

NATIONAL PROGRAMME FOR ENVIRONMENTAL SCIENCES

(TERRESTRIAL ECOSYSTEMS SECTION)

NP14/106/9L-5

FYNBOS BIOME PROJECT: THIRD ANNUAL RESEARCH MEETING

INTRODUCTION

The Fynbos Biome Project has as one of its principal objectives the integration and coordination of ecological research within the biome. Formal coordination at an inter-organizational level is provided by the Steering committee while informal contact between field workers is maintained through workshop meetings, seminars etc. As the project develops, annual research meetings are needed to bring all parties together for an exchange of progress reports, research plans and the review of programme goals. The third such meeting is planned for Monday 29th and Tuesday 30th June and Wednesday 1st July 1981. The meeting activities will be based at the University of Cape Town.

RESEARCH MEETING ACTIVITIES

The three days of meeting activities are planned as follows:

OPTIONAL FIELD TRIPS

1. Monday 29th June 1981 will be a day for optional field trips, with departure points to be specified. Participants and visitors who either have not visited intensive study sites or do not have a good impression of the range of fynbos communities and problems encountered in the biome, are welcome to attend.

REVIEW PROGRAMME

2. Tuesday 30th June 1981 will be the main meeting day during which a review of programme activities will be carried out. The venue for this meeting will be the foyer and conference hall 3A of the Leslie Conference Centre, University of Cape Town.

Form of meeting

The meeting will take the form of 5 morning review sessions, and afternoon poster sessions. Specific individuals have been approached to give 20-30 reviews of ongoing Fynbos Biome Project activities during the morning session. Every listed participant is asked to prepare a poster exhibit for the afternoon poster sessions. Please see annexures 1 and 2 for details of the meeting programme and poster requirements.

### Participation

All researchers already involved in the Fynbos Biome Project, all Steering Committee Members and management personnel from various government departments, and visitors interested in the research activities, should attend.

### Cost of attendance

Coffees, teas and a social function will be provided for a nominal fee. Lunches will be available at the Leslie Conference Centre at the attendees own expense.

### CLOSED WORKSHOP MEETING

3. Wednesday 1st July 1981. Individuals will be invited to attend a single day workshop on identification of Fynbos Biome Project research priorities. This will form part of a current attempt to update the Fynbos Biome Project descriptive document, and review project objectives.
- It is always difficult to keep up-to-date on the work being done, or specific interests of a large group of people. If you are not one of the listed or funded participants in the Fynbos Biome Project and feel that you would like to participate in the workshop meeting, please indicate this on the base of your reply slip. Could you also indicate your area of interest.

FYNBOS BIOME PROJECT: THIRD ANNUAL RESEARCH MEETING

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P R O G R A M M E

TUESDAY 30 JUNE 1981

- 08h15 - 08h45      Registration and Coffee
- 08h45 - 09h00      Introduction: Mr B J Huntley (CSIR)
- REVIEW SESSIONS    Chairman: Professor A A Theron (University of Stellenbosch)
- 09h00 - 09h30      1. BIOGEOGRAPHY AND PALAEOECOLOGY:  
Professor H J Deacon (University of Stellenbosch) &  
Dr Q B Hendey (S A Museum)
- 09h30 - 10h00      2. MAPPING AND CLASSIFICATION STUDIES:  
Mrs M L Jarman (CSIR)
- 10h00 - 10h30      3. NUTRIENT CYCLING STUDIES:  
Dr D T Mitchell (University of Cape Town)
- 10h30 - 11h00      TEA
- 11h00 - 11h30      4. COMMUNITY ECOLOGY STUDIES:  
Professor E J Moll & R Cowling (University of Cape Town)
- 11h30 - 12h45      5. IMPACT AND MANAGEMENT STUDIES:  
(a) Catchment hydrology: Mr J Bosch (Department of  
Water Affairs, Forestry and Environmental Conservation)  
(b) Fire: Mr B W van Wilgen (Department of Water Affairs,  
Forestry and Environmental Conservation)  
(c) Alien vegetation: Dr A V Hall (University of Cape Town)
- 12h45 - 13h45      LUNCH
- POSTER AND DISPLAY SESSIONS
- 13h00 - 14h00      Introduction: Mr P J Frost (CSIR)
- 14h00 - 15h00      SESSION 1 (New projects; proposed projects)
- 15h00 - 15h15      TEA
- 15h15 - 16h15      SESSION 2 (Ongoing research activities)
- 16h15 - 17h15      SESSION 3 (Completed; nearly completed research activities)
- 17h15 - 18h30      COCKTAIL PARTY AT THE SAME VENUE

4. AN INVESTIGATION TO DETERMINE THE USEFULNESS OF  
VARIOUS REMOTE SENSING PRODUCTS FOR STUDYING AND  
MAPPING THE FYNBOS BIOME

EJ Moll, ML Jarman, L Bossi and K McGregor

A basic requirement of the Fynbos Biome Project is the classification and mapping of the various fynbos types. This remote sensing project has seen successful experimentation with the application of computer classification techniques to Landsat imagery, and vegetation mapping has been carried out at 1:20 000 scale in three test areas within the Fynbos Biome. Further investigation into the relative usefulness of already available computer classification procedures when applied to Landsat 1 and 3 computer compatible tape data is being carried out in order to:-

1. identify and map vegetation types at different scales with consistency
2. solve the problem of applying these procedures to areas with marked topography
3. solve problems introduced by using imagery taken at different seasons for different vegetation types
- and 4. determine the value of successive repetitive imagery in monitoring vegetation/habitat change.

Modification of existing software and development of new software is being carried out where necessary, in order to meet these objectives.

6. GRADIENT ANALYSIS OF THE VEGETATION OF THE MOUNTAIN CATCHMENT AREAS  
OF THE SOUTHERN CAPE AND TSITSIKAMMA FOREST REGIONS

W Bond

Fieldwork in the study has been completed.

Principal component analyses on site variables across the Outeniqua and Swartberg Pass study areas have been completed. A radiation/aspect gradient accounts for most of the variance. If the data is partitioned into north and south aspect samples, a complex altitude/rainfall gradient accounts for most of the variance whilst rockiness forms a second component. The analyses identified relationships such as rockiness and aspect, soil water repellency and aspect and altitude, soil pH and organic matter on altitude (= temperature) rather than moisture per se etc.

Floristic ordinations for the two western study areas have been completed. Reciprocal averaging was the most effective in placing plots and particularly variables in a meaningful way along a primary altitudinal gradient. "Centres of gravity" of particular taxa (e.g. Proteaceae, Ericaceae, Restionaceae) on the gradient have been established. Poaceae show a markedly bimodal distribution at mesic and xeric extremes, perhaps representing predominantly C3 and C4 photosynthetic groups.

An initial structural ordination of the vegetation in the Swartberg using a large number of structural variables, showed very little correspondence with floristic analyses. Restioid veld of mid-elevation north aspects was placed at one extreme of the gradient and Succulent Karroid veld at the other. High altitude, mesic ericoid heathlands were placed closest to the Karroid veld. The structural ordination apparently selected restioid and non-restioid vegetation types as opposite extremes although, in the Swartberg, they are most closely related on a moisture gradient. Further analyses, especially on structural variables, are proceeding.

A paper was published on the relationships between rodents and some aspects of habitat structure.

#### Future work

Studies on Structural aspects of the vegetation on mountain gradients have nearly been completed. Future emphasis will be on dynamic aspects especially interactions of fire, fauna and the vegetation.

## 7. VEGETATION DYNAMICS WITHIN AND BETWEEN FYNBOS AND ADJACENT BIOMES

E J Moll and R Cowling

The aim of the project is to characterize fynbos and non-fynbos plant communities in the eastern margin of the Fynbos Biome; here fynbos intermingles with communities of adjacent biomes forming complex tension zones. Two study areas have been chosen: the Humansdorp coastal peneplain where fynbos and non-fynbos communities occur under conditions of similar topography and macroclimate. The emphasis here is to investigate other factors (eg soil nutrients, patterns of landuse), which determines the distribution of the respective vegetation types, and to investigate their dynamic relationships. Vegetation units will be classified and characterized in terms of floristics and phytochorological affinities, functionally significant structural attributes, species diversity relations, post fire reproductive strategies and modes of succession (see Moll and Cowling 1979). A second site is the Gamtoos river valley where two parallel gradients (fynbos and non-fynbos vegetation), from approximately sea-level to 500 m have been analysed. Here we investigate parallel changes in community attributes (as above excluding dynamic aspects) along some identical environmental gradients.

At this stage field work has been completed and plant specimens identified. Data are punched on computer cards and are awaiting detailed analysis.

8. SOME ASPECTS OF THE AUTECOLOGY OF THREE HAKEA SPECIES  
IN THE CAPE PROVINCE, SOUTH AFRICA. (COMPLETED IN 1979)

S R Fugler

The distribution of the three South African pest Hakea, H. sericea, H. gibbosa and H. suaveolens was studied. The H. sericea infestation can be prevented from spreading further north by using the Breë River Valley and the Langkloof as natural barriers. Outlying H. sericea infestations should either be eradicated or contained. H. suaveolens and H. gibbosa can be totally eradicated by mechanical control except in one area where a long term management programme is needed.

Methods of estimating the density and fruit load of H. sericea have been devised. An Australian weevil has been introduced which attacks the fruit of H. sericea. The weevils dispersal from a release point and the proportion of fruit it destroys, can be monitored, using the methods devised.

Selected aspects of the phenology of all three pest Hakea were studied in the field and the nursery. Basic phenological information of value to existing Hakea control programmes was collected and also enabled a prediction of the growth strategy of H. sericea to be made.

11. ASPEKTE VAN DIE MINERALE VOEDING VAN LEDE VAN DIE PROTEACEAE  
AS VERTEENWOORDIGERS VAN DIE FYNBOSGEMEENSKAP

J H Jooste, C M Walters en L M Raitt

By sommige lede van die Proteaceae is 'n besonder hoë Na/K-verhouding aangetoon. Hierteenoor beweer sommige navorsers dat hierdie familie besonder gevoelig teenoor 'n hoë Na-inhoud in die grond is.

Met Leucadendron salignum in sandkultuur is aangetoon dat die plante 'n eenvormige groei patroon getoon het met variërende hoeveelhede Na en K in die groei medium.

Opname studies met afgesnyde wortels en gemerkte elemente het egter 'n voorkeur vir Rb (as plaasvervanger vir K) bo Na getoon. Mededinging vir opname tussen hierdie twee elemente is aangetoon, asook dat die opname van albei onder metaboliese beheer staan.

Die opname van Na en K deur proteoïede wortels was ongeveer dubbel so groot as dié deur gewone wrotels.

14. THE REPRODUCTIVE PHYSIOLOGY OF LOWLAND PLANTS

L Raitt

A study of reproduction (mainly germination) of lowland plants is planned. Initial work is concentrated on common species, though later rare plants will be involved as well. The species chosen will cover a wide variety of communities, growth forms, taxonomic units and reproductive strategies. Temperature will be the first factor studied and thermogradient bars are being obtained for this purpose. The supply of sufficient uniform ripe seed is considered to be a major problem. Work on seed banks and reproductive potential is also being considered.

15. REFLECTIVITY OF SOME FYNBOS COMMUNITIES (1979-1980)

R F Fuggle and M Morris

Detailed radiation studies over six fynbos communities in the Cape of Good Hope Nature Reserve were carried out during summer months. Abnormally low reflectivity values (6%) have been established for Restionaceae and values of about 10% for Leucodendron. This suggests that fynbos vegetation either tolerates heat loadings considerably above those of other plants or has developed unusual strategies for dissipating the radiant heat load.

16. THE BIOLOGY OF PROTEOID ROOTS AND EXTRAFLORAL NECTARIES  
IN THE PROTEACEAE

B Lamont

Proteoid roots are probably normal components of root systems in the 13 genera in southern Africa. This contrasts with Australian sclerophyll vegetation where 5 'primitive' genera lack them. The dense clustering of extremely hairy rootlets serves to a) capture and store surface water, b) prolong the release of nutrients from the organic soil particles and c) increase the absorptive surface over 5x per unit dry weight that of 'normal' roots. Use of antibiotics suggests that proteoid root formation is stimulated by local concentrations of nutrients in otherwise impoverished soils rather than higher microbial activity in these regions.

Extrafloral nectaries at the tips of leaves, scales and bracts are widespread in Leucadendron, Leucospermum, Mimetes, Orothammus, Paranomus, Aulax and to a lesser extent Serruria. They are absent from Protea, Diastella, Brabejium, Spatalla and Sarcocephalus, while the position of Faurea is uncertain. This contrasts with Australian sclerophyll vegetation where extrafloral nectaries have only been recorded in Ademanthos (Lamont 1979). Nectar secretion is associated with young organs only. Ants are the most regular visitors to the nectaries, while wasps, flies and beetles also feed from them. They may have a dual role in protecting young foliage from small herbivores via the aggressive ants and in attracting potential pollinators to the flowers in the absence of floral nectaries.

## 18. THE ECOLOGICAL IMPACT OF HERBIVORY ON SELECTED FYNBOS COMMUNITIES

G N Louw, W R Siegfried, R C Bigalke, G M Puttick and J P Glyphis

The main aim of this project was to examine relative levels of arthropod and antelope herbivory in Strandveld and to assess this in relation to nutritive and secondary compound levels present in the plants.

A thousand random points were used monthly to assess antelope browse. Because browse levels were low a qualitative "search" method was employed monthly as well. This involved examination of ca.300 individual plants along used antelope trails. Phenological observations on the vegetation were coupled to the latter method. A random point method of sampling twigs was used monthly to assess arthropod herbivory on five dominant broad-leafed shrubs. Arthropods were sampled monthly from the same species by beating so that the abundance and diversity of the phytophages could be assessed. In addition, the abundance and diversity of arthropods in Strandveld in general was assessed using light trapping, pitfall trapping and sweep sampling.

Plant material was collected seasonally from a range of 21 plant species chosen to include browsed, unbrowsed and dominant plants. This was analysed for tannins, nutritive value and energy content.

Tannin levels are similar to the highest levels recorded in the literature. High tannin levels appear to correlate with low levels of antelope browse and low levels of arthropod herbivory. Also, arthropod herbivores appear to be less diverse on those shrubs which have higher tannin levels. In general, arthropod numbers peaked in spring and summer and have dropped in late autumn.

Most of the field work for this project has been completed - the remainder will be finished by July. The tannin content and nutritive value of some plant samples still remain to be analysed. We have done a complete literature search and have started writing up the project.

19 a.

### HABITAT ECOLOGY OF THE KLIPSPRINGER IN THE CAPE PROVINCE

P M Norton

This project has been completed and copies of the final report are available in the Jonkershoek Nature Conservation and Jonkershoek Forestry libraries. The main aspects dealt with are habitat preferences, populations and breeding, morphological adaptations, social organization, predation, daily activity patterns, feeding and competition with other antelope and dassies. The significance of these in the management of klipspringers is then discussed.



b.

AN ECOLOGICAL STUDY OF THE LEOPARD IN  
THE CAPE PROVINCE

P M Norton

Field work has recently started with the testing of radio-telemetry equipment. The initial objective is to gather information on home range sizes and daily movements of leopards in the Jonkershoek valley, which can later be compared to data from other areas, probably in the southern Cape and a leopard problem area such as around Clanwilliam. These movements will then be correlated with seasonal fluctuations in the availability of food species and this should help us to understand the reasons for predation on domestic stock in the southern and south-western Cape Province.

20. A GRADIENT ANALYSIS OF ANIMAL COMMUNITIES ON FOREST LANDS IN THE  
SOUTHERN CAPE AND TSITSIKAMMA FOREST REGIONS AND SURVEYS AND  
ASSESSMENTS OF THE FAUNA OF FOREST LAND CATCHMENTS IN THE  
SOUTHERN CAPE AND TSITSIKAMMA FOREST REGIONS

G J Breytenbach

The study has progressed well. At this point in time results show the following: Small mammals

- (1) The main parameter affecting small mammal communities along the gradient is the foliage below 60 cm.
- (2) The density of small mammal communities are also related to the same parameter.
- (3) There seems to be clear cut "niche differences" between the species i.e. Rhabdomys and Aethomys are spatially separated in almost all cases. Acomys and Praomys show micro-temporal variation in utilisation of habitat. Praomys being more active before midnight and Acomys after midnight. There are also differences in food plant selection, utilisation of the habitat and nest site selection.
- (4) Species diversity (and diversity) are as high and higher than most other South African biomes and are also richer than nearly all African biomes.

Future aims of the study

- (1) What is the immediate, short and long term effect of fires?
- (2) How do faunal communities affect floral communities? Specific questions to be answered include seed predation, dispersal and pollination.

25. A STUDY OF ANIMAL COMMUNITIES AND WATER CHEMISTRY  
IN BLACKWATER VLEIS IN FYNBOS

A J Gardiner and J A Day

A number of vleis on the Cape Peninsula and at Bettys Bay have been examined. Physico-chemical analyses of the water show that levels of polyphenols are closely correlated with water colour and can often be explained by the nature of the surrounding vegetation. pH is not directly correlated with any of these factors.

Analysis of the zooplankton shows that diversity is negatively correlated with polyphenol levels and species numbers positively correlated with pH. There appear to be no species restricted entirely to very acid or very black waters.

26. EFFECT OF FIRE REGIME ON MAMMAL POPULATIONS IN FYNBOS  
IN JONKERSHOEK AND ELSEWHERE

R C Bigalke and K Willan

Studies were undertaken on sampling methods for, and fire effects on small mammals in montane fynbos. The sampling methods work was divided into two major parts, namely studies on the relative efficiencies of Sherman and PVC live-traps (Willan 1979) and on the relative efficiencies of various baits, but tentative conclusions in respect of sampling layouts were also reached. Sherman and PVC traps were found to have complementary capabilities, and it is recommended that they are used in conjunction with one another to obtain relatively unbiased field estimates. The most generally efficient bait was oats/raisins/sunflower oil, which was particularly effective for Otomys spp., but oats/peanut butter/lard/candle wax was most efficient for shrews. Hence, it is recommended that in future studies two traps/station be used, one baited with each of these baits. A scheme whereby av.D (Brant 1962) is calculated from data obtained on a 10 x 10 station grid and then applied to estimate the area sampled by 10 x 2 grids, was proposed. This scheme would couple maximum efficiency with minimum bias. Trap-spacing should be 15 m, the length of the trapping period four trap-nights, and the number of traps/station at least two. The fire effects study led to the hypothesis that productivity declines in middle-aged relative to young habitats, but increases as the vegetation becomes older.

27(a) DIE VASSTEL VAN DIE INVLOED VAN BESTUURSMATREËLS OP DIE KWALITEIT  
VAN WATER IN DIE EKSPERIMENTELE OPVANGGEBIEDE VAN JONKERSHOEK,  
ZACHARIASHOEK EN JAKKALSRIVIER

D B van Wyk

Die doel van die ondersoek is om die effek van veldbrand in bergfynbos en bestuur en benutting van plantasies op uitvoer van gesuspendeerde en opgeloste materiaal in stroomvloei te bepaal. Hiervoor is bestaande opvanggebied eksperimente gebruik.

Die studie by Zachariashoek behels die insameling van sewe stroom en twee neerslag monsters by spesifieke punte oor die hele opvanggebied. Die doel van die studie is om vas te stel wat die invloed van beheerde brand, in November, met rotasie van ses en twaalf jaar teenoor totale beskerming van fynbos op die kwaliteit van die water is.

Die waterkwaliteitstudie te Jonkershoek poog om inligting te verskaf in verband met die invloed van kaalkapping van jaar oue uitheemse denne op die kwaliteit van die water.

Weekliks word pH en geleidingsvermoëlesings van water-monsters gedoen terwyl volledige ionontledings op maandelikse monsters uitgevoer word.

Die studie is in die begin 1971 te Zachariashoek begin en in 1974 uitgebrei na Jonkershoek.

(b) DIE VASSTEL VAN DIE INVLOED VAN BEHEERDE BRANDSTELSELS  
SOOS TOEGEPAS IN FYNBOS OP STROOMAFVOER-KOMPONENTE VAN  
EKSPERIMENTELE OPVANG-GEBIEDE TE JONKERSHOEK,  
ZACHARIASHOEK EN JAKKALSRIVIER

D B van Wyk

Die doel van die projek is om die effek van brand 'n bergfynbos op stroomvloei te bepaal, asook variansie en die effek met wisseling van brandomloop in seisoen.

By Zachariashoek word brand in November toegepas op twee opvanggebiede met rotasies van ses en twaalf jaar. Die kontrole opvanggebied se natuurlike plantbedekking word beskerm. Beheerde brande is reeds in 1971 en 1977 uitgevoer. By Jakkalsrivier word 'n brandbehandeling in September en Maart met siklusse van vyf en tien jaar in vyf opvanggebiede toegepas. Beheerde brande is reeds in 1969, 1970, 1974 en 1975 uitgevoer. Die fynbos in drie kontrole opvanggebiede word beskerm. Slikmetings word in al die opvanggebiede gedoen.

Die behandeling van Abdolskloof, Jonkershoek het reeds in 1941 'n aanvang geneem. Die siklusse hier van toepassing varieer van vier tot dertien jaar. Die maand van brand kan lente, somer of herfs wees.

Ontledings op stroomvloei van gebrande fynbos opvang-gebiede in vergelyking met stroomvloei-rekords van beskermde opvanggebiede en reënval is gedoen om die invloed van beheerde brande vas te stel. Voorlopig het dit getoon dat brand 'n geringe invloed op die hidrologie van die opvanggebiede het. Verdere ontledings word uitgevoer om die resultate te bevestig. Die brande van 1971 en 1977 is toevallig beide deur jare met ondergemiddelde reënval opgevolg.

Die verwerking van ingesamelde data duur voort.

(c) BEPALING VAN DIE INVLOED VAN DIE VERVANGING VAN BESKERMDE FYNBOS  
MET PLANTASIES VAN PINUS RADIATA OF DIE STROOMVLOEI -  
KOMPONENTE BY DIE JONKERSHOEK BOSBOUNAVORSINGSTASIE

D B van Wyk

Die eksperiment is meer as 40 jaar gelede begin en sal vir 'n onbepaalde tydperk aangaan.

Die insameling en verwerking van stroomvloei-, reënval- en dergelike rekords vir die studie duur voort op 'n roetine basis.

Verdere ontledings om onverwagte heiging in stroomvloei na die fase van maksimum afname na bebossing word nou gedoen. Die bevindings tesame met vorige bevindings sal later in 1980 gepubliseer word.

Die opvanggebied van Bosboukloof (57% bebos, 40 jaar oud) word op die oomblik kaalgekap. Die reaksie van stroomvloei op die behandeling behoort goeie inligting te lewer in verband met die invloed van ontbossing op stroomvloei.

28(a) INVESTIGATION OF THE EFFECTS OF CLEAR-FELLING OF PINUS RADIATA IN  
BOSBOUKLOOF CATCHMENT, JONKERSHOEK FORESTRY RESEARCH STATION

D B Versfeld

This investigation aims at determining the major effects of harvesting of timber from a Pinus radiata plantation on mineral cycles, sedimentation and natural biota.

The Bosboukloof Catchment, 57% of which was planted to P. radiata around 1940, is being clear-felled between 1979 and 1981.

Root and shoot biomass of Pinus radiata have been intensively sampled to permit estimation of major components (stem, roots, branches, needles) from diameter measurement.

Timber removals from the catchment are measured by volume for nutrient export calculations.

Nutrient inputs in precipitation and output are monitored by sampling in streamflow (TDS, suspended sediment, bedload). Thirty percent of the standing timber in the catchment has now been removed. No changes in pH (6,5) and conductivity have been observed despite logging activity. Movement of minerals through the internal litter cycle is also being monitored. Litter fall under pines averages 3720 kg/ha/yr and shows marked seasonality for some components. After two years needle decay is 45 per cent, branch decay 10 per cent, and cones 3,5 per cent.

(b) ESTIMATING RAINFALL INTERCEPTION IN PINE AND EUCALYPT PLANTATIONS  
AND FYNBOS TO ASSESS THE EFFECTS OF VEGETATION CHANGES

D B Versfeld

Rainfall interception in three Pinus radiata stands has been analysed in detail. In a mature stand interception estimates range from 21 per cent for a 40 mm storm to 26 per cent for a storm of 5 mm. At least 15 mm rain is required to produce stemflow >2 mm - actual stemflow is very variable. Canopy storage capacity is about 1 mm.

An automatic data logger has been acquired for further interception work and the Rutter model for the prediction of interception from stand and climatic parameters is to be tested both in the western Cape and the eastern Transvaal, in stands of natural vegetation, hakea, pines and eucalypts.

29(a) THE INFLUENCE OF MOUNTAIN CATCHMENT DECLARATION ON LAND  
MANAGEMENT IN THE GROOT-WINTERHOEK AREA OF THE WESTERN CAPE:  
ECOLOGICAL, ECONOMIC AND SOCIAL IMPLICATIONS

D P Bands

It is proposed to analyse the ecological, economic and social implications of the declaration of private land as mountain catchment areas in terms of the Mountain Catchment Areas Act (No. 63 of 1970), and to develop a method of assessing alternatives with a view to determining optimum land use combinations and land management practices.

A comprehensive personal-contact questionnaire survey among land owners in the study area, designed to determine, inter alia, land-use, the relative values of land-use alternatives, land values, economic and social status of land owners and occupants, is nearing completion. A ground survey to determine the ecological effect of past and present land use is nearing completion. A map based on ground survey and interpretation of aerial photographs illustrating the close association of settlement and land-use with geology has been drafted. The value of earlier aerial photography jobs for determining veld fire frequency and changes in land use is being assessed.

(b) DISTRIBUTION AND ABUNDANCE OF INVASIVE ALIEN PLANTS IN  
MOUNTAIN CATCHMENTS OF THE WESTERN CAPE FOREST REGION

D P Bands

The objective of this study is to determine and map distribution and abundance of invasive alien plant species in mountain catchments, in order to assess the extent of the problem and plan the necessary control measures.

Surveys of four areas, Cedarberg, Groot-Winterhoek, Hottentots-Holland and Koue-Bokkeveld, totalling approximately        hectares, including both state and private land, have been completed and maps have been prepared. Surveys of two more areas, Hawequas and Riviersonderend are in progress.

30. THE EFFECT OF FLOWER HARVESTING ON THE COMPOSITION AND DYNAMICS  
OF NATURAL FYNBOS, PLANT AND ANIMAL COMMUNITIES

M Wells

The main objectives of this project are:

To discover whether the wild flower picking industry can exist in this sensitive biome without upsetting its dynamics and evolutionary processes (especially in relation to disturbance such as fire);

To point the way to the best management of picked areas for sustained yield and for conservation.

The first approaches will be :-

To carry out a survey of the fynbos cut flower industry; and

To compare the range of picked and unpicked fites.

Long term monitoring of the effects of picking under control conditions is also planned.

This survey and the comparison of picked and unpicked fites will be discussed. We would like to draw on the experience of other fynbos researchers in these planning stages - particularly in the selection of suitable sampling sites. We would also like to invite other researchers to extend their projects to take in the picked and unpicked experimental sites.

31. SOIL FORMS OF THE PELLA RESEARCH SITE

M Fry, JJN Lambrechts and AA Theron

A fixed grid type approach was used for the soil survey at Pella Site. Eight traverses were laid in an E:W direction with pits 1,5 m in depth being dug at intervals of approximately 200 m along these traverses; profile descriptions were made of every pit. Complimentary augering down to 2 m was done between pits on the same and adjacent traverses. All information was plotted on the 1:20 000 contour map provided by the University of Cape Town Survey Department.

In the higher lying areas and on slopes Hutton, Griffin and Clovelly, and in the lower-lying areas, Longlands and Westleigh soil forms, were found to be predominant. Soil of Constantia form occurred as a transition zone between the higher and lower lying areas and the respective soil forms associated with these topographic positions.

33. SEASONAL PROCESS STUDIES WITHIN MOUNTAIN AND LOWLAND FYNBOS

E J Moll, D T Mitchell and J E M Sommerville

The aim of the project is to study the phenology of Coastal Fynbos in relation to phosphorus, nitrogen, water and age after fire. Key questions to be answered:

1. Given the low, possibly limiting, soil phosphorus and nitrogen status of the soil;
  - (a) How does plant phenology relate to their seasonal availability in the soil and to their seasonal distribution in the plant.
  - (b) If polyphosphates occur in non-mycorrhizal and/or mycorrhizal fynbos species, when are they synthesized and mobilised, in relation to phenology?
  - (c) Is there redistribution of nutrients from senescing leaves immediately prior to leaf fall?
2.
  - (a) How is phenology related to different water regimes under the same climatic conditions?
  - (b) How do root and shoot growth, leaf production and fall relate to seasonal soil moisture and root depth?
3. How does plant phenology vary with age after fire in relation to its effects on soil nutrient and water status?
4. What is the seasonal biomass and energy allocation to reproduction and vegetative growth above and below ground?

Four study sites have been selected on three soil types representing vegetation of two ages. Ten plants of five common species have been labelled at each site. Phenological activity of these plants is being observed at monthly intervals. Shoot growth, leaf fall, soil moisture at three depths and plant water potential at dawn and midday are to be measured at monthly intervals. Biomass and calorific values of reproductive and vegetative above and below ground parts are to be determined for two species at bimonthly intervals.

Study sites and plants have been labelled. Recording of phenological activity and shoot and leaf fall measurements have been initiated.

34 &           STUDIES ON PHOSPHORUS CYCLE IN THE FYNBOS BIOME  
35.

D T Mitchell, O A M Lewis, S M Jongens-Roberts and G J Brown

The seasonal distribution of phosphorus in soils and specific elements of coastal fynbos at Pella is being studied. Soils of the Clovelly form have been analysed for total, Bray no. 2, resin bag extractable and inorganic phosphorus. Total and Bray no. 2 phosphorus declined with depth to 40 cm but then increased further down the profile. Resin bag extractable phosphorus decreased throughout the profile and appeared to be the only fraction which varied seasonally. Inorganic phosphorus was mainly bound to iron. Analyses of the rhizospheres of specific physiognomic elements showed no variations in total phosphorus whereas resin bag extractable phosphorus was lowest in the rhizosphere of a restioid element.

Preliminary studies of shrubs of Leucospermum parile during April have shown an absence of new proteoid roots but old ones were present at the soil surface. Analyses of root-systems of L. parile during April revealed higher total phosphorus levels in the lateral roots compared with proteoid roots. Early indications are that shoot growth of L. parile is out of phase with root growth.

Pot trials have also been carried out on seedlings grown in Clovelly soil from Pella and Hutton soil from Jonkershoek. Even though total phosphorus was considerably higher in Hutton compared with Clovelly soils, both soils contained similar levels of resin bag extractable phosphorus. Growth of Leucadendron laureolum was more successful in the Clovelly soil with greater numbers and larger proteoid roots being produced. It is suggested that the compaction of the fine textured Jonkershoek Hutton soil may have physically impeded root growth. High levels of phosphorus expressed on a dry weight basis were found in proteoid roots of L. laureolum which may be acting as a storage compartment prior to redistribution to the growth regions of the plant.

36.                   A PRELIMINARY STUDY OF MINERAL CYCLING  
                  (A. PRODUCTION AND DECOMPOSITION OF PLANT LITTER AND  
                  B. ORGANIC MATTER DISTRIBUTION IN THE SOIL) AND THE  
                  DISTRIBUTION AND ACTIVITY OF MICRO-ORGANISMS IN THE SOIL

D T Mitchell, D L Olivier and P G F Coley

In studying leaf litter production and decomposition at Pella, equipment has been specifically designed to accommodate the discrete physiognomy of proteoid, ericoid and restioid elements of the vegetation. Fine meshed traps have been randomly distributed to assess the general litter production. Random quadrats have been demarcated to monitor litter standing crop, and wood blocks and tethered leaves of specific shrubs have been left under parent plants.



Litter was collected under canopies of Leucospermum parile and Protea repens during March, 1980, and values are 76,3 g dry mass m<sup>-2</sup> and 27,2 g dry mass m<sup>-2</sup> for L. parile and P. repens respectively. These results are comparable with those of other mediterranean type ecosystems. Litter production at Pella appears to coincide with maximum organic matter content at the soil surface. Organic matter at the soil surface dropped from 2,5 - 3% during autumn and winter, 1979, to approximately 1% during spring, 1979. Although maximum moisture content of the soil occurs during winter, the soil temperatures are low (10-15°C). Preliminary results suggest that late winter and early spring may be the seasons of maximum decomposition.

Litter of Leucospermum conocarpodendron has been enclosed in two designs of fibreglass bags (open and closed) and deposited at Kirstenbosch. After eleven months the average disappearance of litter was approximately 47% in the closed bags and the time course drop in dry mass after the first month was linear rather than exponential. Although leaf litter of L. conocarpodendron is grazed by phytophagous invertebrates, fauna excluded by a mesh aperture diameter of 1,5 mm may not be important in the decomposition processes.

#### 38. DENDROGRAPHIC STUDIES OF THE WATER RELATIONS OF THE FYNBOS

K H Schütte and K Achtleitner

The aims of this study are to use modern sensitive dendrographic techniques to study the water relations of selected members of the fynbos. The research technique envisaged a detailed study of the plant under glasshouse conditions, to learn its responses and characteristic behaviour pattern. This is to be followed by field studies, which can be interpreted in depth, due to the existing knowledge of the plant.

The first plant to be studied was Protea repens. Potted plants were studied in detail in the glasshouse. Investigation of transpiration, using a recording balance, was very informative. On warm sunny days i.e. 30°C transpiration exceeded 1.4 mg cm<sup>-2</sup>h<sup>-1</sup>. P. repens frequently transpires at night, even when it is quite short of water. A common rate was between 0.1-0.2 mg cm<sup>-2</sup>h<sup>-1</sup>.

This was not typical xeromorphic behaviour. But certain Eucalyptus spp. and other arid zone plants show this too. Both the dendrometer and the balance show that the P. repens can lose water rapidly, but the dendrometer shows that these plants can only rehydrate slowly i.e. even in well watered soils the stems expand only very slowly, while most woody plants rehydrate rapidly.

The light responses of this plant are reasonably standard. It responds to the dawn twilight but has a slightly unusual response showing an initial stem expansion before a stem contraction. It has a clear cut light phase in stem contraction and to complete this phase the plant must receive a light input of 9.6 KW m<sup>-2</sup>.

Due to non-arrival of equipment, no field work has yet been undertaken on P. repens. Fortunately, the Forestry Department have dendrographic data in P. arborea grown in Jonkershoek. The field grown plants show very similar dendrographic patterns to those studied in the glasshouse. However, it was not possible to transfer data from P. repens to P. arborea to obtain quantitative results of any kind.

39. LONG TERM EFFECTS OF FIRE REGIME ON FYNBOS PLANT COMMUNITY STRUCTURE  
IN LANGRIVIER AND VICINITY, JONKERSHOEK STATE FOREST

B W Van Wilgen

This study is aimed at comparing structure of adjacent stands of fynbos which have been managed on different burning rotations. Langrivier has been protected from fire since 1942. Adjacent firebreaks have been managed on a four year burning rotation, while another adjacent stand was burnt in 1942 and again in 1958.

Biomass of stands representing vegetation under each fire regime was determined by means of clip plots for lower strata and allometric subsampling for larger shrubs. Data are soon to be published.

The effects of fire regime on the floristics of the communities was investigated by means of a stratified sample of 100 relevés of 5 by 10 metres. On each relevé all vascular plants were listed and cover-abundance values assigned. Stratification, total cover and heights of important species were noted. Field work has been completed and data will be worked up for publication in the coming year.

40. SEASONAL VARIATION IN INVERTEBRATE BIOMASS AND NUMBERS  
IN DIFFERENT BURN AGES IN FYNBOS

JH Giliomee, D Donnelly and C Schlettwein

Initially, this study was aimed at determining the differences in arthropod species diversity and biomass in several areas of fynbos, which differ in age as a result of fire. Sampling has been carried out at Jonkershoek on a monthly basis since June 1979, using pitfall traps and a vacuum suction apparatus. The information processed so far shows a slight although not consistent increase in diversity from three year old areas to five year old areas. Biomass, as determined from suction samples, is higher in the five year old areas than in the three year old areas. The pitfall traps show a decrease in diversity from the five year old vegetation to the very old areas (Swartbos Kloof and Langrivier). There appears to be a definite seasonal succession in insect composition, but apparently there is no marked pattern of seasonal change in species diversity.

In addition, however, the information collected so far also serves as pre-burn data, as one of the areas was burned very recently. Another area will be burned in spring. To determine the effects of fire, soil samples and sweepnet samples will also be taken, and termitaria examined, before and after the fire to supplement the pitfall and suction methods.

Various methods have been used throughout the year to collect insects for the purpose of building up a collection of Jonkershoek insects.

41. INVESTIGATION OF THE POPULATION DYNAMICS OF WIDDRINGTONIA  
CEDARBERGENSIS MARSH AND ITS INTERACTION WITH FIRE (ONGOING)

B W Van Wilgen and F J Kruger

This project was initiated with the objective of studying critical features of reproduction and growth of Widdringtonia cedarbergensis in relation to the incidence of veld fires, since the effect of fire is the most controversial aspect of conservation of the species.

A long-term program of monitoring by means of population assessment in permanent sample plots is under way and a good picture of fire survival, germination and growth is emerging. These data are supplemented by means of monitoring by small format air photography to assess adult trees survival of fire. A detailed map of the distribution of the species has recently been prepared, mainly from black and white aerial photographs.

The programme of field research has as yet not clarified several important questions. Germination and establishment in nature is highly unpredictable. Most attempts at artificial re-establishment have failed. Autecological studies, aimed at determining the set of environmental conditions which determine establishment and successful growth, are seen as priority requirements, as is the study of the influence of small mammals on establishment. These problems will most likely receive attention from 1981.

42. EXPERIMENTAL INVESTIGATIONS OF THE EFFECTS OF SEASON OF BURN ON  
FYNBOS COMMUNITIES IN PLOT TRIALS AT KOGELBERG:  
STUDIES ON COMMUNITY STRUCTURE AND FUNCTION AND THE RESPONSE  
OF COMMUNITIES TO TREATMENT

D C Le Maitre

The aim of this replicated plot trial is to determine the influence of fire in different seasons on community structure in the broad-sclerophyllous shrublands of the southern mountains. Treatments include spring, summer and autumn burns and are applied to 7 plots (one is a control) up to 50 m x 50 m in size. The relatively small number of plots available (eight) precluded a random experimental design of the classic kind, and deductions from results will be based on comparative analysis of time trends. Replicated treatments (the summer burn is not replicated) have been applied over three years, beginning 1976 and ending 1979.

The pretreatment measuring program included a botanical analysis by means of samples of 20 2 x 2 m quadrats in each plot, and an analysis of above-ground biomass by means of a combination of allometric and clipping quadrat samples. Climatic data are also recorded and during burns fire parameters were also monitored for a record of fire intensity and behaviour.

Postburn studies will be concentrated on the re-establishment and development of selected species and community succession.

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43. STUDY OF THE ORIGIN, OCCURRENCE AND SPREAD OF FYNBOS FIRES  
AND CONTROLLING EFFECTS OF WEATHER AS INDICATED BY AVAILABLE RECORDS

B W Van Wilgen, F J Kruger and D P Bands

A survey of all fires occurring on State forest and mountain catchment land in the western Cape forestry region during one calendar year was undertaken by means of questionnaires. The survey was completed on 31 March 1979. A report on the project is nearing completion. Information contained in the report includes weather and fuel data, cost breakdowns and fire behaviour characteristics for prescribed burns. Causes and behaviour of wildfires under the relevant weather conditions are also given. Seasonal distribution of burns was also investigated. The report should provide a preliminary picture of present burning regimes, with special reference to prescribed burning as opposed to wild fires. Preliminary information has been gathered for a fire danger rating system, but this aspect of the project will receive further attention in the future.

These results will be used in the design of a new five-year programme of research in this field.

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