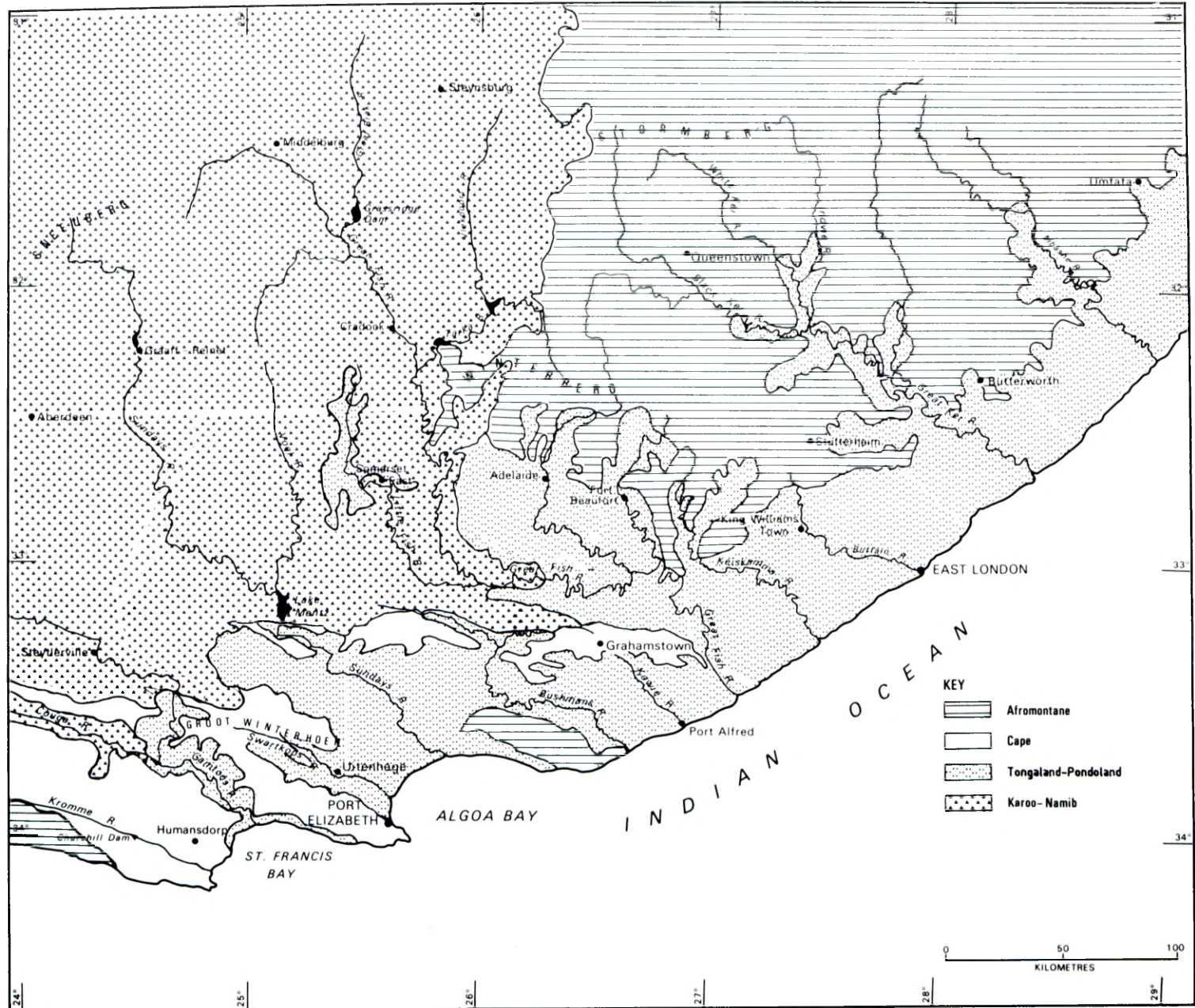


FIGURE 1. — Map of the eastern Cape showing the distribution of the four phytochological regions.

The general aim of this paper is to clarify the classification of vegetation in this region on the biome concept yet maintaining many of the recognized and accepted veld types or vegetation categories. The vegetation map and biomes of the eastern Cape defined by Lubke *et al.* (in press) are presented here to a wider audience in a more concise form. With the increasing pressures of land-use and agricultural development many of the communities within these biomes and their complement of endemic, rare or endangered species are threatened with extinction. We have attempted to identify those species in the eastern Cape which are rare or endangered, define the communities within which they occur and identify which areas are in particular need of conservation.

THE EASTERN CAPE REGION

The eastern Cape is variously defined by the Department of Agriculture (Roux & Van der Vyver in press), Directorate of Forestry (Cobby in press) and others. Rennie (1945) discussed the various regions within the eastern Cape in which he included Transkei and much of the Upper Karoo. This classification is similar to that defined as region D for Development Planning (Anon. 1980). In our studies on the conservation of communities in the eastern Cape, we have defined the eastern Cape as follows: the area south of 31°S and between 24°E and the Great Kei River and the Transkei boundary in the east. This is essentially the same region defined by Gibbs Russell & Robinson (1981) who provided a brief account of the geology, geomorphology and climate. At the Symposium on the eastern Cape (Bruton & Gess in press) reviews of most pertinent aspects of the physical environment were presented by a number of authors and this information will not be presented here. Lubke *et al.* (in press) describe the interrelationship between the environment and the vegetation in more detail.

PHYTOGEOGRAPHICAL AFFINITIES OF THE EASTERN CAPE FLORA

The eastern Cape has long been known as a region of floral transition and complexity (Dyer 1937; Adamson 1938). It forms a major climatic, topographical, geological and pedological transition zone and consequently four major phytogeographical regions or phytochoria converge in this region (Goldblatt 1978, Werger 1978a, Gibbs Russell & Robinson 1981, White 1983, Cowling 1983a). The distribution of these four regions in the eastern Cape is shown in Figure 1.

No comprehensive floristic study has been made of the area which we have defined as the eastern Cape. It is therefore not possible to analyse the species abundance in the four phytochoria without extensive further research, such as Cowling (1983a) has reported for the Humansdorp District. He compared that flora with the Cape flora and the subtropical flora of Natal to show transition between these regions. Using the approach of Cowling (1983a) we have examined the species abundance of the major families in the various regions from published data to give a broad concept of phytochorological association. Data were obtained for the Cape region (Bond & Goldblatt 1984), the Humansdorp District (Fourcade 1941), the Albany and Bathurst Districts (Martin & Noel 1960) and Natal (Ross 1972) and the results presented in the form of pie charts (Figure 2). The families are categorized according to whether they are widespread, predominantly 'Cape' (Bond & Goldblatt 1984) or 'subtropical' (Ross 1972) families and the percentage of species of each family are expressed as a total of all the species of those families in each of the four regions. These families made up 60–75% of the total species composition of the four regions. The widespread families are mostly of equal abundance (~46%) but are less abundant (37%) in

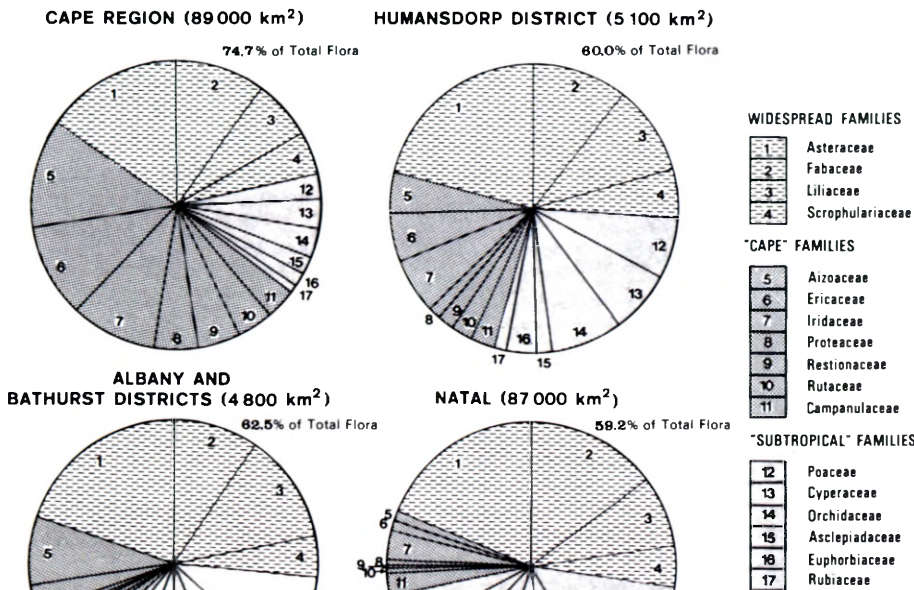


FIGURE 2. — Pie charts comparing the species abundance of the major families in the Cape region, Humansdorp District, Albany and Bathurst Districts and Natal.

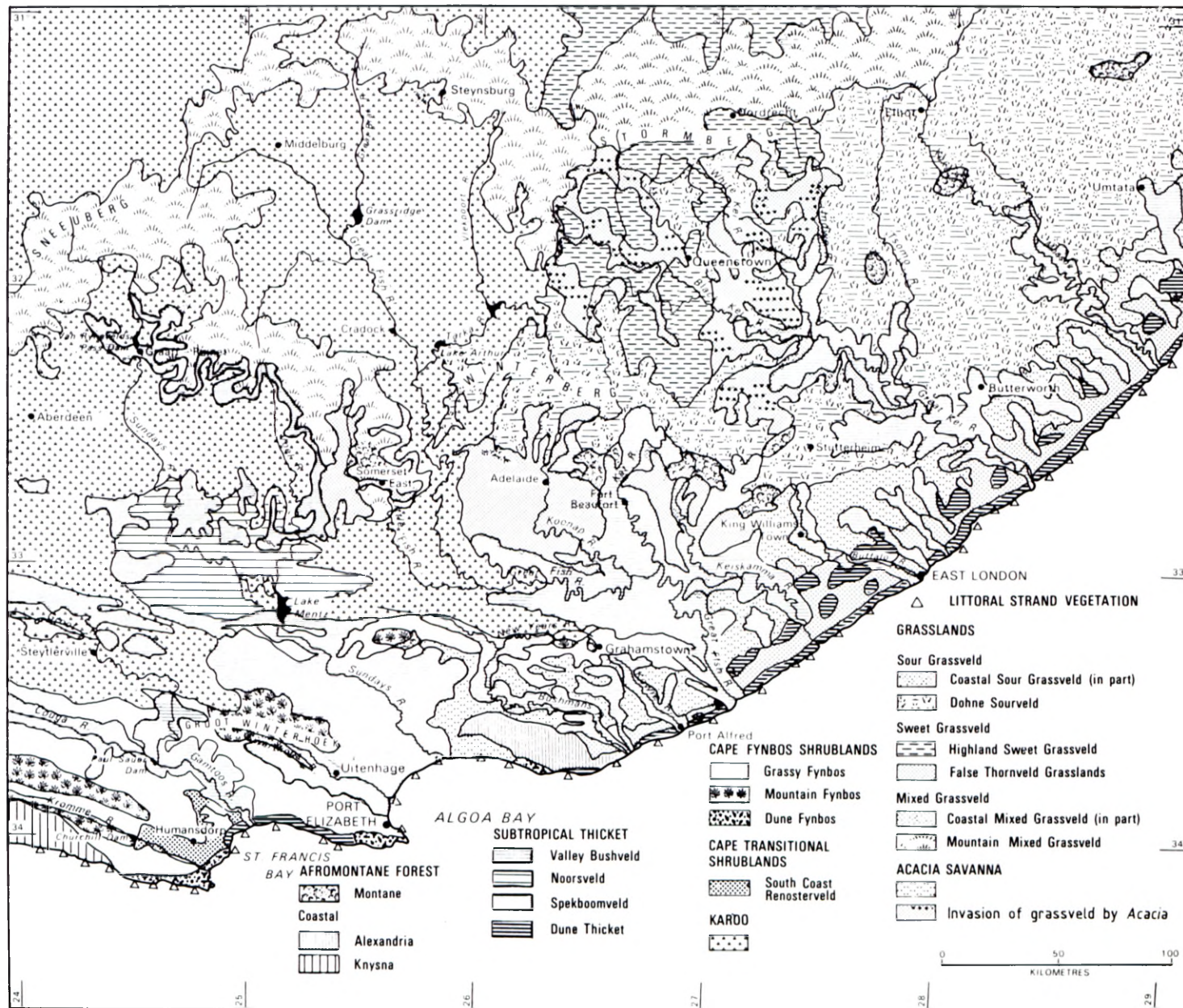


FIGURE 3. — Vegetation map of the eastern Cape and part of the Transkei.

the Cape region. Within the widespread families some species may be specific to either the 'Cape' or 'subtropical' regions but information on species distribution is lacking in many cases. When comparing the pie chart of the Cape Region with that of Natal, the abundance of the 'Cape' families and 'subtropical' families are almost exact mirror images in these two diagrams. The importance of the families of the Cape flora (e.g. Ericaceae and Restionaceae) decreases as one moves eastwards, as these families are replaced by families of the subtropical region (e.g. Poaceae and Asclepiadaceae). This is apparent from the pie charts of the Humansdorp and Albany and Bathurst Districts (Figure 2).

The Cape floral elements extend eastwards and diminish rapidly in abundance from Grahamstown. The Tongaland-Pondoland flora (Moll & White 1978), enters the region along the east coast and the dwarf forest or thicket vegetation penetrates up the river valleys as far as the Gamtoos in the west (Figure 1). The succulent and subdesert shrublands of the Karoo-Namib region (Werger 1978b) extend down the dry river valleys from the arid interior. Afromontane elements (White 1978) of grassland and forest vegetation types extend down the mountains to sea level in the south-western region of the eastern Cape, where coastal forests are composed of many Afromontane species. In many of the plant communities of the eastern Cape a great complexity of floral elements is evident and is described by Cowling (1983a) as a phytocorologically mixed flora.

#### THE VEGETATION OF THE EASTERN CAPE

In order to combine the great complexity of vegetation types in the eastern Cape recognized by Acocks (1975) with a more acceptable type of biome viewpoint (Tinley, in Heydorn & Tinley 1980) and form a hierarchical classification (Cowling 1984) a revised vegetation map has been produced (Figure 3). Using Acocks's (1953) and Pole Evans's (1936) maps as a base, the outlines of the vegetation types were redrawn and reclassified in a biome type hierarchy. The majority of the biomes of southern Africa extend into the eastern Cape from adjacent areas, yet not one of the biomes is confined to the area. The greatest diversity of biomes or vegetation types is found within a radius of 150 km of Grahamstown, an approximate centre of the region. The major vegetation classes recognized in the eastern Cape are briefly described below.

##### *Cape Fynbos Shrublands*

These are plant communities, often characterized by heath plants, which include a variety of communities of nutrient-poor soils often in areas with Mediterranean-type climates or high winter rainfall. Typically they contain shrubs which either have large proteaceous leaves or fine small hard ericaceous leaves, and tufted plants of the Restionaceae ('riete'). The Cape fynbos extends from the south-western Cape to the east just beyond Grahamstown (Moll & Bossi 1984). In this region three types of fynbos occur: Mountain Fynbos on the high altitude south-facing slopes; Grassy Fynbos on lower and

northern slopes and plains where grasses replace the restionaceous element, and Dune Fynbos on calcareous coastal deposits.

##### *Cape Transitional Shrublands*

These plant communities comprise the non-fynbos, small-leaved shrublands occurring in transitional regions between coastal and mountain fynbos or between mountain fynbos and the semi-desert shrubland of the succulent Karoo. South Coast Renosterveld is the only representative of this vegetation type abundant in the Humansdorp District; it has its easternmost limits in the region of Grahamstown. Grasses form a conspicuous component and some of these shrublands have been derived from grasslands in the past (Cowling 1983b).

##### *Subtropical Thicket*

Thicket is a dense woody cover with a closed canopy composed mostly of shade-intolerant species. It extends along the coastal margin of southern Africa and is allied to the thicket of the equatorial zones of Africa (Tinley, in Heydorn & Tinley 1980). This vegetation type has been included in savanna by Huntley (1982) and M. C. Rutherford and R. H. Westfall (pers. comm.) but we have distinguished it as a separate category following the approach of Cowling (1984) and Tinley (Lubke *et al.* in press). In the eastern Cape the thicket penetrates inland along the river valleys and extends into the dry mountainous areas in the south-west. Four types of Subtropical Thicket are distinguished. They include *Dune Thicket*, which is a non-succulent type occurring along the dunes and at low altitudes (usually below 300 m) along the coastal strip. It has strong affinities with the temperate forests (Cowling 1983a), hence Acocks (1975) refers to it as coastal forest. Another type of thicket is *Valley Bushveld* which is one of the commonest vegetation types in the eastern Cape, confined to the hot dry river valleys. The vegetation is dominated by succulents (e.g. species of *Euphorbia*, *Crassula*, *Aloe*, *Delosperma*) though tree species are also common. The *Noorsveld*, a low-growing thicket type occurring at higher altitudes (300–600 m), is also a type of Subtropical Thicket. It is centred around Jansenville, the dominant species being *Euphorbia coerulescens* (noors). The fourth type of Subtropical Thicket in the eastern Cape is the *Spekboomveld* which occurs in the steeper mountainous areas and is dominated by *Portulacaria afra* (spekboom). Acocks (1953) erroneously considered the latter three thicket types to be of karroid veld type owing to the abundance of succulents including many species of the Karoo-Namib affinity (Court in press).

##### *Karoo or Subdesert*

The Karoo vegetation consists of dwarf subdesert shrublands and succulent karroid vegetation types that are widespread in the eastern Cape, extending from the north-west, south-eastwards to the Grahamstown area. Acocks (1975) recognizes a number of variations ranging from succulent through shrubby to grassy forms. Much of this area has long been subjected to grazing and has suffered accord-

ingly. It is slow to recover from disturbances and Tainton (1981) considers it to have been reasonably well grassed, with species of tropical, subtropical and temperate affinities being present. Today, few of these species remain as common karoo elements.

#### *Acacia Savanna*

The Savanna, which is characterized by *Acacia karroo*, extends down into the eastern Cape region from the north-east and is related to the higher rainfall moist savannas. This savanna is partially moist/dystrophic and partially arid/eutrophic savanna (Huntley 1982). *Acacia karroo* has a tendency to invade along streambanks in the grasslands and semi-desert areas. Acocks (1975) refers to this invasion of the grasslands as False Thornveld or Invasion of Grassveld which, for example, around Queenstown, covers an extensive area.

#### *Afromontane Forest*

The forests, which occur in the higher rainfall areas of the eastern Cape from sea level to montane sites, are all of the Afromontane type (White 1983). In the eastern Cape, these Afromontane Forests can be separated into three distinct types. The montane forests form pockets or 'islands' extending from the Drakensberg over a number of mountainous regions in the eastern Cape (White 1978). In the Amatola Mountains these forests form some of the most species-rich forested areas in southern Africa (Lubke *et al.* in press). The second type of Afromontane Forest occurring in the eastern Cape is the Alexandria Forest which occurs in high rainfall pockets of the coastal area where the dune thicket reaches dense temperate forest proportions. The Knysna Forest just reaches the eastern Cape in the west. These forests are not as species-rich as the other forests of the eastern Cape but the trees have the greatest stature of any trees in southern Africa.

#### *Grasslands*

Grasslands of the eastern Cape are composed of three major types, viz. (a) the Sour Grassveld, (b) the Sweet Grassveld, and (c) the Mixed Grassveld. The Sour Grassveld is found in two major blocks, either at high altitudes in areas where the rainfall is heavy with low winter temperatures (Tainton 1981), or along the coastal region in the forest and thicket belt. The high altitude Dohne Sourveld covers an extensive area down the eastern interior of Transkei into the eastern Cape. The Coastal Sour Grassveld is a successional stage to forest or thicket. The sweet Grassveld occurs in areas where rainfall is low and generally occurs in summer. The Mixed Grassveld, which is transitional between sweet and sourveld, is found in coastal and lowland areas and in the mountainous northern areas of the eastern Cape.

#### *Littoral Strand Vegetation*

These plant communities form a narrow discontinuous system along the coastline. The strand plants are characterized by stoloniferous, rhizomatous and sympodial growth and are dune-forming plants growing ahead of accumulating sand. Dune slacks behind the fore-dunes are stabilized by a large diver-

sity of strand plants (Lubke 1983, Lubke & Avis 1982).

### THREATENED AND ENDEMIC PLANTS OF THE EASTERN CAPE

#### *Threatened plants of the eastern Cape*

In 1980 Hall *et al.* published a preliminary list of threatened plant species for South Africa and neighbouring territories. It contains 1 915 vascular plant taxa but a large number of these taxa fall into the Indeterminate (I) and Uncertain whether safe or not (U) categories. Reasons given for this are, (1) the lack of recent herbarium collecting causing an out-of-date image of the present state of rare plants, and (2) the immature state of the taxonomy. Most of the records in the Extinct (X), Endangered (E), Vulnerable (V) and Rare (R) categories were backed by recent field knowledge, especially in the south-western Cape. Intensive studies of threatened plants and their habitats are helping to give an understanding of the strategies needed for their conservation. These studies have been concentrated in specific regions of southern Africa and it was felt that this work needed to be started on a wide scale in all regions (Hall *et al.* 1980).

A survey in the eastern Cape was therefore initiated. A preliminary list of possible threatened and endemic plant species was obtained from literature sources, including Weimarck (1941), Hall *et al.* (1980), Court (1981), Palmer (1981), Von Breitenbach (1982) and Cowling (1983a); lists and records from both the National Herbarium (PRE) and the Albany Museum Herbarium (GRA); and field records from R. A. Lubke (pers. comm.), K. L. Tinley (pers. comm.), A. Jacot Guillarmod (pers. comm.) and the Fynbos Working Group (R. M. Cowling pers. comm.). Information on collection records of these species was then obtained by checking in the Albany Museum and Rhodes University (RUH) Herbaria. Additional information was also obtained from various checklists (Jessop & Jacot Guillarmod 1969, Penzhorn & Olivier 1974, Pennefather & Parsons 1976, Olivier 1977, Palmer 1981, Olivier 1981, 1983). This information is stored in a computer-based data bank which makes it easily available for use to any organization or research body involved with environmental studies or conservation. The conservation status categories are the same as those used by Hall *et al.* (1980).

A total of 662 taxa (Table 1) appear to be under some sort of threat in the eastern Cape, however, most of these fall into the I (117) and U (485) categories. This emphasizes the lack of knowledge and information that is available for the eastern Cape flora. There appears to be only one recently extinct species (Table 1) from the eastern Cape, however, many species were last collected at and around the turn of the century and further investigations may show more species to be extinct. Methods by which these species can be investigated in the field must be formulated if the large number of I and U categories is to be reduced in order to obtain a clearer picture of threatened species. Table 1 also shows the distribution of the threatened species according to the

TABLE 1. — Number of taxa from the main vegetation types of the eastern Cape in the various conservation status categories

		Extinct (X)	Endangered (E)	Vulnerable (V)	Rare (R)	Indeterminate (I)	Uncertain (U)	TOTAL	Endemics (e)	GRAND TOTAL
Thicket	Endemic†		1	4	2	1	21	31	30	61
	Total		1	5	12	14	93	125		155
Fynbos	Endemic†				1	1	20	22	37	59
	Total		1	1	1	8	58	69		106
Forest	Endemic†				1		2	3	4	7
	Total				5	5	30	40		44
Grassland Savanna	Endemic†						3	3	7	10
	Total			3	11	14	55	83		90
Karoo	Endemic†		1				7	8	7	15
	Total		1	1	4	9	41	56		63
Others*	Endemic†	1				1	27	29	27	56
	Total	1		5	8	67	208	289		316
Totals	Endemic†	1	2	4	4	3	80	93	112	205
	Total	1	3	15	41	117	485	662		774

\* Others include wide-spread species, and those which occur in specific habitats such as ponds, vleis and marshes, strand areas, etc., as well as unclassified species.

† Endemic to the eastern Cape.

main vegetation types in the eastern Cape. Most of the taxa fall into the 'others' vegetation category, taxa being classified as 'others' if they cannot be satisfactorily placed into any of the main vegetation categories. These taxa would include widespread species, and species occurring in specific habitats such as ponds, streams, vleis, marshes, salt marshes, estuaries and strand areas. Apart from the 'others' category, Thicket vegetation has the highest number of threatened species (125), followed by Grassland and Savannas (83), Fynbos (69), Karoo (56) and then Forest (40). The implications of these results from a conservation and research point of view will be discussed below.

#### *Endemism in the eastern Cape*

Gibbs Russell & Robinson (1981) point out that, although there is great diversity in the eastern Cape, there are relatively few endemics when compared with endemic centres such as the Cape Floristic Region. They suggest the reasons for this are, firstly, selection pressures, particularly climatic instability, which have acted to produce a flora in which 'generalist' genotypes predominate; secondly, the close proximity of phytochoria of different evolutionary histories ensures that somewhere there is a species already present that can fill, by migration, any new niche which may result from environmental change. Cowling (1983a), however, presents results that indicate that endemism is not universally low in all vegetation types and within different geographical groups of species. He recognizes two endemic centres in the south-eastern Cape, one for Cape taxa, the other for karroid and subtropical taxa. The south-eastern

centre for Cape taxa (Weimarck 1941) consists of the coastal calcareous region from Knysna to the Fish River Mouth where 26.2% or 89 taxa of the sample flora were endemic. The karroid and subtropical taxa occur in the Kaffrarian Transition Zone, namely, the lowlands, valleys and inland basins from the Kei to Gamtoos Rivers and inland to the foothills of the Sneeuwberg-Winterberg-Amatola escarpment. In this zone the karroid succulent flora has a major endemic centre (Cowling 1983a).

As the composition of the eastern Cape flora is not yet well known (Gibbs Russell & Robinson 1981) it is difficult to determine the exact number of endemic species. We have compiled a list of 205 endemic taxa from the literature (Weimarck 1941, Palmer 1981, Court 1981 and Cowling 1983a). Table 1 also shows the distribution of the endemic taxa within the various major vegetation types of the eastern Cape. These results do not support Cowling's (1983a) findings that most endemics in the eastern Cape are of Cape origin. Our results show that the thicket vegetation of the Tongaland-Pondoland region has the highest number of endemics; 61 as opposed to 59 for the Fynbos of the Cape region. This anomaly can be explained by the fact that the south-eastern Cape region as defined by Cowling extends beyond the western limits set for the eastern Cape for this study. Many of the endemics for the south-eastern centre recognized by Cowling had to be eliminated as they extend out of the eastern Cape. He recognized the other endemic centre to consist chiefly of karroid succulent flora which suggests that the karroid vegetation should have the second highest number of endemics in the eastern Cape. Our

results, however, show it to have only 15 endemics. These are species that have distributions in the karroid vegetation only and that have no Karoo affinity. Many of the species recorded as thicket species are succulent species with karroid origins but are now distributed in the thicket vegetation. This explains why our results do not appear to support the findings of Cowling. Figure 4 shows that a large proportion of the endemic taxa (30,2%) are succulent species, many of these possibly of karroid origin.

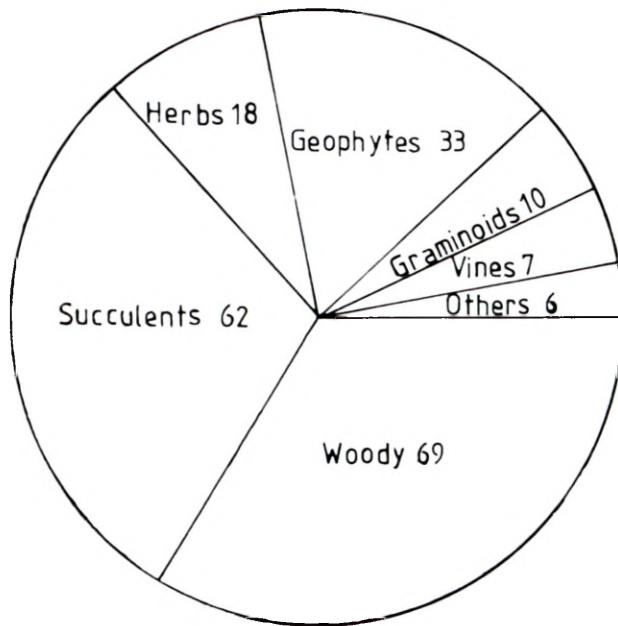


FIGURE 4. — The relative abundance of the major life forms of the eastern Cape endemics.

The lack of distribution records for many of these endemics and the lack of thorough collections from many of the quarter degree grid squares for the eastern Cape (Gibbs Russell *et al.* 1984) make it impossible to plot centres of high endemism in the eastern Cape. Future studies on the eastern Cape flora should provide more substantial interpretive data on endemism. Endemic species are important from a

conservation point of view and have therefore been included in the survey of threatened plants to evaluate the vegetation types of the eastern Cape for conservation purposes.

#### CONSERVATION STATUS OF EASTERN CAPE VEGETATION

There are 90 conservation areas which cover 471 940 ha or 3,04% of the total area of the eastern Cape (A. R. Palmer pers. comm.). The area covered by each vegetation type in the eastern Cape was calculated from the revised map (Figure 3) and, using the areas of each vegetation type present in the conservation areas (Anon. 1981), the percentage of each vegetation type under conservation was calculated (Table 2). Although there are as many as 90 conservation areas in the eastern Cape, these results show that most of the vegetation types are rather poorly conserved. Three of the vegetation types, i.e. Noorsveld, Coastal Grassveld, and Mountain Mixed Grassveld are not present within any of the conservation areas. Ten out of the seventeen vegetation types have less than 1% of their total area in the eastern Cape under conservation (Table 2). More serious than the low percentage of areas under formal conservation is the fact that pressures such as overgrazing, bushclearing and invasion by exotic plant species are increasing and that they are associated with the deterioration of the natural vegetation. It is these problems that must be addressed.

Before a case for the conservation of communities can be put forward, an objective rating of the value of these communities must be made. Estimates of quality or value are rooted in cultural, ethical and aesthetic assumptions (Senanayake *et al.* 1977) which, being value judgements, are in no way objective. It was, therefore, decided to evaluate the vegetation types and rank them in order of priority for conservation using objective means along the lines of those used by Tansley (1982). Each of the main vegetation types was evaluated according to a number of criteria which are considered to be indicative of the conservation value of the vegetation types. For each criterion a value was given to each vegeta-

TABLE 2.—Vegetation types of the eastern Cape (see Figure 3) and the percentage of each conserved

Vegetation type	Total area in E Cape	Area conserved	% Conserved
Afromontane Forest	>135 606 ha	27 123 ha	± 50%
Subtropical Thicket	1 991 730 ha	24 146 ha	1,21%
Noorsveld	414 779 ha	—	—
Spekboomveld	573 593 ha	10 370 ha	1,81%
Dune Thicket	200 963 ha	2 800 ha	1,39%
Grassy Fynbos	658 672 ha	12 530 ha	1,90%
Mountain Fynbos	213 920 ha	9 250 ha	4,32%
Dune Fynbos	54 013 ha	611 ha	1,13%
Renosterveld	66 684 ha	411 ha	0,62%
Karoo	4 370 426 ha	15 921 ha	0,36%
Coastal Sour & Mixed Grassveld	199 298 ha	—	—
Dohne Sourveld	1 054 301 ha	1 503 ha	0,14%
Highland Sweet Grassveld	736 153 ha	800 ha	0,11%
False Thornveld Grassveld	526 812 ha	35 ha	0,01%
Mountain Mixed Grassveld	1 459 100 ha	1 249 ha	0,09%
Acacia Savanna	1 073 919 ha	3 200 ha	0,30%



TABLE 3.—Priority table for the main vegetation types of the eastern Cape. Values represent categories of the numbers of taxa in the various conservation status categories. These categories are explained in the footnote of the table

	Endangered (E) *	Vulnerable (V) *	Rare (R) *	Indeterminate (I) **	Uncertain (U) **	Endemic (e) **	THREAT †	UNIQUE †	% CONS ‡	PAST STUDY †	TOTAL •
Subtropical Thicket	1	3	5	4	5	5	4	3	2	3	35
Fynbos	1	1	1	3	5	5	4	1	2	1	24
Forest			3	2	5	3	2	2	1	3	21
Grassland & Savanna		2	5	4	5	3	1	1	1	2	24
Karoo	1	1	3	3	5	4	2	1	4	2	26

\* 1 = 0–1 species; 2 = 2–3; 3 = 4–5; 4 = 6–10; 5 = 10.

\*\* 1 = 0–1 species; 2 = 2–5; 3 = 6–10; 4 = 10–20; 5 = 20.

† Subjective values of between 1 and 5 depending on the amount of threat, or how unique to the eastern Cape, or how much past study has been conducted on the various vegetation types.

‡ % of total area of that vegetation type conserved: 1 = >2.0%; 2 = 1–2.0%; 3 = 0.6–1%; 4 = 0–0.5%.

• Possible maximum 49.

tion type according to the number of taxa in that category. For the conservation status categories (E, V, R, I, U, e) a number value was assigned. For the percentage of the vegetation type under conservation five integer categories were recognized. Values for the amount of threat, uniqueness, or extent of past studies of the vegetation types were given. These values are explained in the key to Table 3. The vegetation type with the highest value is therefore ranked top on the priority list of vegetation types requiring further investigation for conservation purposes.

Subtropical Thicket with a total of 35 out of a total possible 49 points (Table 3) is therefore considered to be most threatened in the eastern Cape. It has the highest number of vulnerable, rare, indeterminate, uncertain and endemic species in the eastern Cape. This could also possibly reflect a lack of information as to the present composition and distribution of the flora and therefore attention should be focused on this vegetation type. The Karoo vegetation is second on the priority list, and is the least well represented in any of the conservation areas. Hopefully the conservation status of the Karoo will improve as research results from the Karoo Biome Project are obtained. The Fynbos has received much attention from researchers in the fynbos region, and although it is unique and under great pressure, proposals and strategies for management and conservation have still to be formulated by conservation authorities. Grasslands and Savannas extend far beyond the limits of the eastern Cape and are not under great pressure by adverse farming techniques and so are not ranked high on the priority list for conservation even though they are poorly represented in conservation areas in this region. Forests appear to be very well conserved. They are poorly understood and should not be ignored in spite of their low ranking on the priority table.

## CONCLUSIONS

Although the eastern Cape has never been regarded as a clearly demarcated natural area, and has been variously defined by different Government departments, planners, developers and the scientific community, it is a region that has long been known for its immense complexity. It forms a major climatic, topographical and geological transition zone and is consequently a focus of convergence of 4 major phytochoria (Figure 1). The area is rich in species and communities with a complex vegetation which is predominantly transitional between a Cape and subtropical flora (Figure 2).

All of the major biomes of southern Africa except Desert extend into the eastern Cape but none are confined to it. These biomes have been clearly delineated (Figure 3) and differ from the classification of Acocks (1975) in that the Valley Bushveld, Spekboomveld and Noorsveld are allied to the Subtropical Thickets and not to the Karoo vegetation. Subtropical Thicket is recognized as different from Savanna.

Although there is great plant diversity in the eastern Cape, endemism cannot be regarded as high when compared with some endemic centres in southern Africa. The greatest number of endemics to the eastern Cape occur in the Subtropical Thickets (Table 1). This emphasizes the importance of these thickets from a conservation point of view.

The compilation of a list of threatened plants and the storage of data on these species in a computer-based data bank is proving to be invaluable for conservation in the eastern Cape. Government departments and local authorities concerned with conservation have requested data on endangered species for the formulation of conservation policies and protection of important sites. The list also highlights the lack of up-to-date distribution records for many

species and thus stresses the need for more extensive vegetation study and collecting in the eastern Cape.

The conservation status of the eastern Cape vegetation is generally rather poor, with Afromontane Forest being the only vegetation type having more than 5% of its extent conserved. Subtropical Thicket is placed highest on a conservation priority list (Table 3) as it has the highest number of threatened and endemic plants. Present research on the Subtropical Thicket includes an attempt to identify regions with high conservation value based on endemic and threatened plants and to relate these regions to environmental factors (Everard 1985). It is essential that more data be accumulated on this important biome as thickets are being cleared and replaced by pasture at a rapid rate in parts of the eastern Cape (Palmer in press, Olivier in press). Further research on this flora and vegetation is required before ecologists know the consequences of the removal of thicket.

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