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Recovery of eastern Cape heathland after fire

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ABSTRACT

In parts of the eastern Cape, fire is increasing in frequency and intensity in heathland, due mainly to the presence of adventive exotic tree species. These adventives also smother the indigenous vegetation under a dense canopy or with leaf litter. This heathland flora requires a long period to reach its climax and under present conditions, this is rarely attained.

RÉSUMÉ

RECOUVREMENT DE LA LANDE DU CAP ORIENTAL APRÈS LES FEUX

Dans certains régions orientales de la Province du Cap, la fréquence et la force des feux qui détruissent les bruyères s'accroissent, causes surtout par la présence d'espèces d'arbres exotiques. D'autre part, ces intrus étouffent la végétation indigène sous un dôme de verdure et ils sont également nuisibles par la litière de feuilles. Il faut très longtemps à la flore indigène pour retrouver son climax et ceci arrive très rarement maintenant.

INTRODUCTION

Heathland occurs continuously in southern Africa from the western Cape to the Great Fish River in the eastern Cape (Acocks, 1975). Thereafter isolated areas of heathland are found at high altitudes on, for example, the Drakensberg of Natal and Lesotho (Killick, 1963; Jacot Guillarmod, 1971) and up into Ethiopia (see Fig. 4.1 in Killick, 1979). In the Cape Province it is found from sea level to mountain tops wherever soil and climatic conditions are suitable. This vegetation type is now endangered over most of its range in the Cape Province because of man's demands for more agricultural and pastoral land (Trollope & Booysen, 1971) and also the spread of invasive exotic tree species. Fire is also a serious threat to maintenance of species diversity and existence of heathland. Due to the presence of many adventives, mainly woody, fire is an increasing hazard both in intensity and frequency.

STUDY AREA

Eastern Cape heathland exists mainly on Witteberg quartzite-derived soils. These are acid and usually well drained. This soil type extends for only a short distance, as isolated spurs of the Suurberg range, north-eastward beyond the Great Fish River (Fig. 1). It is rarely now that any species typical of heathland can be found in this easternmost portion, now in the Ciskei in a heavily populated area. This vegetation type, described by Acocks (1975) as False Macchia (Type 70) or as nanophanerophyte shrub heathland by Martin & Noel (1960) can therefore be considered extinct beyond the Great Fish River, that is, the easternmost extent of its former distribution within the boundaries of the Cape Province at the time Acocks made his survey of vegetation types of South Africa.

On the south-eastward side of the Great Fish River, heathland is still to be found on the Suurberg range and other outcrops of Witteberg quartzite. The present study area (Faraway) is situated at 33°20'S, 26°29'E and rises to 700 m a.s.l. (Fig. 2). A comparable area of heathland, studied by Martin (1965) for primary communities and plant succession and later, also by Martin (1966) for the effects of burning, lies nearby. This is the Grahamstown Nature Reserve, situated at 33°20'S, 26°31'E. Both plots face south, are on spurs of the Suurberg range and have the same heathland type of vegetation. The Grahamstown Nature Reserve is approximately 81 ha in extent, while the study plot is 31 ha. Both areas have been subjected to fire at irregular intervals and while the Grahamstown Nature Reserve has been kept almost entirely free of invading exotic tree and shrub species, the study area was, in 1974, almost completely covered by these. The species found were *Pinus* spp. (mixed in origin but basically of *P. pinaster* or *P. halepensis*), *Hakea sericea, Acacia longifolia, A. saligna,* and *Solanum mauritianum.* From August 1974, the area was steadily cleared of such exotics so that by August 1980, it was free of these except for a narrow belt along the south-western boundary (Fig. 2), where some very large trees stood.

By growth ring counts and from photographic evidence, it was estimated that the average age of the great majority of the pine trees was 15–17 years; the much larger, older trees were at least 45–50 years old and some may have been even older. Photographs taken in the early 1960's showed an extensive heathland with a scattering of young pine trees only just above the level of the heath vegetation, and a few massive large trees. Though some of the very old trees may have been planted, the younger growth was self-sown or adventive. The cover of trees over the heathland was dense and light penetration was very poor. Leaf litter was deep reaching one metre in a few places where it had settled against obstructions. Etiolated *Protea cynaroides* had produced weak stems three metres in length, projecting up through pine tree branches but many of these were dead stems. Only where an opening, due to fallen trees, existed, could remnants

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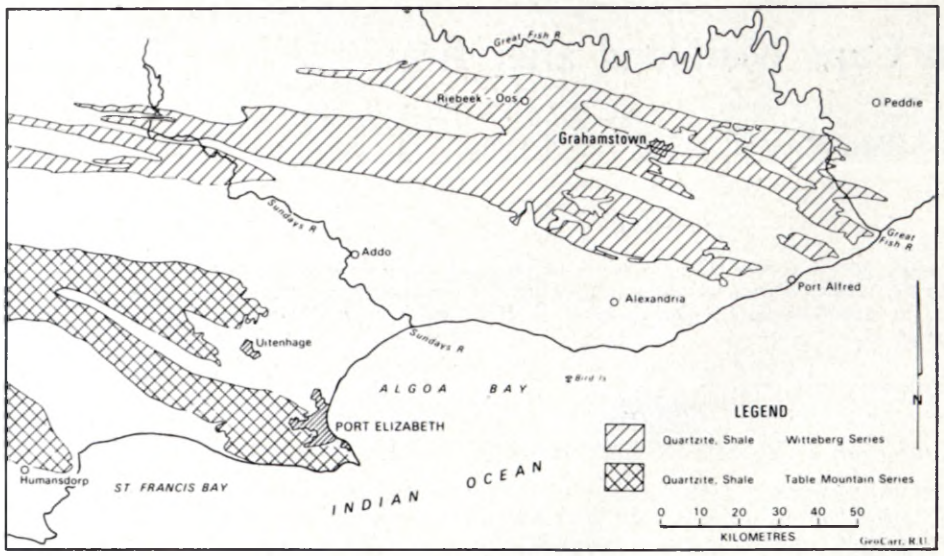

FIG. 1.—Witteberg and Table Mountain series quartzite occurrences in the eastern Cape and Ciskei (east of the Great Fish River).

of the heathland flora be found but even here *Erica chamissonis* bushes were usually dead. Species diversity was low and much of what was present was not flowering.

CLIMATE

The eastern Cape is on the border of the summer and winter rainfall region, along the coastal strip; it experiences a variable precipitation. On average, near the Great Fish River the rainfall is 380 mm or less per annum, but on the spurs of the Suurberg (where the two areas, Grahamstown Nature Reserve and the study plot) are situated, rainfall is higher. A six-year record kept on the study plot gives an average of 850 mm a year. Fog must add considerably to the moisture available to plants in both areas. A mist meter has only recently been installed and data are not yet reliable. Frost seldom occurs and is never severe but snow may fall and lie during winter (Jacot Guillarmod, 1980). The prevailing wind is southwesterly.

METHODS

During the six years preceding August 1980, and as the indigenous vegetation recovered from the effects of the pine tree cover, a record was kept of species identified. Specimens were placed in the Albany Museum Herbarium, Grahamstown (GRA). This record of regenerating heathland was not complete when a fierce fire, fanned by a very strong and dry northwesterly wind ('berg wind'), swept across the study area on August 23rd, 1980. The previous six months had been particularly dry for the area (Table 1) and all vegetation was therefore especially subject to fire damage; even leaves of succulents were wilted or drying up. During the six hours of active fire passage (the wind though mainly north-westerly, veered and backed, so that trees which had escaped the first flames, were later burnt), all live plant material on the heathland was consumed. The marginal trees of the forest patch were also burnt; these were *Rapanea melanophloeos, Apodytes dimidiata* and *Zanthoxylon capensis* for the most part. Only the small portion of

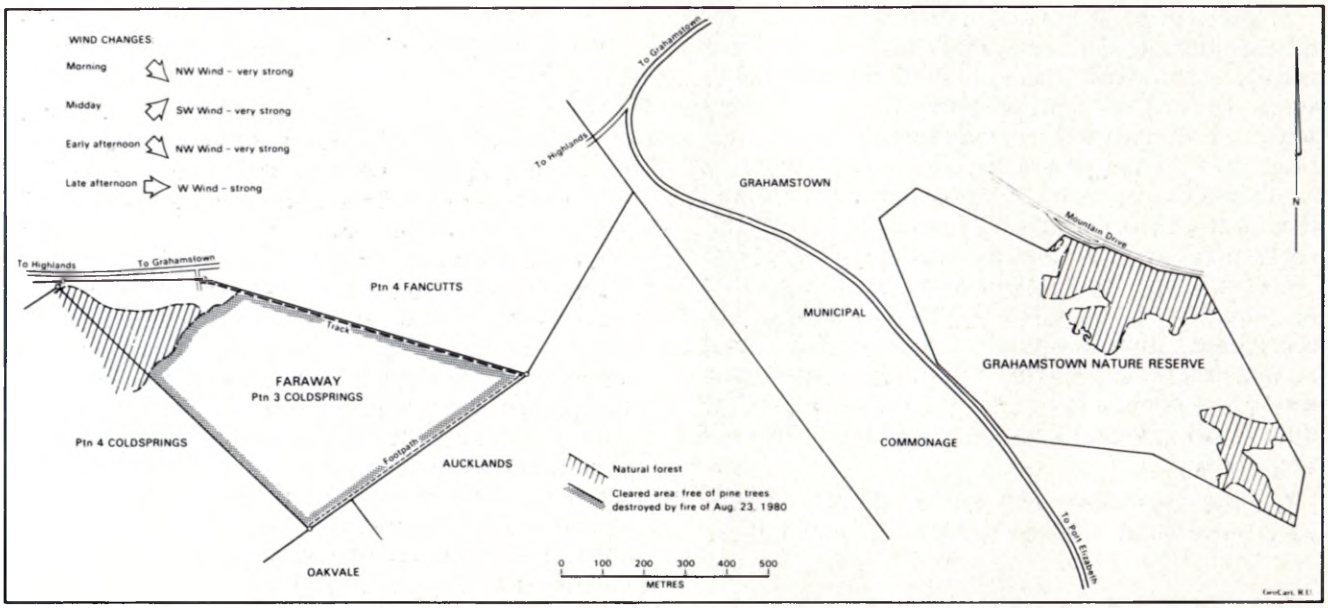

FIG. 2.—Study plot and its relation to Grahamstown Nature Reserve.

heathland lying above the forest escaped destruction. Stumps of previously cut pine trees and underground roots continued to burn on the area for several days after August 23rd.

After the fire, a record of species regenerating was begun; this included time of flowering, date of recognition from characteristic growth form (e.g. *Schizaea pectinata*), height at flowering, and extent of cover, etc. With the detailed work of Martin (1966) for comparison, it should be possible to establish the time taken for this particular type of heathland to reach what Martin considers its climax form, dominated by *Erica chamissonis* and *E. demissa*.

TABLE 1.—Precipitation and temperature data for study area, Faraway

Climatic factor and period	Data
Average annual precipitation on study plot (6 years)	860 mm
Precipitation for six months preceding August 23rd, 1980	184 mm
Precipitation during sixteen days following fire of August 23rd, 1980	
August 26/27	5 mm
August 31/ Sept. 1	8 mm
Sept. 1/2	4 mm
Sept. 6/7	24 mm
Sept. 7/8	4 mm
Totals during three months following fire	
Sept.	75 mm
Oct.	59 mm
Nov.	66 mm
Temperature on day previous to fire (August 22nd., 1980)	max. 29,5°C min. 17,5°C

RESULTS

Regeneration after the fire in August 1980 was assisted by favourable weather conditions. The warmer weather of the spring season was accompanied by gentle rain at frequent intervals. Sufficient plant cover had grown before the first heavy rain storm so that erosion was minimal on the exposed slope and seed had good conditions for germinating. Table 1 gives the main points for climatic conditions.

The first plant to flower was *Cyrtanthus angustifolius* (commonly known as 'fire lily'). The first flower was open by August 30th. The flower stems preceded the leaves and within six weeks more than 300 of these plants had flowered. A second group produced vegetative growth first, and within a month, were flowering; this included *Senecio concolor* and *Clutia heterophylla*. A third group, characterized by *Bobartia macrocarpa* and the grass, *Alloteropsis semialata*, were in flower within three months of the fire. A fourth group of plants has taken a year to reach the flowering stage and includes woody shrubs and trees (e.g. *Halleria lucida*) and biennials *(Senecio pterophorus)* which have appeared from seed that germinated after the fire. Some species, recorded as present before the fire, had not been noted as present fifteen months after the date of the fire. These include seed regenerating species such as *Erica chamissonis* and several other *Erica* species, where the seed requires to be blown into the area by wind from some outside source. It also includes the fern, *Gleichenia polypodioides*.

Seed regeneration has lagged behind regeneration from underground perennating organs in this study area. Only 9% of species noted has proved to be from seed germination, whether from seed present in the area and unaffected by fire (or stimulated, as with *Acacia longifolia*, from supplies dormant previously) or from introduced seed in the post-fire period. All exotic weeds noted for the area prior to the fire have reappeared as seedlings, with one exception, *Hakea sericea*. *Senecio concolor* has regenerated not only from stock but also from seed apparently blown into the area. Bond (1980) suggests there may be various barriers to seed distribution. One barrier in this case is the lack of seed supplies from other areas, as the fire destroyed heathland on most of the surrounding hillslopes and in the valleys.

DISCUSSION

Martin (1966), in comparing the previous state (Martin 1965) of heathland with post-fire regeneration, established five groups of appearance of plant species — flowering within a week, within a month to five weeks, within three months, within a year, and lastly, the species requiring seed supply from stocks outside the burnt area. The present study area has demonstrated this grouping for the first four sections, and the period since the fire has not been long enough to establish whether the fifth group will re-appear. Martin also states that species in this fifth group take at least eight to ten years to become fully established and to produce the climax state of eastern Cape heathland.

Bond (1980) working in senescent fynbos (heathland) in the Swartberg area of the southern Cape, has indicated that too long an interval between burning may also lead to reduction in species diversity. His experimental areas included 40–50 year old heathland and mature heathland of 18–20 years. The present study area could perhaps be considered as approximately six years old (1974–1980) prior to the fire, and approaching its climax, as *Erica chamissonis* was becoming a dominant. The previous dense cover of pine trees had acted to suppress the natural species diversity, which was regenerating when the fire burnt the area.

Acocks (1975) considers heathland took over from temperate forest as the climate of southern Africa became drier and Von Breitenbach (1972) also indicates the destruction of forest encourages the extension of heathland. However, fire at too frequent intervals reduces the diversity of species in heathland and, where these are present, increases the number and variety of exotic weed species whether by stimulating germination of seed already present (*Acacia* species) or by the rapid germination and growth of introduced seed on exposed areas.

This present note will be followed by a more detailed account of the recovery of the study area but, at present, Martin's conclusions for the Grahamstown Nature Reserve seem to be valid for eastern Cape heathland. Specimens of material collected are being placed in the Albany Museum Herbarium, Grahamstown (GRA) together with notes, and plots are being studied regularly by other workers.

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