On Mlilwane, *Brachiaria brizantha* and *Hyperthelia dissoluta* are two strongly associated grasses with a unique distribution cutting across relationships in the general classification hierarchy. They distinguish the Shonalanga Plains Variation of secondary grassland but occur also characteristically and with high presence in the temperate variation of Usutshwana Valley Bushveld. As pointed out by Goodall (1953), if the presence or absence of two species in quadrats are correlated, it is probable that the distribution of one or both species over the area is non-uniform and that the habitat factors controlling them are also non-uniform. The Shonalanga Plains and upper Usutshwana Valley slopes with temperate Bushveld would for such reasons seem to share some distinctive habitat features controlling the distribution of the two species. Both species are warm-temperate to sub-tropical in their distributions, which presumably explains their absence on the frosty, cool-temperate Highveld. Furthermore, their moisture requirements, judging from their general distribution in the Transvaal, seem to be the equivalent of about 700 mm or more annual rainfall on sandy soil; requiring less rainfall in special moist habitats, e.g. along roadsides where water runoff collects, and perhaps requiring a higher rainfall on physiologically drier clayey soils. Such a minimum moisture requirement may account for the absence of *Brachiaria brizantha* and *Hyperthelia dissoluta* on the Central Plains, which have a drier physiography than the Shonalanga Plains. The former rises higher and steeper above its drainage lines than the Shonalanga Plains, and is therefore better drained and being in addition strongly convex, may be expected to have shallower, drier soils. The enclusive floristic affinities between the Shonalanga Plains Grassland and the Temperate Usutshwana Valley Bushveld, would therefore seem to be associated with their moderate winter temperatures coupled with high summer moisture. However, it remains to be explained why the two species in question do not occur on the lower slopes of the Usutshwana Valley, in the Sub-tropical Bushveld. To fit in with the suggested explanation it may be speculated that the bottom slopes of the Valley are hotter, receive less rainfall, are more clayey, more nutrient-rich and are therefore climatically and physiologically drier than the upper slopes, i.e. too dry for the two relevant species.

Other more exclusive species of the Shonalanga Plains include the forbs *Rhynchosia* sp. *cf. R. nervosa* and *Ruellia patula.*

(b) *Thunbergia atriplicifolia – Paspalum commersonii* Variation (Central Plains Grassland)

The grassland variation on the relatively strongly undulating Central Plains is differentiated by *Thunbergia atriplicifolia,* which is negatively associated with differential species of the variation on the Shonalanga Plains.

2. *Loudetia simplex – Diheteropogon amplectens*

Moist Cool-temperate Grassland and Sub-humid Mountain Bushveld (Mountain Grassland and Bushveld)

Diheteropogon amplectens, Themeda triandra and *Loudetia simplex* are distinctive of mountainous parts of Mlilwane, excluding Montane Scrub and Forest. *Themeda triandra* has a particularly wide ecological amplitude in sub-humid temperate grasslands and bushveld in general, occurring on leached sandy to trophic loamy and clayey soils (Werger and Coetzee 1978). However, in sub-humid to semi-arid tropical areas the species, perhaps another (tropical) genotype, is highly indicative of very trophic clayey soils. It might be the absence of *Themeda triandra* on distrophic soils in sub-tropical areas and its presence on such soils in temperate areas that could account for *T. triandra* differentiating mountainous vegetation at Mlilwane. Also in a wider context, *Diheteropogon amplectens* is very typical of humid to dry, temperate to tropical mountain slopes. *Loudetia simplex* seems typical of moist leached soils, particularly in high cool-temperate areas and including clay-loam to sandy soils (cf. Chippendall and Crook 1976; Coetzee 1974a, 1975; Coetzee *et al.* 1976; Wild and Grandvaux Barbosa 1967).

Two distinct community types, each with a number of variations, occur within mountain grassland and bushveld, i.e.

1. Moist Cool-temperate Grassland of the Highveld, and
2. Sub-humid Mountain Bushveld of the Usutshwana Valley.

2.1 *Pogonatherum villosa – Monocymbium ceresiiforme* Moist Cool-temperate Grassland (Highveld grassland)

The most exclusive differential species for the Mlilwane Highveld grassland collectively, are the grasses *Schizachyrium sanguineum, Panicum natalense, Monocymbium ceresiiforme, Pogonatherum villosa* and *Andropogon schirensis*. Individually, and even more so in combination, these grasses over their whole distribution ranges are very typical of sub-humid Highveld grassland i.e. Moist Cool-temperate Grassland, and ecologically strongly related marginal bushveld, i.e. Cool-temperate Sub-humid Mountain Bushveld (cf. Chippendall 1955; Chippendall and Crook 1976; Coetzee 1974a, 1975; Werger and Coetzee 1978).

Two main sub-communities of Highveld grassland occur on Mlilwane. One of these occurs on the lower slopes of the Mlilwane South mountains and is transitional to the grassland communities on the low plains. The other main sub-community is more exclusively Highveld grassland and may be further sub-divided into three variations and two sub-variations. However, at this detailed hierarchical level the classification presented here needs qualification. Variations and sub-variations of typical Highveld grassland are quite clearly defined in Table 1 by groups of strongly associated species and the floristically defined units make ecological sense, following xeric/intermediate/mesic distinctions determined by aspect and soils. But, owing to low sampling intensity and very uneven distribution of quadrats in the Highveld grasslands, the variations shown are not necessarily a complete and equitable inventory of the main differences within the sub-community. On the other hand

whatever differences may still exist within the typical sub-community of *Pogonatherum villosa – Monocymbium ceresiiforme* Grassland are expected to be small compared to the differences that distinguish the sub-community as one entity.

a) *Cymbopogon validus – Monocymbium ceresiiforme* Sub-community (Low-elevation, transitionsl sub-community)

This sub-community was found on the lower slopes of the Mlilwane South mountains, such as the steep slopes below Mlilwane Viewpoint, above the Wilderness road terminus and up to the vicinity of Nature's Corner Viewpoint. The sub-community is transitional to the plains below. The usual dominants are *Hyparrhenia filipendula* and *Loudetia flavida,* which relate the transitional variation to the plains grasslands and to the xeric and intermediate variations of the typical Highveld grassland sub-community. More exclusive relationships with the plains grasslands include the presence of species in the group with *Cassia mimosoides* (see Table 1).

Differential species that are largely restricted to the transitional sub-community are *Cyanotis foecoeda, Cymbopogon validus, Athrixia phylicoides,* and others notably *Acacia davyi* (see Table 1).

b) *Diheteropogon amplectens – Monocymbium ceresiiforme* Sub-community (Typical Highveld grassland)

Fig. 11. Typical Highveld Grassland on the high mountain of Mlilwane North, with a dense stand of Australian *Acacia* trees. Individuals and small clumps of the tree fern *Cyathea dregei,* growing in unsheltered moist habitats, may be seen towards the foreground.

Typical Highveld grassland occupies most of the high region on the Mlilwane Mountains, where winters are frosty, rainfall high and soils distinctly leached (Fig. 11). As an entity the typical sub-community is distinguished from the transitional area by the characteristic mountain combination that the former shares with mountain bushveld, i.e. *Diheteropogon amplectens, Themeda triandra* and *Loudetia simplex.*

Within the Highveld grassland varying aspect has an important effect on temperatures. Soils also vary in rockiness, texture, organic material and drainage. Together, such temperature and soil factors may help determine moisture regime and the Mlilwane Highveld grassland does vary floristically in relation to these environmental factors in a manner suggesting a xeric–mesic gradient. The xeric variation and the adjoining intermediate sub-division of another variation, share *Hyparrhenia filipendula* and *Loudetia flavida* as dominants with the low altitude transitional sub-community and with the mature secondary grasslands on low elevation plains. These two species also occur in the sheltered Usuthwana Valley Bushveld and in the bouldery variation, which has xeric niches, but with considerably lower cover and presence. The relatively warm, dry affinities of *L. flavida* in a Highveld context is supported by other surveys. In the cold South African Bankenveld, which is predominantly Highveld Grassland, Coetzee (1974a) found *L. flavida* restricted to climatically moderate south-facing slopes of warm sheltered valleys. On the nearby Magaliesberg, which has cool moist grasslands and warmer, drier bushveld, *L. flavida* is exclusive to the bushveld (Coetzee 1975). Further north in a predominantly bushveld area that is generally warmer and drier than the Highveld, *L. flavida* is a common grassland and bushveld species, avoiding only the mesic grassland as well as extremely distrophic – sandy and very eutrophic – clayey soils (Coetzee *et al.* 1976).

Xeric Variation

This variation is represented by two very similar stands on a homogeneous, extensive and moderately steep north-facing slope. The soil is a quite sandy clay-loam with fine gravel on the surface. The grassland is short when mature and is dominated by *L. flavida* and the sedge *Bulbostylis burchellii*. The grass *Monocymbium ceresiiforme* is sub-dominant. Distinctive species include the dessication tolerant sedge *Colechloa setifera* (Gaff and Ellis 1974) and others (see Table 1).

Intermediate and non-bouldery-mesic variation

This variation occurs on summits and slopes excluding xeric, steep north-facing slopes and excluding also very bouldery slopes. *Helichrysum coriaceum* and *Digitaria diagonalis* are very characteristic.

One further sub-division is mostly dominated by *Loudetia flavida,* with *Hyparrhenia filipendula* and *Themeda triandra* as co- or sub-dominants.

The second sub-division occurs in special moist habitats such as moist fringes near drainage lines (Quadrat 55) and steep, concave, south-

facing slopes (Quadrats 47 and 49). *Themeda triandra* is usually dominant here, in combination with various occasional dominants such as an unidentified mesophytic species, *Kobresia lanceolata, Pteridium aquilinum* and others (Table 1). *Andropogon schirensis, Alepidia longifolia* and *Gerbera ambiqua* are very distinctive.

Bouldery variation

Very stoney, bouldery grassland slopes with black humic soils and xeric as well as mesic niches, carry a distinct variation that is characterised by *Senecio swaziensis, S. orbicularis, Rhus dura* and *Selago wilmsii*. Dominants vary and include *Loudetia simplex, Diheteropogon amplectens, Xerophyta clavata* or *Loudetia densispica.*

2.2 *Combretum molle – Dombeya rotundifolia*
Sub-humid Mountain Bushveld (Bushveld)

The warm, sheltered bushveld of the Usutshwana Valley is strongly differentiated by a number of species that are typical of both Upland Temperate and Lowveld Sub-tropical Sub-humid Mountain Bushveld. Notable among these are the woody species *Dombeya rotundifolia, Combretum molle, Acacia caffra, Vanqueria infausta* and *Heteropyxis natalense* (Table 1 and Werger and Coetzee 1978). A temperate bushveld community occurs at altitudes intermediate between a sub-tropical bushveld community and the temperate grasslands.

a) *Aloe marlothii – Dombeya rotundifolia*
Temperate Sub-humid Mountain Bushveld

The temperate bushveld community is represented by only three quadrats, two of which are rather fragmentary examples, being physiognomically transitional to grassland. These transitional quadrats are from the edge of the grassland and the woody species occur very sparsely scattered in them. The more typical Quadrat 28 is three-layered, with a luxurious grass stratum, a sparse shrub layer, and 3 m–5 m tall trees covering 30% of the quadrat. *Acacia caffra* is the dominant tree and *Vangueria infausta* the dominant shrub. Dominant grasses include *Hyperthelia dissoluta* and *Themeda triandra,* followed by others with prominent cover (Table 1). The typical quadrat is from a steep concave north-facing slope with deep red colluvial clayey soil and no surface stones or gravel. Habitat and species combination is related to *Eustachys mutica – Acacia caffra* Upland Sub-humid Mountain Bushveld described by Coetzee (1975) and Werger and Coetzee (1978).

The community lacks all the characteristically sub-tropical woody species, but is also positively defined by species exclusive to the temperate community, i.e. the tall succulent *Aloe marlothii* and the grasses *Sporobolus* sp. *cf. S. centrifugus* and *Rhynchelytrum rhodesianum.* Other not-

able differentials are *Brachiaria brizantha* and *Hyperthelia dissoluta,* which are shared with the Shonalanga Plains mature secondary grasslands (Sect. 1.2a).

b) *Annona senegalensis – Pterocarpus angolensis* Sub-tropical Sub-humid Mountain Bushveld.

The sub-tropical bushveld community occurs extensively in the Usutshwana Valley. Physiognomic structure and dominants vary considerably between and within floristically defined sub-divisions of the community but *Pterocarpus angolensis* is mostly dominant in an upper stratum of trees. Shrubs may be absent to virtually impenetrable and the grass cover may be high, or drastically reduced under a dense woody canopy.

The community is strongly differentiated by conspicuous and exclusive woody species that are typical of Sub-tropical Sub-humid Mountain Bushveld, not only on Mlilwane but in a wide context. These are *Pterocarpus angolensis, Annona senegalensis, Antidesma venosum* and *Bauhinia galpinii* (Table 1; Werger and Coetzee 1978).

Two major variations of Sub-tropical, Sub-humid Mountain Bushveld occur on Mlilwane, one associated with outcrop and another, without outcrop, occurring on colluvial soils.

i) *Ozoroa reticulata – Pterocarpus angolensis* Outcrop Variation

Examples of the Outcrop Variation are from shallow soils between unbroken sheet outcrop and from roughly weathered but solid outcrop with shallow soil on little terraces. The representative quadrats were all on moderately steep to steep north-facing slopes. A 6 m–7 m tree stratum is dominated by *Pterocarpus angolensis*. Occasional co-dominant trees include *Combretum molle* and *Albizia versicolor*. A shrub layer with *Annona senegalensis* may be present and the dominant grass is typically *Loudetia simplex*. Quadrat 29 is transitional to the temperate bushveld, with *Acacia caffra, Dombeya rotundifolia* and *Hyperthelia dissoluta* dominant – rather than *Pterocarpus angolensis* and *Loudetia simplex;* and with sheet outcrop but mixed with considerable talus and soil.

Dichrostachys cinerea, Ozoroa reticulata and *Iboza riparia* are conspicuous and strongly differential woody species of the Outcrop Variation. *Triumfetta pilosa* is a distinctive forb.

ii) *Rhoicissus tridentata – Pterocarpus angolensis* Variation on Colluvial soils

The variation on colluvial soils represents the typical bushveld vegetation on lower pediment slopes and plains in the Usutshwana Valley and is differentiated by *Dioscorea cotinifolia* and others. Two distinct physiognomic phases were sampled:

Mesic medium-tall Pterocarpus bushveld with dense scrub

Quadrats 36 and 40 are densely shrubby areas with loosely spaced trees on moist concave slopes with deep colluvial soils (Fig. 12). Trees

Fig. 12. Mesic Medium-tall *Pterocarpus* Bushveld with dense scrub on moist, concave slopes with deep colluvial soils, at the Mantenga Falls in the Usutshwana Valley. An exotic plantation grows on the hill in the background.

are 5 m–8 m tall and dominated by *Pterocarpus angolensis* with or without *Acacia caffra*. The 1 m–4 m high shrub layer is almost impenetrable and dominated by *Bauhinia galpinii*. Also common in the shrub stratum are *Acacia caffra, Antidesma venosum, Anonna senegalensis, Dombeya rotundifolia, Lippia javanica* and the fern *Pteridium aquilinum*. Prominent grasses include *Panicum maximum* and *Themeda triandra* but underneath dense woody vegetation the lowest stratum may consist largely of a tangle of lianas and creepers such as *Dioscorea cotinifolia* and the thorny *Smilax kraussiana*. Grasses are then largely restricted to light-exposed patches in the otherwise luxurious scrub. *Acacia caffra, Bauhinia galpinii* and *Panicum maximum* are differential for this phase.

Dry medium-tall *Pterocarpus* parkland

Quadrats 41 and 52 occur on drier sites. Quadrat 41 on a low but convex plain near the Usutshwana River and Quadrat 52 on an upper pediment slope with shallow soil. The vegetation physiognomy is also quite different (Fig. 12). It consists of a 5 m–7 m tall layer of *Pterocarpus*

Fig. 13. Dry medium-tall *Pterocarpus* Parkland on the convex plain adjoining the Usutshwana River, with Mountain Bushveld in the foreground.

angolensis trees with touching and interlocking canopies, an open layer underneath with only the prominent tree boles and none or very few shrubs and a dense ground cover of 0,5 m–1,0 m tall grasses. The tree layer may be somewhat more open in places. Occasional shrubs, covering less than one per cent, include *Heteropyxis natalensis* and *Anonna senegalensis*. The dominant grasses in the quadrat on the plains are *Brachiaria brizantha, Diheteropogon amplectens* and *Hyperthelia dissoluta,* as in the temperate bushveld (Sect. 2.2a) and some plains grasslands (Sect. 1.2a). *Heteropyxis natalensis, Hyparrhenia filipendula* and *Loudetia flavida* are differential for this phase.

3. Warm-temperate and Sub-tropical Riparian and Ravine Bush

Occasional trees along the major stream on the secondary grassland plains, the Mhlambanyati, include *Syzygium cordatum, Faurea speciosa* and a *Rhus* species. Further upstream in the hilly terrain before the rivulet enters the plains, the riparian bush is denser and common indigenous woody plants include *Syzygium cordatum, Adina microcephala, Erythrina latissima* and *Vangueria infausta*. Exotics noted here include the mesophytic *Psidium guajava* and an Australian species of *Acacia*. *Panicum maximum* is a common grass and the reed *Phragmitis mauritianus* is also present. The vegetation is of a sub-tropical nature and is related to ravine bush in the Usutshwana Valley.

One such ravine in the Usutshwana Valley, mesic and north-facing, was followed for a short distance. The ravine had a bouldery talus bed

with strong water, mostly underground but occasionally reaching the surface. Woody plants noted here include very typical riparian and ravine bush species such as the moist sub-tropical *Dombeya pulchra,* the tropical to warm-temperate *Syzygium guineense* and *S. cordatum,* and the tropical to cool-temperate *Acacia ataxacantha, Grewia occidentalis, Maytenus undata, Halleria lucida,* and the tree fern *Cyathea dregei.* Other species, somewhat less restricted to riparian and ravine bush, but occurring in the example investigated, include *Vernonia colorata,* which is a widespread tropical shrub, *Pterocarpus angolensis, Bauhinia galpinii* and *Antidesma venosum,* which are typical Sub-tropical, Sub-humid Mountain Bushveld species (see Community 2.2b) and the cool mesic *Heteropyxis natalensis, Bequaertiodendron magalismontanum* and widespread *Euclea crispa,* which are most common in Temperate Sub-humid Mountain Bushveld. *Rhus pyroides* and *Maytenus heterophylla* were also present and are examples of species that are very widespread, occurring from tropical to cold temperate regions (Palmer and Pitman 1972; Werger and Coetzee 1978). Grasses found are the shade loving *Setaria chevalieri* and *Oplismenus hirtellus.* Forbs included *Justicea protractra, Achyranthes aspera, Cyperus textilus, Triumfetta pentandra, Eucomis humilis, Rhoicissus tridentata, Pellaea viridis, Maesa lanceolata, Trimeria grandiflora, Thelypteris confluens, Aneilema dregeanum, A. aequinoctiale, Cissampelos torulosa, Stylochiton natalense, Adenia gummifera, Sida rhombifolia* and *Dipogon lignosus.* Very similar vegetation was found on a 40°, north-eastfacing talus slope immediately below a steep cliff, where such azonal bush typically also occurs. Additional characteristic riparian and ravine-related bush species found here were *Trema orientalis* and *Acalypha glabrata.*

4. Afro-Montane communities

Afro-Montane Streambank Scrub and Kloof Forest are restricted to the high Mlilwane North. Typically Afro-Montane Outcrop Scrub is also found in Mlilwane North but examples that are somewhat poorer in typical Afro-Montane species occur in the mountainous part of Mlilwane South.

4.1 Streambank Scrub (*cf.* Killick 1963)

Open Afro-Montane Streambank Scrub occurs patchily along clear fast-flowing mountain streams in high parts of Mlilwane North. The tree fern *Cyathea dregei* may be quite abundant and is typical of these habitats, which also include *Cussonia spicata, Anthocleista grandiflora, Rauvolfia caffra, Halleria lucida* and others.

4.2 Montane Forest

Montane Forest occurs in sheltered, mesic, south-facing kloofs. In a large patch of Montane Forest in one such kloof, the following species that occur in The National List of Trees (De Winter and Vahrmeijer 1972), were identified or collected by Mr. Patrick Watson*:–

**P.O. Box 41237, Craigville, Johannesburg.*

Celtis africana
Ficus natalensis
Xymalos monospora
Pittosporum viridiflorum
Acacia schweinfurthii
Fagara davyi
Bridelia micrantha
Rhus chirindensis
Pterocelastrus echinatus
Greyia sutherlandii
Trimeria grandifolia
Syzygium cordatum
Cussonia spicata
Heteromorpha arborescens
Rapanea melanophloeos
Diospyros whyteana
Buddleia salviifolia
Mackaya bella
Rothmannia capensis
Tricalysia capensis
Vernonia ampla
Ficus capensis
Uvaria caffra
Maerua cafra
Prunus africana
Dalbergia armata
Clausena anisata
Protorhus longifolia
Maytenus mossambicensis *var.* mossambicensis
Allophylus melanocarpus
Rawsonia lucida
Combretum kraussii
Syzygium gerrardii
Scheffleria umbellifera
Curtisia dentata
Bequaertiodendron magalismontanum
Linociera foveolata
Carissa bispinosa
Cephalanthus natalensis
Oxyanthus gerrardii
Psychotria capensis
Brachylaena transvaalensis

Other species recorded by Watson (*loc. cit.*) in the same kloof include the shrubs and undershrubs *Athanasia punctata, Piper capense* and *Polygala*

Fig. 14. Bouldery Outcrop Montane Scrub enclave in typical Highveld Grassland on the Mlilwane North mountains.

virgata, the shade-loving grasses *Setaria chevalieri* and *Oplismenus hirtellus*, the ferns *Trichomanes pyxidiferum, Pteridium aquilinum, Pellaea viridis* and *Marattia fraxinea* and forbs, including *Crocosimia aurea, Stenoglottis fimbriata, Indigofera tristoides, Impatiens dulhiae, Streptocarpus cyneus, Hypoestis phaylopsoides, Galopinia circoeoides* and others.

4.3 Bouldery Outcrop Scrub

Bouldery outcrops provide mesic niches for a stunted, shrubby woody vegetation that has many species in common with Kloof Forest (Fig. 4).

The following tree and shrub species were noted:

Podocarpus latifolius
Strelitzia caudata
Pittosporum viridiflorum
Rhus dura
Apodytes dimidiata
Peddiea africana
Syzygium cordatum
Heteromorpha arborescens
Bequaertiodendron magalismontanum
Iboza riparia
Burchellia bubalina
Tricalysia capensis
Psychotria capensis
Aloe arborescens
Myrica pilulifera
Ekebergia pterophylla
Pterocelastrus echinatus
Greyia sutherlandii
Eugenia natalitia
Cussonia spicata
Rapanea melanophloeos
Olea capensis
Cephalanthus natalensis
Rothmannia capensis
Tapiphyllum parvifolium

Other species include the ferns *Pteridium aquilinum, Dryopteris athamantica, Pellaea calomelanos* and *Pellaea viridis* and the flowering forbs *Cyperus textilis, Cyanotis foecoenda, Stenoglottis fimbriata, Plectranthus rubropunctatus, Hebenstreitia comosa, Melasma scabrum, Streptocarpus galpinii, Conostomium natalense, Helichrysum junodii* and *Senecio rhyncholaenus*.

4.4 Sedge Communities on Sheet Outcrop

Xeric Sheet outcorps are typically colonized by a *Coleochloa setifera* – dominated sedge community with desiccation-tolerant and xeromorphic plants (Fig. 15).

Relevé 30 serves as an example:

Cover	*Species*	*Remarks*
2b	Coleochloa setifera	Desiccation-tolerant (Gaff 1971; Gaff & Ellis 1974)
+	Xerophyta clavata	,,
+	Sporobolus stapfianus	,,
+	Microchloa caffra	,,
+	Cyperus rupestris	–

Cover	*Species*	*Remarks*
+	Pellaea viridis	–
+	Aloe marlothii	Succulent
+	Crassula setulosa	,,
+	Oldenlandia herbacea	–
+	Hyperthelia dissoluta	–
+	Lannea edulis	–
+	Sutera sp.	–

Fig. 15. Extensive xeric sheet outcrop, collonized by *Coleochloa setifera* – dominated sedge community.

5. Exotic Communities

Large dense stands of tall exotic trees, varying in composition and including *Acacia mearnsii* (black wattle), *Eucalyptus* spp. (blue gum), *Jacaranda mimosaefolia* (jacaranda), *Pinus* spp. (pine), *Cupressus* sp. (cypress) are common on the plains and hills of Mlilwane South and *Acacia mearnsii* has invaded every drainage line north of the main watershed in Mlilwane North. A dense stand of *Hakea saligna* occurs in the upper reaches of a Mhlambanyati tributary at the western boundary.

Indigenous plants noted in abundance in a wattle-dominated stand along the Hippo Pool drainage line include *Olea africana* and *Rhus lancea*. The indigenous tree *Dais continifolia* was noted in a stand of wattle on the Mlilwane View Point hillside. Relevé 9 represents a wattle stand on the Shonalanga Plains immediately south of the Mhlambanyati River.

Relevé 9:

The *Acacia* – dominated canopy is dense, commencing from 5 m upward. Below this is a strongly shaded open space and short *Digitaria ternata* – dominated field layer. A herd of blue wildebeest were noted in this vegetation. The soil is red, clayey, with a thick decomposing organic mat.

Cover	*Growth form*	*Species*
5	Woody:	Acacia mollissima (wattle)
+		Diospyros galpinii
+		Diospyros lycioides
+		Euclea crispa
+		Clutia pulchella
3	Grass:	Digitaria ternata
+		Eragrostis curvula
+	Forb:	Mariscus *sp.*
+		Pteridium aquilinum
+		Pellaea viridis
+		Conyza floribunda
+		Thunbergia atriplicifolia
+		Teucrium riparium
+		Commelina africana
+		Hemizygia *sp.*
+		Ceratotheca triloba
+		Tagetes minuta

Stand No. 9 may, on the basis of the above composition, be loosely classified with the adjoining Secondary Grassland of the Shonalanga Plains (Table 1).

Psidium guajava is a very common invader of mesic habitats in the disturbed and eroded foothills. Other, associated, exotics include *Musa, Mangifera* and *Pinus* spp. trees. Indigenous woody plants found in these communities are sparsely scattered and include a Lowveld (Sub-tropical) Sub-humid Mountain Bushveld combination, i.e. *Antidesma venosum, Erythrina lysistemon, Vangueria infausta, Ficus ingens* and *Vernonia colorata.*

Distinctly moist areas interrupting *Annona senegalensis – Pterocarpus angolensis* Sub-tropical, Sub-humid Mountain Bushveld of the Usutshwana Valley (Sect. 2.2b), typically have patches and lines of *Psidium guajava* – invaded vegetation in which *Psidium guajava, Pteridium aquilinum, Lippia* sp., *Pseudarthria hookeri, Vernonia colorata* and *Cymbopogon validus,* amongst others, are conspicuous.

Relevés 21 and 22 are representative of dense shrubby stands of *Psidium guajava* invaded vegetation on foothill slopes in Mlilwane South.

Growth form	*Species*	*Relevé No. (P=present)*	
		21	*22*
Woody:	Psidium guajava	P	P
	Vernonia colorata	P	P
	Rubis rosaefolia	P	P
	Lippia *sp.*	P	P
	Iboza riparia	P	
	Caesalpinia decapetala		P
Grasses:	Cymbopogon validus	P	P
	Sporobolus africanus	P	
	Paspalum commersonii	P	
	Hyparhenia filipendula	P	
Forbs:	Paspalum dilatatum	*21*	*22*
	Pseudarthria hookeri		P
	Desmodium hirtum	P	P
	Conyza floribunda	P	P
	Tagetes minuta	P	P
	Pteridium aquilinum	P	P
	and others.		P

Erosion dongas are invaded by various indigenous mesophytic trees and grasses, including the trees *Syzygium cordatum, Ficus capensis* and *Maesa lanceolata* and the grasses *Phragmites mauritianus* and *Hyperthelia dissoluta.* Exotic *Pinus* sp. trees are prominent in most dongas, abundant in some and occur also on hillsides breaking up with erosion. Other donga exotics include *Psidium guajava,* which may also be abundant and the occasional *Acacia mearnsii, Eucalyptus* and *Musa.*

Discussion

Variation in climate, physiography, vegetation and conservation status, as well as potentially well-adapted fauna, requires that Mlilwane be divided into different management regions, each with its own priorities and management principles (*cf.* Van Riet *ca* 1972; Joubert 1976). These must satisfy the demand for outdoor recreation in the form of:

a. nature reserves conserving the natural harmony between climate, geology, geomorphology, soil, water, fire, indigenous vegetation and animal life;
b. zoo-botanical gardens where man may encounter various species of plants and animals that cannot be catered for in the context of a natural environment, because the available area and natural landscapes are limited or of a different character; and
c. facilities, such as accommodation, associated with human attendance.

The sketch map of plant communities (Fig. 9) suggests the following sub-division of Mlilwane (classification of landscapes based on Westhoff 1973):

Sub-natural Landscapes

These are the landscapes where climate, geology, geomorphology, soils, vegetation structure and indigenous floristic composition, although influenced somewhat by man, are essentially in natural harmony. The areas and communities concerned are shown in Fig. 9 and were mapped by Van Riet (*op. cit.*) as Wilderness areas where the primary aim is preservation of the Wilderness atmosphere. This means conserving all components of the ecosystem and keeping out man-made structures as well as fauna and flora foreign to the character of the climate, physiography and plant communities.

Sub-units are:

1. Upper Usutshwana Valley Bushveld

Essential features of this unit are: valley topography; sub-humid, sub-tropical, grading into warm-temperate, climate; two Sub-tropical Bushveld communities with structural variations, grading into warm-temperate Bushveld; and the Usutshwana River with Sub-tropical Riparian and Ravine Bush. The area is marred by a railway line.

2. Mountain Grasslands and Montane Vegetation

Here the essential features are: upland, hilly topography; moist cool-temperate climate; typical Moist Cool-temperate Grassland with a bouldery and two non-bouldery variations; Montane Kloof Forest and Montane Streambank and Outcrop Scrub.

Semi-natural Landscapes

Two areas are included here:

1. Shonalanga and Central Plains

The smooth, gently undulating geomorphology on these plains is in natural harmony with geology and climate; the soil has been disturbed by ploughing but natural secondary succession by indigenous plants has reached an advanced stage, having been left fallow for 80 years; and physiognomy has changed from Bushveld to grassland, but exotics are absent.

It is suggested that, on the Shonalanga Plains particularly: the original land surface be preserved; natural secondary soil and vegetation succession be allowed to take its course to serve as an example of natural recovery and the time involved; and human disturbance of the scenery be avoided.

Urgent detailed description of the burning experiment and *Combretum zeyheri* Bushveld relict, with accompanying soil profiles would be of considerable academic importance and is strongly recommended.

The Central Plains, boxed in by Mlilwane Cultural Landscapes, must have somewhat lower priority as a semi-natural area than the Shonalanga Plains.

2. Far-northern Mlilwane

The area north of the major watershed in Mlilwane-north consists of typical sub-natural Moist Cool-temperate Grassland but with the drainage lines in the area completely invaded by wattle. It is suggested that the natural grassland scenery be maintained as such to provide more natural habitat for the game species associated with the adjoining Sub-natural Mountain Landscape.

Cultural Landscapes

As shown in Fig. 9 the areas dominated by such landscapes include: extensive large erosional dongas; large stands of thoroughly established exotic trees; recently cultivated lands, some with micro-relief severely altered by deep furrows and contour banks; dams; areas succumbing to excessive erosion; guava-infested areas; building complexes; and enclaves of sub-natural and semi-natural grassland.

These areas are suited for development as an attractive zoo-botanical garden with the emphasis on Swaziland and southern African fauna and flora. Care should be taken to incorporate the enclaves of sub-natural grassland while retaining their status as such (Fig. 9). The young secondary grasslands may be managed for optimum sustained fodder production. Elsewhere the various existing and potential man-made habitats and fascilities could be exploited to accommodate a large number and diversity of plants and animals.

Accommodation areas and outdoor recreation facilities such as picnic sites as well as any drastic manipulation of the environment should be restricted to this area (*cf.* Van Riet 1972).

Acknowledgements

We wish to thank His Majesty King Sobuza II of Swaziland and his National Trust Commission for the opportunity to survey the Mlilwane Wildlife Sanctuary and in particular their Executive Officer Ted Reilly and his wife Liz for their hospitality and our most pleasant stay with them during the fieldwork phase; for providing us with guides and facilities such as transport, maps and aerial photographs; and for assistance and informative discussion. Our thanks also to the South African National Parks Board of Trustees in whose service this survey was performed, and to Dr. S. C. J. Joubert who is in charge of the overall project of describing the Swaziland Reserves with a view to drawing up management proposals.

We are gratefully indebted to Mr Patrick Watson and to our colleagues Dr. S. C. J. Joubert and Messrs W. P. D. Gertenbach and A. L. F. Potgieter for their company and field assistance during the description of the Afro-Montane vegetation.

Computer facilities were generously provided by the Botanical Research Institute of the Department of Agricultural Technical Services, South Africa, through the assistance of Dr. J. W. Morris and Mrs. Charlotte Braak.

Mr Ian Whyte of the National Parks Board and Mrs. Jeanette Coetzee assisted with the figures and our collegue Mr. W. de Beer printed the photographs.

Our thanks to Dr. M. J. A. Werger of Nijmegen University for comments.

REFERENCES

ACOCKS, J. P. H. 1953. Veld types of South Africa. *Mem. bot., Surv. S. Afr.* 28:1–192.

ACOCKS, J. P. H. 1975. Veld types in South Africa. *Mem. bot. Surv. S. Afr.* 40:1–128. (2nd ed.).

CHIPPENDALL, Lucy K. A. 1955. A guide to the identification of grasses in South Africa. *In:* MEREDITH, D. (Ed.) *The Grasses and Pastures of South Africa.* Cape Town: C.N.A.

CHIPPENDALL, Lucy K. A. and A. O. CROOK. 1976. *240 Grasses of Southern Africa.* Salisbury: Collins.

COETZEE, B. J. 1974a. A phytosociological classification of the vegetation of the Jack Scott Nature Reserve. *Bothalia* 11:329–347.

COETZEE, B. J. 1974b. Improvement of association-analysis classification by Braun-Blanquet technique. *Bothalia* 11:365–367.

COETZEE, B. J. 1975. A phytosociological classification of the Rustenburg Nature Reserve. *Bothalia* 11:561–580.

COETZEE, B. J. , F. VAN DER MEULEN, S. ZWANZIGER, P. GONSALVES and P. J. WEISSER. 1976. A phytosociological classification of the Nylsvley Nature Reserve. *Bothalia* 12:137–160.

COMPTON, R. H. 1966. An annotated check list of the flora of Swaziland. *J. S. Afr. Bot.* suppl. vol. VI:1–191.

DAHL, E. 1956. Rondane; mountain vegetation in South Norway and its relation to the environment. *Skr. norske Vidensk – Akad.* 3:1–374.

DAUBENMIRE, R. 1968. *Plant communities.* New York: Harper and Row.

DEPT. OF MINES. 1970. *Geological Map of the Republic of South Africa and the Kingdom of Lesotho and Swaziland.* 1:1 000 000 Pretoria: Govt. Printer.

DE WINTER, B. and J. VAHRMEIJER. 1972. *The National List of Trees.* Pretoria: Van Schaik.

D.O.S. 1965. *Topo-cadastral map of Swaziland* 1:50 000. 2631 AC. Directorate of Overseas Surveys.

EDWARDS, D. 1967. A plant ecological survey of the Tugela River Basin, Natal. *Mem. bot. Surv. S. Afr.* 36:1–285.

GAFF, D. F. 1971. Desiccation – tolerant flowering plants in southern Africa. *Science* 174: 1033–1034.

GAFF, D. F. and R. P. ELLIS. 1974. Southern African grasses with foliage that revives after dehydration. *Bothalia* 11:305–308.

GERTENBACH, W. P. D. and A. L. F. POTGIETER. 1978. A phytosociological classification of the Hlane Wildlife Sanctuary. *Koedoe* 21:47-65.

GOODALL, D. W. 1953. Objective methods for the classification of vegetation. I. The use of positive interspecific correlation. *Aust. J. Bot.* 1:39–63.

JOLLY, G. M. 1954. Theory of sampling. *In:* BROWN, D. (Ed.) *Methods of surveying and measuring vegetation.* Farnham: Royal Commonw. Agric. Bur.

JOUBERT, S. C. J. 1976. *'n Meesterplan vir die bestuur van die Nasionale Krugerwildtuin.* Unpubl. Mscrp. Kruger National Park, Skukuza, R.S.A.

KILLICK, D. J. B. 1963. An account of the plant ecology of the Cathedral Peak area of the Natal Drakensberg. *Mem. bot. Surv. S. Afr.* 34:1–178.

LEISTNER, O. A. and M. J. A. WERGER. 1973. Southern Kalahari phytosociology. *Vegetatio* 28:353–399.

LIGHTFOOT, C. 1970. *Common veld grasses of Rhodesia.* Salisbury: Govt. Printer.

MUELLER-DOMBOIS, D. and H. ELLENBERG. 1974. *Aims and methods of vegetation ecology.* New York: Wiley.

MOLL, E. J. 1976. The vegetation of the Three Rivers Region, Natal. *Natal Town and Regional Planning Report* 33:1–134.

PALMER, E. and N. PITMAN. 1972. *Trees of southern Africa.* Vol. 1–3. Cape Town: Balkema.

PIENAAR, U. DE V. 1963. The large mammals of the Kruger National Park – their distribution and present-day status. *Koedoe* 6:1–37.

ROBERTS, B. R. 1973. *Algemene grasse van die Oranje Vrystaat.* Bloemfontein: Prov. Adm. O.F.S.

SCHULZE, R. E. and O. S. MCGEE. 1978. *Climatic indices and classifications in relation to the biogeography of southern Africa. In;* WERGER, M. J. A. (Ed.) *Biogeography and ecology of southern Africa.* The Hague: Junk.

VAN DER SCHIJFF, H. P. 1958. Inleidende verslag oor veldbrandnavorsing in die Nasionale Krugerwildtuin. *Koedoe* 1: 60–93.

VAN DER SCHIJFF, H. P. 1969. *A check list of the vascular plants of the Kruger National Park.* Pretoria: Univ. Pretoria.

VAN RIET, W. *ca* 1972. *Mlilwane Wildlife Sanctuary: A provisional Master Plan.* Van Riet and Mansvelt, Bellville, R.S.A.

VAN WYK, P. 1974. *Trees of the Kruger National Park.* 2 Vols. Johannesburg: Purnell.

WALKER, B. H. 1976. An approach to the monitoring of changes in the composition and utilization of woodland and savanna vegetation. *S. Afr. J. Wild. Res.* 6:1–32.

WALTHER, H. and H. LIETH. 1960. *Klimadiagramm – Weltatlas.* Jena: Fisher.

WEATHER BUREAU. 1954. Climate of South Africa. 1. *Climate statistics.* Pretoria: Govt. Printer.

WEATHER BUREAU. 1957. *Climate of South Africa.* 4. *Rainfall Maps.* Pretoria: Govt. Printer.

WEATHER BUREAU. 1965. *Climate of South Africa.* 9. *Average monthly rainfall up to the end of 1960.* Pretoria: Govt. Printer.

WERGER, M. J. A. 1974. On concepts and techniques applied in the Zürich-Montpellier Method of vegetation survey. *Bothalia* 11: 309–323.

WERGER, M. J. A. and B. J. COETZEE. 1978. The Sudano-Zambesian Region in southern Africa. *In:* WERGER, M. J. A. (Ed.) *Biogeography and ecology of southern Africa.* The Hague: Junk.

WESTHOFF, V. 1973. In: *Natuurbeheer in Nederland.* Alphen a/d Rijn: Samson.

WESTHOFF, V. and E. VAN DER MAAREL. 1973. The Braun-Blanquet Approach. *In*: TÜXEN, R. (Ed.) *Handbook of vegetation science.* The Hague: Junk.

WILD, H. and L. A. GRANDVAUX BARBOSA. 1967. *Vegetation map of the Flora Zambesiaca area.* Salisbury: Collins.