8TH ANNUAL RESEARCH MEETING

OF THE

FYNBOS BIOME PROJECT

ROBERT LESLIE SOCIAL SCIENCES BUILDING, UNIVERSITY OF CAPE TOWN
26 AND 27 JUNE 1986

DISTURBANCE REGIMES AND THE DYNAMICS OF FYNBOS BIOME COMMUNITIES

8STE JAARLIKSE NAVORSINGSVERGADERING

VAN DIE

FYNBOSBIOOMPROJEK

ROBERT LESLIE MAATSKAPLIKE WETENSKAPGEBOU, UNIVERSITEIT VAN KAAPSTAD
26 EN 27 JUNIE 1986

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INTRODUCTION

The Fynbos Biome Project of the National Programme for Ecosystem Research is one of several national scientific programmes administered by the CSIR. The National Programme is a co-operative undertaking of scientific bodies in South Africa concerned with research related to environmental problems. It includes research designed to meet local needs as well as projects being undertaken in South Africa as contributions to the international programme of the Scientific Committee on Problems of the Environment (SCOPE), the body set up in 1969 by the International Council of Scientific Unions (ICSU) to act as a focus of non-governmental international scientific effort in the environmental field.

The Fynbos Biome Project forms part of the activities of the Committee for Terrestrial Ecosystems of the National Programme for Ecosystem Research. It aims to provide the fundamental knowledge needed for the optimum use of natural communities by man. It is a joint undertaking of scientists from the Department of Agriculture and Water Supply, the Cape Provincial Administration, the CSIR, the Department of Environment Affairs and the three western Cape universities. As far as possible, participating organizations finance their own research within the Project. University research is financed from a central fund administered by the National Committee for Ecosystem Research and contributed largely by the Department of Environment Affairs.

The overall and ultimate objective of the Project is **to provide sound scientific knowledge of the structure and functioning of constituent ecosystems as a basis for the conservation and management of the fynbos biome.** At the outset of the Project it was intended that the objective would be realized by:

- synthesizing available knowledge in order to identify major gaps;
- stimulating and coordinating existing research in order to optimize present efforts;
- giving priority to the urgent launching of new research in order to gain a deeper understanding of:
    - the major natural influences which control the distribution, structure and functioning of ecosystems within the biome, as well as
    - the effect of major disturbances, especially fire and invasive weeds, on these systems. The results of these studies would be used to predict the effects of land management practices.

The research programme of the Fynbos Biome Project was divided into three phases: Phase I - baseline studies of the fynbos biome; Phase II - comparative studies of component ecosystem structure and functioning; Phase III - validation studies or testing of Phase II hypotheses and models.

Formal coordination at an inter-organizational level has been provided by the Steering Committee while informal contact between field workers has been maintained through workshop meetings, seminars, etc. As the Project developed, annual research meetings became a major mechanism for bringing all parties together for an exchange of progress reports, research plans and the review of programme goals. The eighth such meeting is planned for Thursday, 26 and Friday, 27 July 1985 at the Robert Leslie Social Sciences Building, University of Cape Town.

The theme of the two day meeting is **Disturbance regimes and the dynamics of fynbos biome communities.** The meeting consists of invited keynote papers and contributed poster papers from a number of Project participants.

BACKGROUND

The overall aim of the Fynbos Biome Project is to gain a predictive understanding of the structure and functioning of fynbos ecosystems for their management. All fynbos ecosystems are subjected to disturbances although the nature of the disturbance regime may vary enormously from site to site. The life-history strategies of, and the kinds of interactions between fynbos organisms, have evolved in response to recurrent disturbances (eg fire) which comprise major selective pressures.

There is much evidence from a wide range of ecosystems, that accurate predictive models of disturbance - induced changes in community structure, can be best developed using a detailed demographic approach. Over the last few years much research within the Fynbos Biome Project has concentrated on population level responses to variations in the disturbance regime.

The time has come for Project participants to review progress in this field and assess to what extent a population level approach is achieving the aims of the Project. Therefore the content of this year's annual research meeting is structured around a theme which explores the nature of the disturbance (or selective) regimes across the biome, and investigates population and community level responses. In a closed workshop session after the open symposium, participants will review the written contributions prepared by the speakers in the symposium session and debate critically the relative merits of approaches thus far used to gain a predictive understanding of biome community dynamics. The appropriate research approach (if one exists) should be identified, as should major gaps in our knowledge. These recommendations are important in deciding on future research directions and the funding of projects.

PROGRAMME

- The 30 minutes allotted for each paper includes discussion time.

THURSDAY, 26 June 1986

08h00 REGISTRATION AND COFFEE

Introduction

Chairman: Mr B J Huntley, Foundation for Research Development, CSIR

09h00 FIRE AND ITS ROLE IN COEXISTENCE AND SPECIATION IN GONDWANA SHRUBLANDS
Dr R M Cowling, Department of Botany, University of Cape Town

Disturbance regimes

Chairman: Mr M C Walters, Department of Agriculture and Water Supply

09h30 FIRE REGIMES IN THE FYNBOS BIOME
Mr B W van Wilgen, Jonkershoek Forestry Research Centre

10h00 PATCH DYNAMICS AND DISTURBANCE REGIMES IN FOREST AND THICKET COMMUNITIES
Mr D Everard, Department of Plant Sciences, Rhodes University

10h30 TEA

Population responses

Chairman: Mr F J Kruger, South African Forestry Research Institute

11h00 PLANT LIFE HISTORIES, POPULATION DYNAMICS AND SPECIES INTERACTIONS IN RELATION TO DISTURBANCE: AN OVERVIEW
Mr P T Manders, Jonkershoek Forestry Research Centre and
Mr R N Cunliffe, Department of Botany, University of Cape Town

11h30 SEED SIZE AND TYPE VERSUS GROWTH RATE AND STRESS TOLERANCE IN THE GENUS LEUCADENDRON
Mr J J Midgley, Saasveld Forestry Research Centre (Paper to be delivered by Mr G J Breytenbach)

12h00 DYNAMICS OF SOIL-STORED SEEDBANKS IN RELATION TO DISTURBANCE
Ms S M Pierce, Department of Botany, University of Cape Town

12h30 DYNAMICS OF CANOPY-STORED SEEDBANKS IN RELATION TO DISTURBANCE
Mr D C le Maitre, Jonkershoek Forestry Research Centre

13h00 LUNCH AND POSTER SESSION
Chairmen: Mr P M Norton, Jonkershoek Nature Conservation Station
Mr B W van Wilgen, Jonkershoek Forestry Research Centre

Population responses (continued)

Chairman: Dr M C Rutherford, Botanical Research Institute

15h30 GERMINATION SYNDROMES OF CAPE PROTEACEAE
Mr G J Brits, Protea Research Centre, Tygershoek Experimental Farm

16h00 FRUITING, DISPERSAL AND ESTABLISHMENT PATTERNS OF SOUTH WESTERN CAPE THICKET SHRUBS
Mr R S Knight, Percy FitzPatrick Institute of African Ornithology, University of Cape Town

16h30 FYNBOS INSECT COMMUNITY DYNAMICS
Dr M D Picker and Mr D Raubenheimer, Department of Zoology, University of Cape Town

17h00 GENERAL DISCUSSION

17h30 SOCIAL FUNCTION

FRIDAY, 27 June 1986

Implications for community organization and ecosystem functioning

Chairman: Dr J A van Zyl, Cape Department of Nature and Environmental Conservation

09h00 FYNBOS RODENT POPULATION DYNAMICS IN RELATION TO FIRE
Mr G J Breytenbach, Saasveld Forestry Research Centre

09h30 MOLERAT-GEOPHYTE INTERACTIONS
Mr B A Lovegrove, Department of Zoology, University of Cape Town

10h00 POLLINATOR-PLANT INTERACTIONS IN RELATION TO FIRE REGIME IN FYNBOS COMMUNITIES
Mr A G Rebelo, Percy FitzPatrick Institute of African Ornithology, University of Cape Town

10h30 TEA

Implications for community organization and ecosystem functioning (continued)

Chairman: Professor H J Deacon, Department of Archaeology, University of Stellenbosch

11h00 PATTERNS OF FYNBOS PLANT SPECIES RICHNESS IN RELATION TO DISTURBANCE
Mr F J Kruger, South African Forestry Research Institute

11h30 FIRE AND FYNBOS ECOSYSTEM NUTRIENT DYNAMICS
Professor D T Mitchell, Department of Botany, University of Cape Town

12h00 PREDICTING THE EFFECTS OF NUTRIENT POLLUTION AS A DISTURBANCE FACTOR IN THE FYNBOS BIOME
Mr E T F Witkowski and Miss N Romoff, Department of Botany, University of Cape Town

Closure

Chairman: Mr B J Huntley, Foundation for Research Development, CSIR

12h30 GENERAL DISCUSSION

12h45 CLOSING COMMENTS

ABSTRACTS OF POSTER PAPERS

1. **FYNBOS UNDERFOOT**

E R Ashton
Parks and Forests, Cape Town City Council, P O Box 694, Cape Town, 8000
E J Moll
Department of Botany, University of Cape Town, Private Bag, Rondebosch, 7700

Visitor pressure on the summit area of Table Mountain is increasing - the impacts of trampling are illustrated by a series of photographs.

2. **FIRE - AN EFFECTIVE TOOL IN THE CONTROL OF ACACIA CYCLOPS?**

P M Beeston
Department of Botany, University of Cape Town, Private Bag, Rondebosch, 7700

Burning of an island stand of A cyclops at the Walker Bay Forest Reserve provided the opportunity to monitor the fire behaviour and assess the effect of fire on acacia seeds buried at different depths in the soil.

Fire danger indices for the day of the fire were below average for the time of year (January), although it was relatively windy for prescribed burning. The fire intensity calculated from Byram's formula was between 20 272 and 60 816 KWm-2 and maximum soil temperatures at 1 cm and 4 cm below the surface exceeded 160°C and 71°C respectively (van Wilgen and Holmes 1986).

The seed bank at this site was measured to be 5 392q295 seeds/m^2, with 96,2% of the seeds occurring in the litter layer and upper 4 cms of mineral soil. The fire consumed the litter and killed 100%, 90,8%, 82,6% and 52,0% of seeds buried at 1 cm, 2 cm, 3 cm and 4 cm respectively. Furthermore, the enforced dormancy of surviving seeds increased to 70%, 25,3% and 21,2% at 2 cm, 3 cm and 4 cm respectively, compared to 2,4% for seeds in an untreated control. It is likely that seeds buried below 4 cm were also affected by the fire.

On the basis of this data, it was calculated that the fire killed 95,2% of the seed bank and increased and enforced dormancy of surviving seeds in the upper 4 cms to 44%. After one rainy season 4,5% of the original seed bank (or 240 seeds/m^2) will remain in the soil.

Fire is an effective tool in reducing large seed banks to a manageable size where seeds are concentrated near the surface (ie in the upper 4 cm of soil). However, it is probable that any indigenous soil-stored propagules will also be destroyed, resulting in slow recolonization. Revegetation of the site may therefore need to be encouraged by artificial means.

3. PROTEA INSECT COMMUNITY DYNAMICS

J H Coetzee and L M Latsky
Vegetable and Ornamental Plant Research Institute
Private Bag
ELSENBURG
7607

The insect fauna of five Proteaceae species are being monitored to gather data on the insect-plant relationship. The species monitored are: Protea neriifolia, Protea repens, Protea cynaroides, Leucospermum cordifolium and Leucadendron laureolum.

These species were not only chosen because of their importance as components of the fynbos flora, but also because they are cultivated commercially.

The aim of this bio-ecological study is to establish: a faunal list for these Proteaceae; the interaction between the phytophagous insects and their protea hosts; the seasonal distribution of the insects; and the guild composition of the Arthropods.

The information will also be used to determine whether a correlation exists between the architectural complexity of the host plants and the insects associated with them. Attention will also be given to the area distribution of the host plants and their list of insects.

The plants are monitored in their natural habitat as well as in cultivated stands. Insects are collected on a monthly basis by means of the knock-down method. Inflorescences are collected and examined to identify and count the flower visitors. Leaf samples are collected from the different growth cycles, to establish how much damage has been caused by insects. The data on Proteaceae-insects is being processed at present and should lead to a greater understanding of the insect-plant interrelationship.

4. NATURAL FIRE ZONE EXPERIENCE: A MANAGEMENT OPTION

C de Lange
Knysna Forestry Region
Private Bag X12
KNYSNA
6570

5. ROADS AS A DISTURBING FACTOR IN FYNBOS

B L Dawson
PU-NTC Institute for Ecological Research, P O Box 352, Brackenfell, 7560

There are approximately 29 500 kilometers of roads (not including municipal roads) within the fynbos biome. The total extent of the road reserve is in excess of 64 000 hectares, of which about 19 700 hectares comprises the actual road surface. A further ±1 850 hectares of the fynbos biome consists of road reserves for national roads which have been proclaimed but not yet constructed.

Road construction includes activities such as the stripping of vegetation and topsoil, earthworks resulting in unnatural cut and fill slopes with altered drainage patterns, the opening up of quarries and "borrow pits" to obtain suitable construction material, the erection of temporary construction yards, the construction of haul roads and detours, and afterwards (maybe!) the establishment of vegetation which is not always (!) indigenous.

Some road maintenance activities include aspects such as mowing, weeding, burning and weedspraying.

From this information it can be seen that roads, due to their extent and some of the activities associated with building and maintaining them, have a considerable disturbing impact on the fynbos biome.

6. EFFECTS OF DISTURBANCE BY TILLING IN A MOUNTAIN FYNBOS ECOSYSTEM

G W Davis
Botanical Research Institute, Private Bag X16, Rondebosch, 7700

This poster represents an experimental study, and is part of an investigation into the ecological impact of the local wildflower industry on fynbos vegetation. Its objective is to quantify some of the effects of tillage, and the cultivation of non-endemic species on a selected mountain fynbos ecosystem.

In the first year and a half, since the site was prepared by burning, rotivating, and the planting out of sets of indigenous floricultural species (Protea cynaroides and P repens), selected parameters of the experimental system have been monitored. Recorded observations indicate that physical disturbance of the soil alters the substrate energy budget by increasing reflectivity of the soil surface during the summer period, while reduction of plant cover (viz transpirational surface area) raises the water content of the soil relative to that of an undisturbed treatment. Transpiration measurements made on a subset of the introduced P cynaroides plants confirmed that water was more available to plants on the disturbed soil. Seedlings of the shrub species dominant on the site prior to the burn (Leucadendron xanthoconus) were found to be more frequent on the undisturbed soil following a spring flush of germination.

The observed changes to the system suggest a number of key questions which could guide future, and more intensive research in the realms of both basic fynbos ecology and conservational management.

7. MIERE EN VERSTEURING

A de Kock
Jonkershoek Forestry Research Centre
Private Bag X5011
STELLENBOSCH
7600

Miere kan as bio-indikasie van die omvang van versteuring gebruik word. Hiervoor is daar verskeie redes: hulle is uiters volop; daar is 'n relatief-hoë spesierykheid; daar is baie spesialisspesies; hulle is op die hoër trofiese vlak; hulle word maklik bemonster; hulle word gewoonlik maklik identifiseer; en hulle reageer op veranderde ongewingstoestande.

Gebiede waar miere as bio-indikatore gebruik kan word, is: waar daar indringing deur Argentynse miere is; waar menslike aktiwiteite veroorsaak dat die ekologie versteur word; voordat gruisgate of oop myne in gebiede begin word, en weer na rehabilitasie; om agteruitgang van die ekosisteem te monitor in gebiede wat aan versteuring onderworpe is, bv by fynbos wat aan woongebiede of kampterreine grens; om die bewaringstatus van 'n natuurreservaat te bepaal; wanneer plantegroeiveranderings in 'n gebied oor 'n tydperk gevolg word, mag daar ook 'n waarneembare suksessie van mierfauna wees.

'n Bekende voorbeeld waar miere as bio-indikatore gebruik word om versteuring te bepaal, is waar mierspesies soos Anoplolepis custodiens se aan- of afwesigheid gebruik word as 'n aanduiding dat die Argentynse mier Iridomyrmex humilis, daar af- of aanwesig is. Die moontlike gebruik van indikatorspesies of groepe is hier, sowel as in Australië, nog in die ondersoekfase.

8. POST-FIRE PLANT SUCCESSION IN FERNKLOOF NATURE RESERVE

P B Drewe
Hermanus Herbarium, Hermanus 7200 and
R S Knight
Percy FitzPatrick Institute, University of Cape Town, Private Bag, Rondebosch, 7700

During the past summer two fires occurred in Fernkloof Nature Reserve. The objective of this study is to compare the post-fire plant succession following mid and late summer burns. Herbarium specimens and field observations are collected from each burn. Preliminary results show similar post-fire flowering patterns.

9. DEBRIS DAMS: ENERGY RETENTION IN AN ACID WESTERN CAPE STREAM

M P Henshall-Howard and J M King
Fresh Water Research Group, Zoology Department, University of Cape Town, Private Bag, Rondebosch, 7700

Litter from riparian trees is the major source of organic energy for the biota of shaded mountain streams. When litter falls in the water, much is immediately swept downstream and this is of limited use to the biota. However, some becomes trapped in debris dams that form upstream of boulders or fallen trees, and so becomes available to the stream organisms.

Studies at Langrivier, Western Cape, compared to those of the Hubbard Brook system, USA, have shown that the organic dams in Langrivier are much smaller and more ephemeral than those in the American streams. The poor retention of organic energy by Langrivier stream may well be implicated in the low secondary productivity of that stream.

The probable reason for Langrivier's poor ability to retain organic material in dams is the low fall of wood from riparian trees. Dams will be small, unstable and ephemeral in the absence of large pieces of wood, as these provide the basic framework upon which twigs and leaves accumulate.

10. **DO ACACIAS IMPROVE NATURAL SOILS?**

J J Jackelman
Department of Botany, University of Cape Town, Private Bag, Rondebosch, 7700 and
A B Low
Cape Flats Nature Reserve, University of the Western Cape, Private Bag X17, Bellville, 7530

This study has set out to test the validity of the often used and largely unfounded statement that acacias "ameliorate" or "improve" natural soils. Adjacent Acacia saligna and natural communities were compared on three major soil types - shale: Tygerberg Hill (Coastal Renosterveld), acid sand: Mamre (Coastal Fynbos) and calcareous sand: Belhar (Strandveld).

The sandy acacia soils showed higher levels of organic matter in the paired sites and this invariably correlates closely with cation exchange capacity and soil total nutrient status. Such changes in these soils are due to production of large quantities of leaf litter with high nutrient loads (phyllode analyses show marked concentrations in certain elements) while significant fibrous root production under A saligna must also play an important role. Little difference was observed in the paired shale-derived soils which displayed comparatively high soil OM and nutrient levels.

Models are presented which suggest the effect acacia-influenced soils might have on plant growth, and it is suggested that acacias may have a stronger influence on the chemistry and organic constitution of sandy soils.

11. **VISCUM CAPENSE INFECTION ON HOST PLANTS OF THE COASTAL AND INLAND AREAS OF THE CAPE FLATS**

C P Klein, R F Striker, A B Low and J Aalbers
Department of Botany, University of the Western Cape, Private Bag X17, Bellville, 7530

Viscum capense, a hemi-parasite, is commonly found on several dune scrub species occupying calcareous sands of the Cape Flats and elsewhere. In selected species investigated, levels of infection varied from individual to individual but were greatly reduced at the coast.

Xylem water potentials were similar at both inland and coastal sites while nutrient loads were higher at the latter, possibly reflecting greater cation and phosphorus availability.

A reduction in infection is thought to be due to harsher conditions prevailing at the coast and possibly fewer avian frugivores, rather than water or nutrient limitations.

12. **DOES COMPETITION OCCUR BETWEEN FRUGIVOROUS BIRDS FOR FRUIT RESOURCES IN THE SOUTH WESTERN CAPE?**

R S Knight
Percy FitzPatrick Institute of African Ornithology, University of Cape Town, Private Bag, Rondebosch, 7700

Information on the abundance of fleshy fruits in relation to observations on frugivory by birds has been collected over a two-year period in a coastal

thicket site at Hermanus in the southwestern Cape. It was initially hypothesized that there would be few aggressive interactions among avian frugivores during periods of fruit abundance, and more during periods of fruit scarcity. The results indicate that such interactions are generally rare, but those that do occur were associated with periods of fruit abundance.

Periods of fruit abundance were normally associated with single plant species, and during such periods feeding visits by frugivores to the range of available, palatable fruit crops were frequent and few fruits remained undisturbed. The abundant fruit crops appear to be used by the influx of non-resident frugivores and an increased incidence of frugivory by primarily insectivorous birds. During periods of apparent fruit scarcity, some plants did not attract avian frugivores. Since the number of birds that are totally reliant on fruits is low at Hermanus, periods of fruit scarcity result in low levels of plant seed dispersal. Periods of high fruit production increased frugivory by birds, which may participate in intra- and inter-specific aggressive interactions and begin to feed on fruit crops that had hitherto remained undispersed. Contrary to predictions, therefore, the small population of resident frugivores interact aggressively only during periods of fruit abundance. This overt agressiveness may constitute evidence for interference competition.

13. RESPONSE OF PROTEA REPENS AND ERICA PLUKENETII TO NUTRIENT ADDITIONS

A J Lamb and E Klaussner
Jonkershoek Forestry Research Centre, Private Bag X5011, Stellenbosch, 7600

The slow growth of fynbos vegetation is thought to be caused by low nutrient concentrations in the soil. The temporary increase in nutrient availability resulting from fire explains the rapid growth of fynbos vegetation immediately following burning. After a fire, growth rates steadily decline with time and can be correlated with increased amounts of nutrients accumulated in standing dead biomass and litter.

A factorial experiment with three treatments (N, P and N + P) and a control was laid out in 6-year-old fynbos in 1982. Protea repens and Erica plukenetii were measured for response. The number and length of current vegetative shoots per previous vegetative shoot and the number of flowering shoots per previous shoot were measured on all P repens shrubs. The biomass of approximately 75 randomly selected E plukenetii shrubs per treatment was determined.

The poster illustrates the response of these shrubs to the nutrient additions.

14. SEASONAL DYNAMICS OF ANNUALS COLONIZING DISTURBED CALCAREOUS SAND ON THE CAPE FLATS

A B Low, P M McLaren and L F Cyster
Department of Botany, University of the Western Cape, Private Bag X17, Bellville, 7530

Growth and development of annuals (chiefly Dimorphotheca pluvialis and Senecio littoreus) on disturbed calcareous sand was followed over a year. Plants displayed exceptional rates of growth and mass accumulation, mostly concentrated over the coldest and wettest time of the year. Mass flowering (±synchronous) immediately succeeded the attainment of maximum vegetative growth and this was followed closely by prolific seed production, senescence and total plant death.

15. **NUTRIENT REGIMES IN A SEQUENCE OF MOUNTAIN FYNBOS COMMUNITIES DELIMITED BY SOIL MOISTURE STATUS**

A B Low, Cape Flats Nature Reserve, University of the Western Cape, Private Bag X17, Bellville, 7530

Eight communities were described along a moisture gradient at De Tronk in the Groot Winterhoek mountain area. Communities were distinguished from one another on the basis of 12 topsoil analytical parameters using a covariance biplot.

In general highest organic matter and total nutrient contents were found in a water-logged cyperoid/restioid marsh (low decomposition rates) and under a well-drained rocky outcrop scrub community which featured a high annual litterfall. A well leached restioid plain typically displayed lowest quantities of both OM and nutrients.

The sites high in OM and nutrients were however best separated if seasonal soil moisture status was employed as an additional parameter.

Major foliar nutrient patterns were also detected in dominant species along the gradient, and the hemicryptophytic Restionaceae in particular displayed low levels of these nutrients.

16. **THE CAPE FLATS - RATIONALIZING CONSERVATION AND HOUSING PRIORITIES**

A B Low
Cape Flats Nature Reserve, University of the Western Cape, Private Bag X17, Bellville, 7530

The exploitation of Cape lowland regions is most severe on the Cape Flats where housing is now a very real threat to the status of the remaining natural habitats. Should conservation be considered a major issue in a "Third World" community where a desperate need for survival can take no cognizance of white elitist conservation endeavours?

Viewed in a broad and pragmatic sense, conservation must be seen as contributing to the upliftment of community life in this area. While these communities battle to maintain some semblance of human dignity against a background of poverty and the Group Areas Act, conservation in any of its forms can only succeed if it is to offer direct benefit to these very individuals.

It is therefore imperative that suitable multiple-use nature areas and green belts be included in all future housing schemes for the lower socio-economic group and that practical environmental awareness and community upgrading projects be implimented without delay.

17. **VEGETATION OF A CAPE FLATS "ISLAND" - THE CAPE FLATS NATURE RESERVE**

A B Low
Cape Flats Nature Reserve, University of the Western Cape, Private Bag X17, Bellville, 7530

All nature reserves in the Greater Cape Town Region are "islands" insofar as they are surrounded by urban development, invasive vegetation or farming activities.

The vegetation of the Cape Flats Nature Reserve has with careful management, survived admirably given its small size (20 ha) and the burgeoning suburbia on its doorstep.

A vegetation description (DECORANA and BB table) shows a fair diversity in plant communities in the three major habitats present, viz: vlei, flats and duneland. Communities could not, however, be clearly distinguished from one another on the grounds of soil chemical characteristics: seasonal soil moisture may therefore be a necessary factor to consider where somewhat uniform recent calcareous sands are present.

18. FYNBOS RE-ESTABLISHMENT AT THE CAMPS BAY RESERVOIR

C H Petersen
Parks and Forests Branch, Cape Town City Council, P O Box 1694, Cape Town, 8000

The re-establishment of a natural vegetation cover at the new Camps Bay reservoir is regarded as an important project for aesthetic and environmental reasons. The construction of this reservoir, which is situated within the Table Mountain Nature Reserve, was completed at the end of 1984. The original subsoil and topsoil which had been stored since the start of construction, was replaced, following which stabilization using logs and a dust suppressant was undertaken. Indigenous seed which had been collected from surrounding communities over the preceding year, was sown early in 1985. A number of indigenous nursery-grown plants and seedling sods from a firebelt were planted out during the winter of 1985. Re-establishment methods were also employed on the soil storage area and the pipeline. Visual results to date have been very pleasing, and the methods used on the various sites are currently being evaluated as part of the student project.

19. FATE OF SEED - MYRMECOCHORY OR PREDATION?

S M Pierce
Department of Botany, University of Cape Town, Private Bag, Rondebosch, 7700

Myrmecochory (seed dispersal by ants) is reputed to be widespread in Cape fynbos taxa. Although many studies have been made on the relatively large-seeded members of the Proteaceae, this study was the first investigation of the fate of the small seed (1-1,5 mm seed length) of six small-leaved fynbos species. Fresh seeds of three species lacking elaiosomes - Passerina vulgaris, Metalasia muricata and Felicia echinata and three species with elaiosomes - Agathosma apiculata, A stenopetala and Muraltia squarrosa were set up in a cafeteria experiment sited in dune fynbos in the SE Cape. Treatments involved depots:

1. excluding invertebrates (ants);
2. excluding rodents;
3. open to both invertebrates and rodents;
4. excluding both = control.

Results showed fairly rapid rates of removal (almost 100% removal from open depots after six days). There was no significant difference between seed removals of the different plant species ie seeds with elaiosomes were not preferred over seeds lacking elaiosomes. In treatments 1, 2 and 3 seed

remnants indicated predation had occurred. In some cases, the elaiosome had been removed, but the seed remained behind. A further cafetaria experiment was conducted using Muraltia squarrosa seeds to determine the role of elaiosomes. Results from depots containing whole seeds and seeds from which the elaiosomes had been removed, showed no significant difference between seed removals. These studies cast some doubt on the efficacy of myrmecochory of small-seeded species. With regard to elaiosome-bearing seeds, is the fate of seed, whether it be dispersal or predation, determined by the size of the seed relative to the size of the ant?

20. **SOME ASPECTS OF FYNBOS SEEDLING DYNAMICS AFTER A FIRE**

F M Pressinger
Botanical Research Institute, Private Bag X16, Rondebosch, 7700

The effects of changes in plant density and watering regime on fynbos seedling growth was investigated. Protea repens was chosen as a representative fynbos species. Experiments were performed under controlled nursery conditions and in the field after a fire. Growth was measured in terms of plant biomass.

21. **CHARACTERISTICS OF THE SOIL SEEDBANK OF COASTAL FYNBOS, PELLA, AND THE EFFECT OF FIRE**

L M Raitt
Department of Botany, University of the Western Cape, Private Bag X17, Bellville, 7530

A greenhouse germination technique was used to estimate the relative size of the soil seedbank from five sites at Pella. Results show a seedbank rich in species (more than one hundred species were recorded) with an autumn peak, dominance by annuals and apparent fire enhancement.

22. **THE USE OF ECOLOGICAL THEORY IN THE REVEGETATION OF SEVERELY DISTURBED AREAS**

N Romoff
PU-NTC Institute for Ecological Research, c/o Department of Botany, University of Cape Town, Private Bag, Rondebosch, 7700

Severe disturbances, such as those caused by quarrying and roadbuilding, result in the removal of all plant material and topsoil. A revegetation programme aims to return or recreate a stand of vegetation indigenous to the area. There are a variety of techniques available to such a programme, such as hydro-seeding with a nurse-crop, the addition of nutrients, irrigation, the use of soil-stabilizers, and the introduction of indigenous seed. However, in order to ensure the success of the project, cognisance should be taken of the ecological processes involved. What are the factors affecting the recolonization process and how useful are theories such as Grime's plant strategies (1977) and Connell and Slatyer's vital attributes (1980)? Must one use other existing theories of succession - or is it necessary to develop new ideas more suited to severe disturbances in a mountain fynbos situation?

Such questions are important in the light of increasing public awareness of environmental impacts, and the pressure for development contractors to make money available for ecologically acceptable revegetation programmes.

23. ECOLOGICALLY DIAGNOSTIC XYLEM ANALYSIS (EDXA)

A Scholtz
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EDXA is a computer based method designed to measure those wood anatomical variables that can be observed in transverse section. The programme handles the input of data, the calculation of a complete range of variables and a choice of indices, the basic statistical analysis of sets of individual analyses and the production of distribution data (graphs) for the tracheary system.

The poster illustrates the application of the method in palaeoclimatology. Sample areas of wood preserved as charcoal in assemblages from Boomplaas Cave were analyzed and the climates that occurred at nine periods in the past 60 000 years were thus reconstructed in relative detail. The method holds the promise of providing climatic records for regions not served by an adequate historical record.

However, the method has numerous other potential applications, ranging from an aid in taxonomic studies to using trees as proxy weather stations/ecological status indicators (of use for management), quasi-dendroclimatological work and the measurement of various aspects of wood quality (silviculture). In more pure research the method would be of use in the investigation of phenological problems such as the development of drought or cold resistance, the ability to adapt to a range of conditions, to exploit underground water resources etc. At present a mechanical/mathematical model of wood is not available and data produced in this approach would make a substantive contribution towards constraining and testing such a model.

A major focus of research in the immediate future will be on analyzing the wood of selected species over ecological gradients and here the cooperation of field botanists in the selection and collection of samples is requested.

24. PHOTOSYNTHESIS IN RELATION TO PLANT AGE IN PROTEA LAURIFOLIA THUNB

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The maximum photosynthetic capacity of mature individuals (±35 years) and seedlings (±three years) of Protea laurifolia Thunb was studied using infrared gas analysis. This study was conducted from January to May 1986 under cloudless conditions in natural mountain fynbos at Bainskloof. The leaves of the seedlings maintained a higher net photosynthetic rate than the leaves of mature plants throughout the entire day. The summer months with their high temperatures and high evapotranspirative demand, produced midday depressions in net photosynthetic rates, possibly due to stomatal closure. The seedlings exhibited a less pronounced midday depression. After February, the leaves of mature plants experienced decreases in morning and late afternoon photosynthetic rates and increases in midday photosynthetic rates - an inversion of the diurnal pattern of C-fixation during summer. The seedlings, however, maintained a constant diurnal pattern of C-fixation throughout the

study period. It appears that the interplay of biological and environmental factors, which determine seasonal changes in C-fixation rates, does not affect the seedlings and the mature individuals in the same way. These ecophysiological attributes may enhance the competitive ability of the seedlings during the early successional stages after fire.

25. SMALL MAMMAL CAPTURE IN SWARTBOSCHKLOOF

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A preliminary analysis of capture/recapture data of small mammals in the Swartboschkloof is presented for the period April 1985 to May 1986.

26. PREDICTING THE EFFECTS OF NUTRIENT POLLUTION AS A DISTURBANCE FACTOR IN THE FYNBOS BIOME

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Research findings from field and laboratory fertilizer experiments carried out in the fynbos biome and other Mediterranean-type ecosystems will be discussed. From these, predictions will be made of the effects of nutrient pollution on fynbos communities.

Two field fertilizer experiments carried out in the fynbos biome will be discussed in detail. The first, on sand-plain lowland fynbos at Pella is a factorial fertilizer experiment using 0,5 g m^{-2} phosphorus ($Ca_3(PO_4)_2$),5 g m^{-2} nitrogen (NH_4NO_3) and balanced supply or nutrients (all essential plant nutrients other than nitrogen and phosphorus). Fertilizers were applied in September 1984 onto 36 10 x 5 m plots supporting four-year old fynbos vegetation. To date, the community composition of these plots has been monitored prior to fertilizer additions and one year later. The foliage projective cover and percentage frequency in $1m^2$ quadrats of each species and the canopy volumes of each shrub species is monitored annually. The standing crop of the dominant physiognomic plant forms has been determined for four of the treatments one year post fertilization.

The second experiment on mesic mountain fynbos at Dunghuy Park Quarry (Caledon) in June 1984 was established to determine the effects of commercially available fertilizers on the re-establishment of indigenous plant cover on a severely disturbed area (top-soil plus approximately 1 m subsoil removed). Nutrient applications include various levels and combinations of liming, inorganic fertilizers and organic fertilizers such as guano and wheat straw, totalling 23 treatments. Each treatment was randomly assigned to three 8 x 10 m plots. Vegetation cover was assessed after 13 months and the species composition after five, nine and 13 months.

27. MICROBIAL ATP, CO_2 EVOLUTION, PROTOZOA AND AEROBIC BACTERIA (PLATE COUNTS) IN TWO SWARTBOSCHKLOOF SOILS

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Microbiological investigations have been conducted with Clovelly and Glenrosa soils (derived from sandstone and granite, respectively) from beneath Protea neriifolia on similar sites in Swartboschkloof, Jonkershoek. The soils have been sampled at one to two month intervals from March 1986 to May 1986.

Microbial ATP has been consistently higher in the Glenrosa soil than in the Clovelly soil. In both soils ATP peaks were recorded mainly in summer and lowest values in winter in an approximately inverse relationship to the moisture content of the sampled soil. Evolution of CO_2 from sieved soil incubated in the laboratory was also consistently higher in the Glenrosa soil, and in both soils increased and decreased with the soil moisture content. Soil characteristics, especially nutrients, are being studied to explain the microbiological differences between the two soils. The apparent inverse relationship of soil microbial ATP to soil moisture and CO_2 evolution is difficult to explain, and biological interactions may be involved.

The possible effect of predatory protosoa on the soil microbial populations and hence on their ATP is being investigated. In Clovelly soil subjected to wetting and drying cycles in the laboratory, the protozoal population by MPN count showed similar trends to the soil moisture as incubation (26°C) progressed; however, plate counts of aerobic bacteria remained approximately constant. In view of the shortcomings of plate counts of soil microorganisms, other enumeration techniques will have to be tried before conclusions on the effects of fluctuations in the protozoal populations can be made.

28. IMPACT OF HAKEA CONTROL IN FYNBOS

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The woody shrub Hakea sericea is an aggressive invader of fynbos. On the Outeniqua mountains it forms a dense cover which supresses the fynbos. Slashing dense Hakea results in a very high fuel load due to a thick mat of dead vegetation. The following general conclusions were made from monitoring data:

1. resprouting plants are virtually eliminated from dense Hakea sites;
2. soil seed stores are depleted to some extent;
3. survival of termite mounds decreases considerably;
4. total plant cover is reduced, resulting in increased soil erosion.

An effective control strategy is not one that only eradicates the alien plant. It should not have a drastic effect on the indigenous plant communities.

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STEERING COMMITTEE FOR THE FYNBOS BIOME PROJECT

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FRD SECRETARIAT

Mrs M L Jarman (Convener)
Dr R M Cowling (Co-convener)
Ms T Greyling
Mrs P van Helsdingen
Ms E Mantle

Meeting convened by the NATIONAL PROGRAMME FOR ECOSYSTEM RESEARCH of the CSIR