

read in December, 1958, they did not even reach 400°F at 1' 6" above the ground; the harm done to trees and shrubs is, therefore, negligible. Where a thick mat of old grass has accumulated, very little waste is left, but generally the areas burnt in December are patchy and the seed stalks are left unburnt. Patches of *Panicum* underneath trees do not burn at all and, as with parts burnt during February and April, the large trees are well protected. Grasses as well as shrubs sprout well after December burning.

As the veld in the vicinity of the plots is generally green, and plenty of good burnt veld is to be found in the neighbourhood at this time (because of the biennial control veld burning), game do not concentrate on the plots and the grazing on grass and shrubs is slight. The only grasses grazed to any extent are: *Panicum maximum* (buffalo grass), *Setaria flabellata* and *Hyparrhenia dissoluta* (thatch grass). The shrubs which are lightly browsed are: *Pavetta schumanniana*, *Lonchocarpus capassa* (apperblaar), *Dombeya rotundifolia* (wild pear), *Annona chrysophylla* (wild custard apple), *Antidesma venosum* (voëlsit), *Mundulea sericea* (corkbush), *Vangueria infausta* (mispell), *Sclerocarya caffra* (marula), *Trichilia emetica* (Natal mahogany), *Albizia harveyi*, *Dichrostachys nyassana* (sickle bush) and *Peltophorum africanum* (African wattle).

The sprouting shrubs are browsed chiefly by kudu but the tracks of wildebeest, zebra, steenbuck, warthog, reedbuck, waterbuck and impala have also been seen on plots burnt in December.

On some of the plots comparatively few pioneer plants appear after veld burning, but on others they are conspicuous and abundant. The most important species are: *Triumfetta hirsuta*, *Vernonia natalense*, *V. kraussii*, *Pseuderthia hookeri*, *Solanum* spp., *Indigofera* spp., *Commelina* spp., *Agathisanthemum bojeri* and *Jatropha zeyheri*.

Many young grass seedlings are seen after the burning, especially after the bi- or triennial veld burning.

(b) *Combretum* Veld.

(i) *Veld Burning During February.*

In contrast with the Large-leaved Deciduous Woodland type, the plots in the *Combretum* veld burn poorly during February. This must be ascribed to the lower rainfall as a result of which the grass cover is less dense and there is not such an accumulation of old material as in the former veld type. The grass which is green during February veld burnings burns badly, in patches, and gives off a considerable amount of smoke; the grass stubble remains unburnt. It has been noted that factors such as time of the day, air temperature, wind force, and relative humidity influence the burning of the grass.

Considering the conditions, very little damage is done to trees and shrubs during February veld burning. As with the former veld type *Panicum* underneath the trees protects them from harm.

Grasses and shrubs sprout well after veld burning during February, because the soil is still moist at this time of the year; the only exception is *Dichrostachys nyassana* which sprouts poorly (cf. veld burning during February in former veld type).

Plots burnt during February are grazed heavily because it is generally the only short pasture in the area. Grasses grazed heavily are: *Brachiaria serrata*, *B. nigropedata*, *Hyparrhenia dissoluta* (thatch grass), *Urochloa mosambicensis*, *Loudetia simplex* and *Panicum maximum*.

The sprouting shoots of the following shrubs are eaten: *Ormocarpum trichocarpum*, *Strychnos innocua* (monkey orange), *Dalbergia melanoxylon* (zebrawood), *Ziziphus mucronata* (buffalo thorn), *Acacia exuvialis*, *Combretum zeyheri*, *C. suluense* (Zulu combretum) and *Pterocarpus rotundifolius* (round-leaved kiaat). (The latter two species are especially eaten by elephant).

Animals seen on the plots after veld burning during February are kudu, zebra, roan, reedbuck, impala, warthog, steenbuck, duiker, hares and elephant.

Pioneer plants are inconspicuous on plots burnt during February.

(ii) Veld Burning During April.

Conditions during April, 1958, were such that the plots burnt very well. As a result of the high rainfall during the summer months the grass grew luxuriantly and towards April conditions were comparatively speaking dry, with the result that there was a good deal of material to burn. It may happen, however, that the grass is still fairly green in April and will burn poorly as in 1957. As mentioned under veld burning during February, the extent of the burn depends on climatic factors on the day the burn takes place. On the plots where much old material had accumulated, the fires were hot and clean burns resulted. Even *Panicum* underneath the trees was burnt and trees and shrubs were damaged. On plots where the grass cover was sparse the fires were not so hot, and a lot of material was left unburnt, with the result that trees and shrubs were less affected than on other plots.

Grasses sprouted very poorly on those plots burnt during April, 1958. In contrast, however, most shrubs, with the exception of *Dichrostachys nyassana* (sickle bush), sprouted luxuriantly.

The majority of grasses are usually grazed only lightly but in some cases a fair amount is utilized. The species well grazed are: *Brachiaria nigropedata*, *B. serrata*, *Setaria flabellata*, *Urochloa mosambicensis*, *Panicum*

maximum, *Loudetia simplex* and *Digitaria* sp. The young shoots of nearly all the shrubs growing on the plots are grazed well.

Animals seen on the plots are: zebra, wildebeest, impala, kudu, warthog, buffalo, giraffe, roan and hares.

Very few pioneer plants are seen on the plots after veld burning during April.

(iii) Veld Burning During August.

As mentioned under the previous veld type, the conditions during August are generally dry. Where a fair amount of old grass has accumulated, as in the case of biennial or triennial burning, the fires are hot and shrubs and trees are badly damaged.

Plots which are burnt annually have no accumulation of old material and the grass covering is less. The result is that fires are not hot and plots are burnt in patches. The damage to trees and shrubs is, therefore, comparatively slight.

The grasses and shrubs on the plots burnt during August, 1958, sprouted vigorously but this is largely due to the good rains which fell early in September.

None of the grasses was heavily grazed on the August, 1958, burns. Shrubs were initially well browsed, but this decreased as growth proceeded. The following species were browsed: *Strychnos innocua* (monkey orange), *Dalbergia melanoxylon* (zebrawood), *Combretum apiculatum* (red bush-willow), *Lonchocarpus capassa* (appelblaar), *Albizzia harveyi*, *Randia* sp., *Combretum imberbe* (leadwood), *Acacia exuvialis*, *Lannea discolor* (bakhout), *Combretum suluense* (Zulu combretum), *Gymnosporia buxifolia* (pendoring), *Ximenia caffra* (sour plum), *Cassia petersiana* (dwarf-cassia), *Heeria reticulata* (Lowveld resinbush), *Rhoicissus cuneifolius*, *Flacourtia hirtiuscula*, *Ehretia amoena*, *Acacia gerrardi* (red thorn), *Ormocarpum trichocarpum*, *Gymnosporia senegalensis* (senegal pendoring), *Strychnos spinosa* (monkey orange), *Commiphora mollis* (kanniedood) and *Dichrostachys nyassana*.

Animals found grazing on the plots were: kudu, steenbuck, buffalo (spoor), impala, roan, reedbuck, giraffe and warthog.

Spring communities were inconspicuous on most plots.

(iv) Veld Burning During October.

After the good spring rains during September, 1958, the grasses on most plots were green by October. Fires were, therefore, comparatively slow and not very hot, with the result that the damage to trees and shrubs was slight. On a few plots a fair amount of old material had accumulated and

consequently the fires were hot and the damage to trees and shrubs relatively greater.

During temperature tests conducted on plots the following were recorded:
Skukuza No. 9. (Triennial burn.)

- 1' 6" from the soil surface — between 600°F and 700°F.
- 3' from the soil surface — between 400°F and 500°F.
- 6' from the soil surface — below 400°F.
- 12' from the soil surface — below 400°F.

Skukuza No. 1. (Biennial Burn)

All temperatures were below 400°F.

Grasses as well as shrubs sprouted very well after burning in October. Shrubs which were severely burnt developed luxuriant bushgrowth.

Grazing was slight on plots burnt during October. This was due to the fact that abundant grazing was available in the vicinity as a result of the triennial rotational burns. On most plots the grass was not grazed at all and on others none of the grasses was heavily grazed. The only shrubs, the young shoots of which were eaten, were *Acacia exuvialis*, *Combretum apiculatum*, *C. suluense*, *Ormocarpum trichocarpum*, and *Strychnos innocua*.

Animals seen on the plots, or of which spoor was seen, were warthog, steenbuck, kudu, buffalo, impala, giraffe and wildebeest.

Pioneer plants were rare on most plots.

(v) Veld Burning During December.

Veld burning during December is the feeblest (cf. former veldtype) of all the burning in *Combretum veld*. During this time of the year the veld is mixed with green grass and the fires burn slowly, crackling and accompanied with much smoke. Plots burn in patches and the seed stalks of grasses remain unburnt.

During December, 1958, temperature tests were carried out on two plots and the following were recorded:

Mbyamide No. 10. (Triennial Burn.)

- 1' 6" above the ground — Temperature below 400°F.
- 3' above the ground — Temperature between 500°F and 600°F.
- 6' above the ground — Temperature below 400°F.
- 12' above the ground — Temperature below 400°F.

Mbyamide No. 2. (Biennial Burn)

Temperature at all heights below 400°F.

Grasses and shrubs all sprouted vigorously after this treatment of the plots.

The grazing on all plots was light and none of the grasses was heavily grazed. The following shrubs, the shoots of which were lightly grazed, are important: *Pavetta schumanniana*, *Combretum zeyheri*, *Acacia exuvialis*, *Strychnos innocua* (monkey orange), *Pterocarpus rotundifolius* (round-leaved kiaat), *Dalbergia melanoxylon* (zebrawood), *Acacia gerrardi* (red thorn), *Combretum hereroense* (russet bush-willow) and *Albizia harveyi*.

Pioneer plants were inconspicuous on most plots.

(c) Knobthorn-Marula-Veld.

(i) Veld Burning During February.

Burning in February is carried out with difficulty, chiefly because the plots in this type of veld are covered with dense stands of *Bothriochloa insculpta* (stinkgrass); this grass hardly burns, or not at all, especially when green. The patches of *Panicum* and *Digitaria* forming so-called islands in the *Bothriochloa*, also burn poorly. The only grass which burns at this time of the year is *Themeda triandra* (red grass), and it has often been seen how the islands of red grass burn in between the other grasses. On patches which burn to a fair extent, a lot of stubble and seed stalks remain unburnt. A clean burn is seldom produced in February in this veld type (abnormally dry years excluded). Damage to trees and shrubs is relatively negligible and not worthy of mention.

On account of the moisture content of the soil being normally relatively high in February, the patches where the grass does burn, sprout well. Shrubs which are burnt also sprout well — *Dichrostachys glomerata* (sickle bush) is the only exception.

Grazing is extensive on the burnt patches. Nearly all the grass shoots are cropped short and no selective grazing takes place; even *Bothriochloa insculpta* (stink grass) is closely cropped after February burns.

The following grasses were heavily grazed after the 1959 burning: *Themeda triandra* (red grass), *Panicum coloratum* (buffalo grass), *Ischaemum glaucostachyum*, *Panicum maximum* (buffalo grass), *Bothriochloa insculpta* (stink grass) (by zebra and wildebeest), *Digitaria* sp. (finger grass) and *Cenchrus ciliaris* (blue buffalo grass).

Shrubs were also well browsed and the shoots of the following were cropped: *Lonchocarpus capassa* (appelblaar), *Fluggea virosa*, *Combretum imberbe* (leadwood), *Dalbergia melanoxylon* (zebrawood), *Acacia nigrescens* (knobthorn), *Gymnosporia buzifolia* (pendoring), *Heeria insignis* (resin-tree), *Ximenia caffra* (sour plum), *Gossypium herbaceum* (wild cotton), *Commiphora calciicola* (kanniedood), *Dichrostachys glomerata* (sickle bush), *Gardenia*

spatulifolia (lowveld gardenia), *Ormocarpum trichocarpum*, *Euclea divinorum* (gwarri) and *Maerua legati*.

Animals which grazed these plots were: wildebeest, impala, kudu, giraffe, steenbuck, warthog, zebra and hares.

On most plots only a few herbs were seen. The most important kinds were *Heliotropium nelsonii* and a *Solanum* sp.

(iii) Veld Burning During April.

In contrast with veld burning during February, knobthorn-marula plots burn very well during April. The veld at this stage is fairly dry and generally hot, fast-burning fires are experienced, especially where old material has accumulated.

In a stand of pure *Bothriochloa insculpta* (stinkgrass) only the leaves burn and the stems are left, but if it is mixed with other grasses such as red grass, finger grass, buffalo grass and *Setaria*, not much waste is left. Trees which occur in this veld type generally stand singly and are fairly tall, with the result that they come to very little harm, although often the lower leaves are scorched.

Owing to drier conditions, the grasses generally show less growth than after the veld burning in February, and shrubs generally sprout poorly after the veld burning in April. On some of the plots species like *Dichrostachys glomerata* (sickle bush), *Grewia* spp., and *Ormocarpum trichocarpum* do not sprout for a few months after veld burning.

Grazing after veld burning in April depends largely on the amount of available water. It was found that on certain plots where there was no water in the vicinity, the veld was poorly grazed (cf. Lindanda plots), while on others, where water was to be found in the neighbourhood, grasses were closely cropped (cf. Mareyo-, Satara- and Nwanetzi experimental plots). No selective grazing occurred.

Grasses which were heavily grazed after veld burning in April, 1958, were: *Panicum coloratum* (buffalo grass), *Digitaria* sp. (finger grass), *Setaria woodii*, *Bothriochloa insculpta* (stinkgrass) (by zebra and wildebeest), *Schmidtia bulbosa*, *Themeda triandra* (red grass) and *Panicum maximum* (buffalo grass).

Except on the Lindanda experimental plots (where few shrubs shoots were cropped) the majority of shrubs were well browsed.

Practically no pioneer plants were seen on any of the plots.

(iii) Veld Burning During August.

As a rule the veld under consideration is fairly dry in August and burning treatments can be easily carried out. This is particularly true regarding biennial and triennial veld burning where a fair amount of old material has accumulated and where "stinkgrass" is well mixed with other grasses. Such fires are hot and shrubs are generally severely scorched. At some triennial veld burning, very hot fires are experienced and flames leaping to 20 feet are not exceptional. In such cases the harm done to trees and shrubs is extensive. With annual burning, conditions are different: the grass stand becomes less dense with successive fires, there is no accumulation of old material and, as a result of this severe treatment, "stinkgrass" multiplies. Plots burnt annually in August do not burn cleanly — especially those where "stinkgrass" is common, and the fires are cool; it is often difficult to apply a burning treatment on such plots. One such plot (Nwanetzi 7) would not burn at all during August, 1958: two attempts (on different occasions) failed and it was finally left unburned. The grass covering of the plot was sparse and it consisted mainly of "stinkgrass" which, as has been mentioned before, burns poorly.

Grasses on plots which were burnt during August, 1958, sprouted vigorously after the first spring rains during September, but shrubs generally did not sprout well.

The majority of plots burnt during August were poorly grazed. Of the grasses, only *Urochloa mosambicensis*, *Panicum coloratum* (buffalo grass), *Cenchrus ciliaris* (blue buffalo grass), *Themeda triandra* (red grass), and *Digitaria* sp. (finger grass) were reasonably utilized. Amongst the shrubs, the young shoots of the following were browsed: *Dichrostachys glomerata* (sickle bush), *Cissus lonicerifolius*, *Lonchocarpus capassa* (appelblaar), *Combretum imberbe* (leadwood), *Sclerocarya caffra* (marula), *Gymnosporia senegalensis* (senegal pendoring), *Dalbergia melanoxylon* (zebrawood), *Acacia exuvialis*, *Fluggea virosa*, *Ziziphus mucronata*, *Heeria reticulata*, *Albizzia harveyi*, *Lannea kirkii* (baster marula) and *Ximenia caffra* (sour plum).

Animals seen on the plots, or of which the tracks were found, were zebra, steenbuck, giraffe, buffalo, wildebeest, impala, warthog and hares.

Very few herbs were seen on the plots.

(iv) Veld Burning During October.

As a result of the early spring rains in September, 1958, the grass was already green and most of the trees and shrubs had started to bud at the time when the October burning was executed. The plots, however, burnt well, especially where old material had accumulated. Generally the fires

were hot and the plots burnt cleanly except that stands of "stinkgrass" remained unburnt. Shrubs were severely burnt back.

During temperature tests conducted on two plots, the following temperatures were recorded:

Mayero No. 5. (Plot burnt biennially in October)

- 1' 6" above ground surface — Temperature between 400°F and 500°F.
- 3' above ground surface — Temperature below 400°F.
- 6' above ground surface — Temperature below 400°F.
- 12' above ground surface — Temperature below 400°F.

Satara No. 10. (Plot burnt triennially in October)

- 1' 6" above ground surface — Temperature between 500°F and 600°F.
- 3' above ground surface — Temperature between 500°F and 600°F.
- 6' above ground surface — Temperature between 500°F and 600°F.
- 12' above ground surface — Temperature below 400°F.

Shrubs and grasses sprouted well after the October burning but growth was later retarded by drought conditions.

Nearly all plots were lightly grazed after the October burning. Game was, to a large extent, lured away by the luxurious growth in the vicinity after triennial rotational burning and accidental fires.

The only grasses readily cropped were: *Panicum coloratum* (buffalo grass), *Urochloa mosambicensis*, *Themeda triandra* (red grass), and *Digitaria* sp. (finger grass). Selective grazing took place to a certain extent.

As in the case of the grasses, shrubs were lightly browsed. Shoots of the following were eaten: *Maerua legati*, *Fluggea virosa*, *Grewia villosa*, *Lonchocarpus capassa* (appelblaar), *Balanites maughamii*, *Lannea kirkii* (baster marula), *Commiphora betchuanica*, *Sclerocarya caffra* (marula), *Heeria reticulata* (lowveld resin-tree), *Dalbergia melanoxylon* (zebrawood), *Combretum guenzii*, *Combretum imberbe* (leadwood), *Albizzia harveyi*, *Ximenia caffra* (sour plum), *Cissus lonicrifolius* and *Combretum hereroense* (russet bush-willow).

Animals seen on the plots, or of which spoor was seen, were: zebra, buffalo, kudu, warthog, giraffe, impala, steenbuck and hares.

(v) Veld Burning During December.

The December, 1958, burning was undertaken after good rains had fallen during spring. The grass consisted mainly of young green shoots, yet it was not as green as with the previous two veld types and in general the plots burnt very well. On some of the plots fairly hot fires were experienced, especially on those of the triennial burns (which, in the veld type under discussion, were treated for the first time during 1958). Plots burnt fairly clean

except where grass was very green and where there were patches of stink-grass. On some plots shrubs were burnt back.

During temperature tests, the following temperatures were read in two of the Nwanetzi plots.

Nwanetzi No. 10. (Triennial burn in December)

1' 6" above ground level	— Temperature	600°F — 700°F.
3' above ground level	— Temperature	500°F — 600°F.
6' above ground level	— Temperature	500°F — 600°F.
12' above ground level	— Temperature	below 400°F.

Nwanetzi No. 2. (Biennial burn during December)

1' 6" above ground level	— Temperature	400°F — 500°F.
3' above ground level	— Temperature	below 400°F.
6' above ground level	— Temperature	below 400°F.
12' above ground level	— Temperature	below 400°F.

Plots were grazed very poorly on the whole after the December burning. Detailed observations must still be undertaken here.

(d) Mopane-Veld.

This has been burnt only twice during the period from the end of March, 1958, to the beginning of April, 1959, viz. during April and August, 1958. This ended the first cycle of burning, which commenced during August, 1957. All plots in the mopane-veld have now been burnt once, except those burnt annually, which had two treatments.

(i) Veld Burning During April.

On the whole, plots burnt very well during April, 1958, with the exception of the Dzombo plots, where the grass was sparse and still fairly green. Otherwise the plots burnt cleanly and hot to very hot fires were experienced on most blocks. In general the shrubs were burnt back severely, and trees suffered a fair amount of damage (particularly at the Shawu plots, where old material has formed a thick mat). It was found that mopane shrubs were burnt to the ground, even on plots where the fires were not particularly hot. On account of the high resin content of the leaves, mopane shrubs burn very easily even though the leaves may still be green.

On heavier soils, where the moisture content remains high for longer periods, the grasses sprouted fairly well after the April burning, but on the poorer, stony soils, the grasses sprouted poorly. Shrubs sprouted reasonably well, but not luxuriantly. As noted in the previous veld types, *Dichrostachys glomerata* (sickle bush) sprouted poorly on the plots where it occurs.

Plots were lightly grazed after burning during April. Grasses which were heavily grazed were: *Panicum coloratum* (buffalo grass), *Cenchrus ciliaris* (blue buffalo grass), *Urochloa mosambicensis*, *Schmidtia bulbosa*, *Ischaemum glaucostachyum* and *Setaria woodii*.

Shrub shoots of the following were browsed: *Dalbergia melanoxylon* (zebrawood), *Colophospermum mopane* (mopane), *Acacia nigrescens* (knob-thorn), *Lonchocarpus capassa* (appelblaar), *Cassia abbreviata* (long-tail cassia), *Gymnosporia senegalensis* (Senegal pendoring), *Dichrostachys glomerata* (sickle bush), *Sclerocarya caffra* (marula), *Heeria insignis* (resin-bush), *Commiphora pyracanthoides* (kanniedood), *Acacia tortilis* (umbrella thorn), *Euphorbia guerichiana*, *Cissus lonicerifolius*, *Fluggea virosa*, *Albizzia harveyi*, *Combretum imberbe* (leadwood), *C. apiculatum* (red bush-willow), *Gossypium herbaceum* (wild cotton) and *Ormocarpum trichocarpum*.

Animals seen on the plots were: zebra, steenbuck, warthog, kudu, roan antelope, tsessebe, impala, giraffe, elephant, wildebeest and hares. It was again noted that elephant fed on the charred tips of the mopane shrubs.

Pioneer plants were scarce on most plots.

(iii) Veld Burning During August.

Only annual treatments were applied during August, 1958. Although the grass was dry on most plots at this time, the plots burnt very poorly and patchily due to the fact that very little dry material had accumulated during the year. Very hot fires were not experienced on any of the plots and the damage to the shrubs and trees was fairly slight.

Due to the dry conditions experienced after the burning, the grass on some plots sprouted very poorly. On others, where there had been light local rain, the grasses (particularly stinkgrass) sprouted well. The same applied to the shrubs.

The plots burned in August were poorly grazed. Grasses, reasonably cropped, were: *Urochloa rhodesiensis*, *Cymbopogon excavatus* (turpentine grass) (eaten particularly by eland), *Panicum coloratum* (buffalo grass) and *Cenchrus ciliaris* (blue buffalo grass). The following shrubs were cropped: *Lonchocarpus capassa* (appelblaar), *Dichrostachys glomerata* (sickle bush), *Heeria insignis* (resin-bush), *Commiphora pyracanthoides* (kanniedood), *Colophospermum mopane* (mopane), *Dalbergia melanoxylon* (zebrawood), *Albizzia harveyi*, *Asparagus* sp., and *Gossypium herbaceum* (wild cotton).

Animals which grazed the plots were: zebra, eland, roan antelope, warthog, steenbuck, buffalo, wildebeest, reedbuck and kudu.

(b) TRIENNIAL ROTATION BURNING.

After a thorough investigation of the triennial rotational burning in the Park, a report was completed and presented to the Board in 1958. The triennial burning policy of the Board is supported until such time as the burning experiments prove this policy to be wrong. Although the Biological Section supports the Board's triennial rotation burning policy as an interim measure, it was felt that certain alterations were very necessary and a number of recommendations were made. The recommendations were confirmed by Board Resolution No. 62 of December, 1958, and the amended policy has already been put into operation. A summary of the recommendations is listed below.

As certain blocks were eliminated from the burning programme, a reclassification of these was necessary. This has already been done after thorough consideration of the previous history of each block. A number of maps indicating the new burning blocks are in preparation. In future, a register of the blocks will be maintained to sketch the entire history of each at a glance.

SUMMARY OF RECOMMENDATIONS IN CONNECTION WITH THE TRIENNIAL ROTATION BURNING POLICY.

1. That all poor, stony, hilly veld which is sparsely covered be withdrawn entirely from the burning programme.
2. That all damaged areas (by drought, veldfires or overgrazing) be eliminated from the programme until such time as they have recovered sufficiently to be reintroduced into the burning programme.
3. That all blocks situated in the Combretum-veld and in the Mopane-veld be inspected by the Biological Section, together with the Game Rangers in the year which they are due for treatment, and should their condition be such that burning will cause damage, they be eliminated from the programme and burnt only when the condition of the grass coverage justifies or necessitates it.
4. That wherever possible, the catchment areas of all large rivers, having their sources in the Park, be protected against burning. Where roads or fire-breaks already exist along river courses, these roads be used to protect the riparian vegetation and the catchment areas.
5. That the catchment areas of all permanent and semi-permanent springs be immediately and effectively protected from veld-fires.

6. That, wherever possible, vleis and marshy valleys be protected from veld-fires.
7. That, where practicable, all mountain slopes in the Park receive complete protection from veld-fires. Blocks in mountainous areas should be as small as possible to ensure that accidental fires be limited to as small an area as possible.
8. That those areas noted for their profusion of flora and exceptional plantgrowth (Punda Maria sand veld, the Mwambiya sand veld, Pafuri, and the Mopane-forest south-east of Punda Maria) should receive complete protection from fires regardless of the economic implications or the grazing potentialities of the areas, and that these areas be treated as botanical reserves within the Park.
9. That 4 of the 9 existing blocks situated within the Satara section and infested with stinkgrass, be controlled and treated at the discretion of the Biological Section. The preliminary treatment envisaged is:
 - (a) to lengthen the period of 3 years intervening between burning to preferably 5-10 years according to the degree of infestation;
 - (b) to divide the area into smaller blocks for more adequate protection against accidental fires and to enable a more selective treatment in the whole area to be exercised by the Biological Section.
10. That all blocks north of the Sabie River be divided into smaller sections of approximately 25 sq. miles, so that they can be burned with ease within a day when they are due for treatment in the burning programme, with the understanding that the total area of the veld (i.e. approximately one third of the Park), which receives annual treatment remains the same as the present larger sections. The divisions of the Park into smaller blocks is also recommended to ensure more adequate protection against accidental fires in the Park. To circumvent problems in connection with veld control which may arise later, it would be desirable to divide the blocks so as to obtain, as far as possible, similar veld types in each block.
11. That the practice to burn during the months of August and September be abandoned as a drought after such burning can have a grave detrimental effect on the plants. The average monthly rainfall figures for the Park indicates that the only reliable months for burning are November and December. The rainfall for October seems to be very uncertain in many instances; should the rainfall be such that it exceeds at least 2 inches during the latter half of that month, the burning programme could be commenced (especially in the south). The northern regions receive their general rains a little later entailing a later commencement of the burning programme.

12. That a total rainfall of at least 2 inches shall immediately precede burning in all sections of the Park.
13. That climatic conditions, which will limit damage to plantgrowth to a minimum, shall be selected for all controlled burning. Should there be any doubt with the Rangers as to the subsequent weather conditions, the burning should be abandoned. Should climatic conditions be unfavourable during the day, burning should rather be undertaken at night.
14. *Subsidiary Recommendations.*
 - A. That where a conservation programme in any specific area is a potential danger to itself or the surrounding areas (e.g. the accumulation of old plant material), the policy for that specific area be revised and all possible measures for the protection of the area itself and for the surrounding areas be taken.
 - B. That when a block is accidentally burnt during unfavourable weather conditions, all possible attempts be made to extinguish the fire. If only a portion of the block is accidentally burnt, it is recommended that the remainder of the block be burnt when weather conditions are favourable during the same year in which the accidental fire occurred to prevent the development of a condition where veld of different ages exists in the same block. This block must be rested for at least three years before inclusion again in the burning programme (cf. Board Resolution No. 66B of 13th September, 1957, and No. 44B of 10th December, 1957).
 - C. That as large an area of the Park as possible be protected by fire-break roads along its boundaries.
 - (i) *Eastern Boundary.* That where no fire-break roads exist along or near the eastern boundary, such roads be made as near as possible to the Park's boundary, where the terrain permits, and that measures to prevent the spread of fire over the boundary presently practised, also be enforced.
 - (ii) *Western Boundary.* That all interested persons be approached to obtain a parallel fire-break road (as is at present in existence between the Native TRUST Territories and the Park north of the Letaba River) along the Western boundary in the sections where it does not exist.
 - D. That all fire-break roads be so constructed as to function effectively to combat fires, that they should not hamper the mobility of the Game Rangers or individuals fighting the fires in any measure; and that they be effectively drained to avert soil erosion. Narrow fire-breaks (hoed paths) hoed manually, are not recommended and though the possibility of ploughed fire-breaks (ploughed with disc

ploughs) must still be investigated, they cannot be recommended at this stage.

F. TOURISM.

The distribution of questionnaires to tourists has been continued but the distribution and collection thereof has been unsatisfactory and during the period of 4 years only 1,500 questionnaires have been returned, giving an average of 237 forms per annum. This average is exceptionally low and represents a very small percentage of the tourists visiting the Park. During the coming season active steps will be taken to obtain the return of a larger number of forms, otherwise the data obtained will be of little value for a statistical analysis.

During the year the analysis of the data has been continued, but it is a big undertaking and the analysis is not as yet, up to date.

The undesirable practices introduced and continued by tourists, viz. the feeding and disturbing of game along the roads, are increasing. Along the Lower Sabie road monkeys and baboons are being fed and spoiled on a large scale and this has now spread to the baboons and even hornbills at Leeupan. At some places, as a result of this spoiling, the baboons have become so bold that they enter motor cars to obtain titbits. It seems obvious that before long there may be harmful results to both animals and tourists. Along the Skukuza-Tshokwane road and the Nahpe road, ground hornbills, hyaenas and jackals have been observed adopting the same habits. Birds are being seriously spoiled in the rest camps and, partially due to this, the spotted-backed weaver has taken on serious proportions in the Skukuza rest camp, so that the birds must be driven away during the breeding season to save the large trees from being stripped of their leaves.

It is apparent that camera enthusiasts are the chief culprits for enticing animals with food so that better "close-ups" may be obtained.

On the whole the game adopt a negative attitude towards the tourist car, but as soon as the tourist leaves his car to disturb or feed animals, the amicable relationship is disrupted and a disturbance is caused in the habits to which the animals are accustomed.

Dust on the roads is becoming increasingly objectionable as it not only creates unpleasant conditions for the tourist, but also the dust deposits on the pasturage beside the roads is detrimental and grazing is not satisfactorily utilized. The problem of dust on pasturage and subsequently the effect on the game is envisaged for study during the present season.

It is again stressed that the disturbing influences such as excessive speed and other infringements should not always be ascribed to the tourist. From time to time animals are injured or killed by members of the staff and unnecessary speeding can be considerably diminished. It is also hoped that night travelling will be limited to a minimum. During the year an instance of a buffalo charging a tourist's car and denting the right front door, was reported. The occupants were not injured.

ADMINISTRATION AND LIBRARY.

The extension of the Biological library, which contains principally essential reference books, is being continued. In the course of the year the despatch of scientific periodicals from Head Office was started. This meets the needs of a very serious deficiency experienced in the past. A number of reference works, containing articles dealing specifically with biological work, were obtained on loan basis from Head Office.

VISITING SCIENTISTS AND OTHER VISITORS.

- (1) Mr. P. J. Geldenhuys, Ecological Research Institute, Johannesburg.
- (2) Mr. Richard J. Neutra of America and Mr. J. Treadwell of the Wild Life Protection Society, Johannesburg.
- (3) Dr. and Mr. Ferreira, Museum Alvaro de Castro, Lourenço Marques.
- (4) Dr. Brink and Mr. Kitching, Bernard Price Institute, University of the Witwatersrand, Johannesburg.
- (5) Mr. B. de la Bat, Chief Nature Conservator, S.W.A.
- (6) Dr. Kirsh and Mr. Potgieter, Klipfontein Organic Products (various visits).
- (7) Mr. C. J. Pienaar and Mr. D. Coetzee, Department of Agriculture, Barberton and Nelspruit respectively.
- (8) Dr. Martola, Ambassador for Finland in South Africa, Pretoria.
- (9) Dr. Naudé and Miss Van der Merwe, Division of Entomology, Department of Agriculture, Pretoria.
- (10) Mr. C. J. Pienaar, Agricultural Research Station, Barberton; and Messrs. Pienaar and Lowes of the Agricultural Research Station, Pretoria.
- (11) Dr. J. A. Louw, Veterinary Officer, Barberton.
- (12) Mr. John Clarke of America.
- (13) Mr. Justice Beadle and party, Chairman of the Nat. Parks of Rhodesia.
- (14) Miss J. Sidney, London Zoological Society, London.
- (15) Mr. O. Prozesky, Transvaal Museum, Pretoria (two visits).
- (16) Dr. Lübke, German Minister of Agriculture and Mr. Dick Pentzhorn, Department of Agriculture, Pretoria.

- (17) Mr. J. Claassen, Regional Director, Department of Agriculture, Queens-town.
- (18) Prof. R. Stebbins, America.
- (19) Dr. G. Lombard, Department of Inland Fisheries, Lydenburg.

APENDAGE A.

VELD FIRES

1958.

 Controlled burns.
 Uncontrolled burns.



APPENDAGE B.

TABLE 1.

BOTANICAL SURVEY OF THE WOLHUTER CIRCLE WHICH WAS NOT BURNT FOR AT LEAST 9 YEARS. (SURVEY ACCORDING TO THE POINT-QUADRATE METHOD).

SPECIES RECORDED.	Number of times recorded.	Percentage cover.	Percentage Frequency.
<i>Panicum maximum</i>	7	0.70	10.00
<i>Hyparrhenia dissoluta</i>	9	0.90	12.86
<i>Andropogon</i> sp.	3	0.30	4.29
<i>Heteropogon contortus</i>	2	0.20	2.86
<i>Bulbostylus</i> sp.	3	0.30	4.29
<i>Cyperus</i> sp.	2	0.20	2.86
<i>Sporobolus eylessii</i>	5	0.50	7.14
<i>Schizachyrium semiberbe</i>	20	2.00	28.57
<i>Andropogon amplexans</i>	1	0.10	2.86
<i>Trichoneura grandiglumis</i>	2	0.20	1.43
<i>Helicrysum nudifolium</i> var. <i>leiopodium</i>	3	0.30	4.29
<i>Setaria flabellata</i>	2	0.20	2.86
<i>Hyparrhenia filipendula</i>	3	0.30	4.29
<i>Elyonurus argenteus</i>	1	0.10	1.43
<i>Pogonarthria squarrosa</i>	1	0.10	1.43
<i>Loudetia simplex</i>	5	0.50	7.14
<i>Agathisanthemum bojeri</i>	1	0.10	1.43
Total	1000	100.0	100.03
Plants	70	7.0	—
Uncovered soil	930	9.30	—

APPENDAGE B.

TABLE 2.

BOTANICAL SURVEY EAST OF FAAI DETOUR AND OPPOSITE THE WOLHUTER CIRCLE. (SURVEY ACCORDING TO THE POINT-QUADRATE METHOD).

SPECIES RECORDED.	Number of times recorded.	Percentage cover.	Percentage Frequency.
Hyparrhenia dissoluta	15	1.50	17.24
Panicum maximum	6	0.60	6.90
Andropogon amplexans	12	1.20	13.79
Loudetia simplex	5	0.50	5.75
Bulbostylus sp.	4	0.40	4.60
Trichoneura grandiglumis	1	0.10	1.15
Vernonia kraussii	1	0.10	1.15
Andropogon shirensis	4	0.40	4.60
Schizachyrium semiberbe	5	0.50	5.75
Eragrostis calcantha	2	0.20	2.30
Helicrysum nudifolium var. leiopodium	2	0.20	2.30
Sporobolus eylessii	10	1.00	11.49
Cyperus sp.	4	0.40	4.60
Heteropogon contortus	1	0.10	1.15
Elyonurus argenteus	12	1.20	13.79
Microchloa caffra	1	0.10	1.15
Hyparrhenia filipendula	1	0.10	1.15
Perotis patens	1	0.10	1.15
Total	1000	100.0	100.01
Plants	87	8.70	—
Uncovered soil	913	91.3	—

APPENDAGE B.

TABLE 3.

STRIP SURVEY OF TREES AND SHRUBS IN THE WOLHUTER CIRCLE, WHICH WAS NOT BURNT FOR AT LEAST 9 YEARS.

SPECIES	TREES					SHRUBS			
	Stem diameter in inches					Diameter of bush in feet			Percentage Frequency
	0-1"	1-3"	3-5"	5-7"	>7"	0-1'	1-3'	>3'	
<i>Terminalia sericea</i>	63	8	1	2	4	19	—	—	97
<i>Dichrostachys nyassana</i>	27	9	—	—	—	33	—	—	69
<i>D. nyassana</i> (dead)	16	8	—	—	1	6	1	—	32
<i>Grewia flavescens</i>	—	—	—	—	—	2	—	—	2
<i>Ehretia amoena</i>	1	—	—	—	—	1	1	—	2
<i>Rhus pyroides</i>	2	—	—	—	—	1	1	—	3
<i>Sclerocarya caffra</i>	11	—	1	—	3	2	—	—	4
<i>Annona chrysophylla</i>	1	—	—	—	—	1	—	—	17
<i>Phyllanthus</i> sp.	—	—	—	—	—	1	—	—	2
<i>Gymnosporal buxifolia</i>	2	1	—	—	—	1	—	—	1
<i>Parinari mobola</i>	—	6	1	—	—	1	—	—	1
<i>Ziziphus mucronata</i>	2	—	—	—	—	3	—	—	4
<i>Fluggea virosa</i>	1	—	—	—	—	—	—	—	8
<i>Gymnosporia senegalensis</i>	2	5	—	—	—	4	—	—	5
<i>Cassia petersiana</i>	3	—	—	—	—	—	—	—	11
<i>Strychnos innocua</i>	—	—	1	—	—	4	—	—	4
<i>Dombeya rotundifolia</i>	1	—	—	—	—	—	—	—	3
<i>Royena schlechteri</i>	—	1	—	—	—	3	—	—	5
<i>Combretum sulense</i>	—	—	—	—	—	—	—	—	1
<i>Grewia manicola</i>	1	—	—	—	—	—	—	—	1
<i>Rhus transvaalensis</i>	1	—	—	—	—	—	—	—	1
<i>Pellaphorum africanum</i>	1	—	—	—	—	1	—	—	2
Total	135	38	4	2	8	83	3	—	273
Percentage Frequency	49.45	13.9	1.46	.73	2.93	30.4	1.1	—	99.97
									100.02
									31.5

APPENDAGE B.

TABLE 4.

STRIP SURVEY OF THE TREES AND SHRUBS EAST OF THE FAI DETOUR OPPOSITE THE WOLHUTER CIRCLE, WHICH WAS NOT BURNT FOR AT LEAST 3 YEARS.

SPECIES	TREES					SHRUBS			
	Stem diameter in inches					Diameter of bush in feet			Grand Total
	0.1"	1-3"	3.5"	5.7"	> 7"	0.1'	1.3'	> 3'	
<i>Parinari mobola</i>	1	—	—	—	—	—	—	—	1
<i>Dichrostachys nyassana</i>	6	7	—	—	3	80	—	—	96
<i>D. nyassana</i> (dead)	—	5	—	—	—	3	—	—	8
<i>Terminalia sericea</i>	12	1	3	—	—	70	—	—	86
<i>Gymnosporia senegalensis</i>	2	—	—	—	—	2	—	—	4
<i>Ziziphus mucronata</i>	—	—	—	—	—	3	—	—	3
<i>Strychnos spinosa</i>	1	1	—	—	—	—	—	—	1
<i>Mundulea sericea</i>	—	—	—	—	—	7	—	—	8
<i>Grewia monticola</i>	—	—	—	—	—	1	—	—	1
<i>Sclerocarya caffra</i>	3	1	—	—	3	2	—	—	9
<i>Ormocarpum trichocarpum</i>	—	4	—	—	—	1	—	—	5
<i>Cassia petersiana</i>	5	—	—	—	—	1	—	—	6
<i>Lannea edulis</i>	—	—	—	—	—	—	—	1	1
<i>Royena schlechteri</i>	—	—	—	—	—	1	—	—	1
<i>Ehretia amoena</i>	—	—	—	—	—	1	—	—	1
<i>Ximenesia caffra</i>	—	—	—	—	—	1	—	—	1
Total	30	19	3	—	6	173	—	1	232
Percentage Frequency	12.93	8.19	1.29	—	2.59	74.57	—	.43	100.00

APPENDAGE C.

TABLE 1.

BOTANICAL SURVEY IN THE VICINITY OF MOOIPLAAS ON AN AREA TO THE WEST OF THE ROAD, WHICH HAD NOT BEEN BURNT FOR AT LEAST 9 YEARS. (SURVEY EXECUTED ACCORDING TO THE POINT-QUADRATE METHOD).

SPECIES RECORDED.	Number of times recorded.	Percentage cover.	Percentage Frequency.
<i>Bothriochloa insculpta</i>	5	0.50	10.42
<i>Schmidtia bulbosa</i>	5	0.50	10.42
<i>Digitaria eriantha</i>	9	0.90	18.75
<i>Cenchrus ciliaris</i>	4	0.40	8.33
<i>Enneapogon</i> sp.	8	0.80	16.67
<i>Panicum coloratum</i>	12	1.20	25.00
<i>Heteropogon contortus</i>	1	0.10	2.08
<i>Fingerhuthia africana</i>	1	0.10	2.08
<i>Panicum maximum</i>	3	0.30	6.25
<i>Tricholaena monachne</i>	—	—	—
<i>Sporobolus pyramidalis</i>	—	—	—
Total	1000.00	100.00	100.00
Plants	48.00	4.80	—
Uncovered soil	952.00	95.20	—

APPENDAGE C.

TABLE 2.

BOTANICAL SURVEY OF MOOIPLAAS EAST OF THE ROAD, WHICH WAS BURNT 3 YEARS (1955) AGO. (SURVEY EXECUTED ACCORDING TO THE POINT-QUADRATE METHOD).

SPECIES RECORDED.	Number of times recorded.	Percentage cover.	Percentage Frequency.
<i>Bothriochloa insculpta</i>	19.5	1.95	29.10
<i>Schmidtia bulbosa</i>	15.5	1.55	23.13
<i>Digitaria eriantha</i>	9.5	0.95	14.18
<i>Cenchrus ciliaris</i>	8.5	0.85	12.69
<i>Enneapogon</i> sp.	6.0	0.60	8.96
<i>Panicum coloratum</i>	4.5	0.45	6.72
<i>Heteropogon contortus</i>	1.5	0.15	2.24
<i>Fingerhuthia africana</i>	0.5	0.05	0.75
<i>Panicum maximum</i>	0.5	0.05	0.75
<i>Tricholaena monachne</i>	0.5	0.05	0.75
<i>Sporobolus pyramidalis</i>	0.5	0.05	0.75
Total	1000.00	100.00	100.02
Plants	67.00	6.70	—
Uncovered soil	933.00	93.30	—

APPENDAGE C.

TABLE 3.

STRIP SURVEY OF THE TREES AND SHRUBS IN THE VICINITY OF MOOIPLAAS ON THE PORTION WEST OF THE ROAD, WHICH HAD NOT BEEN BURNT FOR AT LEAST 9 YEARS.

SPECIES	TREES					SHRUBS			
	Stem diameter in inches					Diameter of shrubs in feet			Grand Total
	0-1"	1-3"	3-5"	5-7"	>7"	0-1'	1-3'	>3'	
<i>Colophospermum mopane</i>	—	—	—	—	—	14	26	23	63
<i>Grewia monticola</i>	—	6	2	2	2	9	1	—	10
<i>Acacia nigrescens</i>	5	—	—	—	—	1	—	—	1
<i>Dalbergia melanoxylon</i>	1	—	—	—	—	6	1	1	8
<i>Combretum mosambicense</i>	—	—	—	—	—	3	—	—	3
<i>Grewia bicolor</i>	—	—	—	—	—	3	—	1	4
<i>Ormocarpum trichacarpum</i>	—	—	—	—	—	4	—	—	4
<i>Dichrostachys glomerata</i>	2	—	—	—	—	8	—	—	8
<i>Grewia kwebensis</i>	—	—	—	—	—	—	1	—	1
Total	8	6	2	2	2	48	29	25	102
Percentage Frequency	6.56	4.92	1.64	1.64	1.64	39.34	23.77	20.49	83.60
									100.00

Associated sp.
Combretum imberbe
Acacia exuvialis
Acacia heisteria

Ehretia amoena
Terminalia prunoides

APPENDAGE C.

TABLE 4.

STRIP SURVEY OF THE TREES AND SHRUBS IN THE VICINITY OF MOOIPLAAS ON THE PORTION EAST OF THE ROAD, WHICH WAS BURNT 3 YEARS AGO.

PORTION EAST OF TAIL ROAD

SPECIES	TREES					SHRUBS				Grand Total	Percentage Frequency
	Stem diameter in inches					Diameter of bush in feet					
	0.1"	1-3"	3-5"	5-7"	>7"	0.1'	1-3'	>3'	Total		
Colophospermum mopane	—	2.5	—	—	1.0	7.5	48.5	32.0	88.0	91.5	57.37
Dracaena trichocarpum	—	—	—	—	—	2.0	—	—	2.0	2.0	1.25
Ehretia amoena	—	—	—	—	—	4.0	.5	.5	5.0	5.0	3.13
Acacia nigrescens	—	.5	—	—	1.0	8.0	.5	—	8.5	10.0	6.27
Grewia bicolor	—	—	—	—	—	—	1.5	1.5	3.0	3.0	1.88
Dichrostachys glomerata	—	—	—	—	—	4.0	—	—	4.0	4.0	2.51
Commiphora pyracanthoides	—	—	—	—	—	12.0	—	—	12.0	12.0	7.52
Fluggea virosa	—	—	—	—	—	.5	—	—	.5	.5	.31
Acacia heteracantha	—	—	—	—	—	.5	—	—	.5	.5	.31
Acanthaceae sp.	—	—	—	—	—	.2	5.0	—	7.0	7.0	4.39
Grewia kwebensis	—	—	—	—	—	2.5	—	—	2.5	2.5	1.57
Commiphora calcicola	—	—	—	—	—	2.5	.5	—	3.0	3.0	1.88
Grewia monticola	—	—	—	—	—	14.0	—	—	14.0	14.0	8.78
Euphorbia sp.	—	—	—	—	—	—	—	—	—	.5	.31
Asparagus sp.	.5	—	—	—	—	1.0	.5	—	1.5	1.5	.94
Combretum mosambicense	—	—	—	.5	—	—	—	—	—	.5	.31
Combretum imberbe	—	—	—	—	—	.5	—	—	.5	.5	.31
Sclerocarya caffra	—	—	—	—	—	1.0	—	—	1.0	1.0	.61
Unidentified	—	—	—	—	—	—	—	—	—	—	—
Total	.5	3.0	—	.5	2.0	62.5	57.0	34.0	153.5	159.5	100.00
Percentage Frequency	.31	1.88	—	.31	1.25	39.18	35.74	21.32	96.94	100.00	—

Associated sp.

Bolusanthus speciosus

Cassia abbreviata

Heeria insignis

Dalbergia melanoxylon

Acacia exuvialis

Bolusanthus speciosus
Heeria insignis
Acacia exuvialis

Associated sp.
Cassia abbreviata
Dalbergia melanoxylon