NATIONAL PROGRAMME FOR ENVIRONMENTAL SCIENCES

(TERRESTRIAL ECOSYSTEMS SECTION)

NP 14/106/9L-5

FYNBOS BIOME PROJECT : FOURTH ANNUAL RESEARCH MEETING

PROGRAMME

FRIDAY, 11 JUNE 1982

08h15 - 09h00	Registration
09h00 - 09h15	Welcome & Introduction
SESSION I	PHENOLOGICAL STUDIES WITHIN AND ADJACENT TO THE FYNBOS BIOME
09h15 - 12h15	Chairman: Professor E J Moll (University of Cape Town)
09h15 - 09h45	The role of phenological studies in the Fynbos Biome Project and a survey of some of the approaches being used to them. Miss J E M Sommerville (University of Cape Town
09h45 - 10h00	Phenology of the major vegetation types of the south western Cape Mr D le Maitre (Department of Environment Affairs) Miss J E M Sommerville (University of Cape Town) and Mr C Boucher (Department of Agriculture and Fisheries)
10h00 - 10h15	Phenological trends at the southern and south eastern end of the Fynbos Biome Miss S Pierce (University of Cape Town) Mr W Bond (Department of Environment Affairs), and Mr A Palmer (Cape Provincial Administration)
10h15 - 10h45	TEA
10h45 - 11h00	Phenomorphology of arid-mediterranean vegetation types Miss A le Roux)Cape Provincial Administration) Professor G Orshan (Hebrew University, Israel)
11h00 - 11h30	Phenomorphology of the fynbos Miss X Kyriacou (University of Cape Town) and Professor G Orshan (Hebrew University, Israel)
11h30 - 12h00	Discussion
12h00 - 12h15	Summary and future prospects Miss S Pierce (University of Cape Town)

SESSION II	MODELS OF MEDITERRANEAN-TYPE ECOSYSTEMS - FYNBOS BIOME
12h15 - 13h00	-
12h15 - 12h45	Report on simulation modelling programme
	Professor P Miller (San Diego State University) Mr F J Kruger (Department of Environment Affairs) Mr J Miller (San Diego State University) Mr J Midgeley (Department of Environment Affairs)
12h45 - 13h45	Discussion
13h00 - 13h45	LUNCH
SESSION III	POSTER SESSION AND VEGETATION NOMENCLATURE WORKSHOP
13h45 - 17h30	
13h45 - 14h00	Briefing session
14h00 - 14h30	General poster viewing session
14h30 - 17h00	Session IIIa Individual poster presentations and review of posters Session IIIb Workshop on nomenclature of sub-divisions of Acocks Veld Types
17h00 - 17h30	Report back and concluding comments
17h30 - 18h30	COCKTAILS

20h00 DINNER AT THE CONSTANTIA NEK RESTAURANT

APPENDIX I

POSTER TITLES AND ABSTRACTS

Presentation Time (Two parallel sessions)

Will participants please note time of start of their presentation:- only up to 5 minutes if individual presentation time allowed.

GENERAL (SESSION A)

TIME

14h30 1. THE CONSERVATION OF *WIDDRINGTONIA CEDARBERGENSIS*: PRELIMINARY RESULTS OF AN INVESTIGATION INTO THE ECOLOGY OF THE CLANWILLIAM CEDAR.

S.A. Botha & P.T. Manders, Jonkershoek Forestry Research Station.

ABSTRACT

The Clanwilliam cedar is an endemic species restricted to the Cedarberg Mountains. Numbers have apparently declined drastically since the area was first exploited by European settlers. Individuals of *Widdringtonia cedarbergensis* seldom survive fires and the species only repopulates the area after a fire, from tha current year's seed crop.

The early phases of a study aimed at conservation of the species have included phenology, growth response to climate and site factors and the identification of the rodent species responsible for post-dispersal seed predation.

14h40 2. RECENT LANDUSE ON THE FYNBOS SITE.

S. Brownlie, School of Environmental Studies, University of Cape Town.

ABSTRACT

The fire regime, landuse and management practices on the coastal fynbos research site at Pella from 1920 to 1981 were investigated to determine their possible long term effects on the vegetation, soils and fauna. External influences on the site such as those of land transformation, soil erosion and alien vegetation encroachment were also investigated; using aerial photograph interpretation, interviews and historical literature sources.

The fire regime has changed from intentional patch-burning on a 3 to 4 year rotation prior to 1960 to solely accidental conflagrations on a 7 year frequency after 1960. The earlier fire regime is thought likely to have effected net losses of of nutrients from the fynbos site and possibly eliminated plant species whose primary juvenile period is more than 3 to 4 years.

Grazing, quarrying and bush cutting on the fynbos site are thought to have had minimal long term impact on the site ecosystem.

Increased cultivation and afforestation of land surrounding the site has served to isolate the site from nearby fynbos

14h40 2.... areas, and has encouraged soil erosion and the impingement of acacias and cluster pines on to the site.

Results of the study indicate that, in considering management of conservation worthy areas in the coastal lowland, the possible external influences must be taken into account and hidden costs, especially as regards the control of alien vegetation in this area, budgeted for.

14h50 3. PELLA POST-FIRE, THE FIRST YEAR.

C. Boucher, J. Krauss, X Kyriacou, E.J. Moll, J. Sommerville, Department of Botany, University of Cape Town.

ABSTRACT

Twelve sites and six communities of various ages having different intensity of burn were investigated. At each site line-intercept data were collected from five 10 m fixed lines at monthly intervals for the first six months (Dec. 1980 to May 1981) and then in July and October 1981. Results show some differences in both regeneration rate and composition. These results are illustrated by histograms of the seven dominant families at the twelve sites. A comparison of four of the sites shows that both total cover and non-woody resprouters regenerate faster after a light fire than after a severe. In this severly burnt "Renosterveld" reseeders were relatively more abundant than elsewhere.

15h00 4. THE EPIGAEIC INVERTEBRATE FAUNA OF JONKERSHOEK VALLEY WITH PARTICULAR REFERENCE TO ANTS.

D. Donelly & J.H. Giliomee, Department of Entomology, University of Stellenbosch.

ABSTRACT

A survey was done in the Jonkershoek Valley in order to compare the epigaeic fauna in areas under different management practices. Ants were found to be a major component of this fauna. Grids of pitfall traps in six fynbos areas yielded 8711 ants comprising 45 species. Over the whole valley the most common species was the pugnacious ant, *Anoplolepis custodiens*, followed by *Pheidole capensis*. These and several other species have been excluded from Swartboschkloof, however, where the alien argentine ant *Iridomyrmex humilis* is the most dominant. This indicates a greater competitive advantage of this species over the indigenous ant species. The four sites situated in the fire breaks, which are burned on a regular basis, had higher numbers of individuals and species of ants than the two more mature fynbos areas studied. A nearby plantation of the pine *Pinus pinaster* proved similarly low in number of epigaeic ant species, and was particularly low in numbers of individuals. Analysis of similarity of the fynbos ant fauna showed the four fire break sites to be the most similar, which in turn were least similar to the alien-invaded Swartboschkloof.

15h10 5. INSEKTE IN ASSOSIASIE MET PROTEA REPENS.

J.H. Coetzee en J.H. Giliomee, Departement van Entomologie, Universiteit van Stellenbosch.

SAMEVATTING

'n Wye reeks insekte word geassosieer met *P. repens*. Die insekte kan in drie groepe verdeel word nl. saadvoeders, blaarvoeders en blombesoekers. Die groep wat die meeste skade veroorsaak is die saadvoeders. Die blomme van *P. repens* gaan na die blomstadium toe en vorm saadkoppe wat op die plant bly vir 'n onbepaalde tydperk, totdat 'n veldbrand of insekte die saadkop beskadig en die saad vrygestel word. Op die plant is daar dus saadkoppe van verskillende ouderdomme. Daar is 'n hele aantal insekspesies wat die saadkop en die saad as bron van voedsel gebruik. Die eiers word in of op die saadkop gelê en die hele lewensiklus word in the saadkop voltooi. Teen die tyd dat die saadkop een jaar oud is, is gemiddeld 40% van die sade beskadig en na twee jaar is dit 80%. Ten spyte van die "hoë" verliese is die plant se strategie om die sade in die kop to hou na rypwording,eerder as om hulle vry te stel soos by ander Proteaceae.

Daar is ongeveer nege insekspesies wat in die saadkop voed. Die belangrikste is die larwes van die kewers *Genuchus hottentottus*, *Sphenoptera sinuosa*, *Euderes lineicollis* en die motlarwe *Cryptolechia ammopleura*.

15h20 6. SUNBIRD-ERICA POLLINATION SYSTEMS IN MOUNTAIN FYNBOS.

A. Rebelo, Percy FitzPatrick Institute of African Ornithology, University of Cape Town

ABSTRACT

The large number of bird-pollinated Erica species found in the southwestern Cape are dependant on two bird species for pollination. This is unusual in that in other areas (California, Australia, Hawaii, Columbia) there are far less ornithophilous plants and many more avian pollinators. Floral syndromes are adapted to ensure optimal pollen flow by affecting pollinator density and behaviour. Because of the low bird pollinator diversity, competition theory predicts that there will be morphological diversity of floral characters ensuring spatial and temporal separation of pollen flow, whilst those characters which attract the pollinators will be similar. The study aims to explain how such a large number of bird pollinated Erica species can coexist in the Fynbos with only two pollinators present. The study will contribute to explaining the large amount of species in the Erica genus and how they coexist in the Fynbos biome.

15h30 - 15h50 T E A

15h50 7. SOIL MICROBIAL BIOMASS DETERMINATIONS (TOTAL, FUNGAL AND BACTERIAL). LITERATURE SURVEY OF RECENT DEVELOPMENTS.

M.A. Loos, Department of Microbiology and Virology, University of Stellenbosch.

ABSTRACT

Plate counts of soil bacteria and fungi have long been discredited as they usually determine less than 10% of these organisms. Present approaches to estimating biomass are (i) direct microscopic counts and measurements, (ii) luminometric determination of ATP as an indicator of metabolically active cell material, (iii) respiration studies with fumigated and non-fumigated soils (respiration of dead microbial cells in fumigated soils provides a measure of microbial biomass C), and (iv) respiration studies with glucose-amended soils in absence and presence of inhibitors of bacteria (streptomycin) and fungi (actidione). A differential centrifugation method (v) also compares active bacterial and fungal biomass. The experimentally simpler procedures (ii), (iii) and (v) seem more suited to survey-type studies than procedures (i) and (iv) and thus the most appropriate at this stage for investigations of fynbos soils.

16h00 8. WATER RELATIONS IN THE NANOPHYLLOUS FYNBOS.

K.H. Schûtte, Botany Department, University of Cape Town.

ABSTRACT

Psychrometric techniques were adapted to enable the water potential of nanophyllous plants, by far the commonest constituents of fynbos, to be measured in the field. The poster shows three days data collected from Metalasia muricata.

Metalasia muricata is a very typical nanophyte. Data are presented to show that its transpiration is very light sensitive but wind insensitive.

Some Restio transpiration rates are presented.

16h10 9. FYNBOS IN THE TRANSKEI.

C. Johnson, University of the Transkei, Umtata.

ABSTRACT

In compiling a vegetation map of the Transkei one comes across vegetation patches that appear similar to Fynbos types.

The main aim of this research is to determine the degree of similarity between these vegetation patches and other Fynbos communities. Aerial photographs (1937 & 1982) will be used to determine the changes that might have occurred in these patches.

16h20 10. A SYNTAXONOMIC AND SYNECOLOGICAL STUDY IN THE HUMANSDORP REGION OF THE FYNBOS BIOME.

R.M. Cowling, Department of Botany, University of Cape Town.

ABSTRACT

A hierarchical syntaxonomic scheme of vegetation in the eastern border of the Fynbos Biome (Humansdorp region) is presented as a second approximation after the earlier work by Acocks (1953) in the area. Details on the physiography, geology, climate, soils, historical features and present management of the area are given to provide the setting for this and other papers dealing with community characterization and ecological relationships, dynamics, structure and biogeography. A community classification is generated using a hierarchical numerical classificatory technique (TWINSPAN) which produces ordered two way phytosociological tables. Tabular comparisons and final sorting is according to the methods of the Zurich-Montpellier school. Higher syntaxonomic ranks (classes and orders) are subjectively defined. Four classes, seven orders and 22 communities are recognised in the study area. The classes are: Cape Fynbos Shrublands (3 order, 10 communities), Cape Transitional Small-leaved Shrublands (1 order, 4 communities), Subtropical Transitional Thicket (2 orders, 6 communities) and Afromontane Forest (1 order, 2 communities). Discussion of the scheme is focussed on the level of the order (roughly equivalent to a veld type). In addition to diagnostic floristic elements, syntaxa are further characterized using biogeographic, structural and habitat criteria. The role of historical land use on vegetation dynamics and interrelationships is briefly discussed. As far as possible syntaxonomic concepts are extrapolated to the entire Fynbos Biome as well as biomes adjacent to its eastern boundary. Certain syntaxa are examined relative to the Shrubland/heathland concepts developed for mediterranean-type ecosystems.

16h30 11. A GLIMPSE OF EARLY FYNBOS VEGETATION: THE BANKE MICROFLORA.

A. Scholtz, Department of Archaeology, University of Stellenbosch.

ABSTRACT

A study of pollens from the sediments filling the Arnot Pipe at Banke, Namaqualand has produced new detail about the early (50-70 million year) evolutionary history of the fynbos.

Some 70 different pollen and spore types have been recorded and it is obvious that already in this time range a distinct flora had evolved in the subcontinent. A number of old families like Araucariaceae, Pinaceae, Winteraceae and Chloranthoceae now extinct in Africa are present. The Restionaceae, Proteaceae and Ericaceae are each represented by only one form type and there is no evidence of marked speciation in these groups. There are on the other hand upwards of four genera of Rubiaceae present and the area was important for the evolutionary history of sections of this family. Other families represented include the Palmae, Ulmaceae, Myricaceae, Podocarpaceae, Gunneraceae.

16h40 12. THE GLACIAL MAXIMUM ENVIRONMENT IN THE SOUTHERN CAPE: EVIDENCE FROM THE CANGO VALLEY.

H.J. Deacon, Department of Archaeology, University of Stellenbosch.

ABSTRACT

Evidence from five independent studies show that the environment of the Cango Valley was cold and dry at the last glacial maximum 30 000 - 15 000. Oxygen isotope measurements on a speleothem from the Cango Caves shows a temperature depression of 5^{o}C relative to the present and climate models suggest a decrease in precipitation of the order of 30%. Both charcoal and pollen studies show low diversity of the vegetation at the last glacial maximum and this is also reflected in the microfauna. This extremely harsh environment characterized by the virtual absence of tree and taller shrub taxa was preceded by cool moist conditions locally favouring *Olea* woodland and succeeded after 15 000 years by a succession leading to the synthesis of the present vegetation mozaic. The seasonal rhythms of the present pertain specifically to the last few thousand years and in a more general sense to the last 10 to 14 000 years. Conditions of of general climate were markedly different at the last glacial maximum. Past climatic changes have had a strong forcing effect on vegetation communities in the fynbos as like changes occur elsewhere.

16h50 13. CONSERVATION STATUS OF THE RESTIONACEAE - STATE OF THE ART.

E.R. Ashton & H.P. Linder, Bolus Herbarium, University of Cape Town.

ABSTRACT

The world distribution and concentration of species in the south-western Cape Province are illustrated. Of the about 300 species recognized by Pillans, 60 are on the threatened plants list: 20 are considered rare, 15 vulnerable, 11 endangered, 7 indeterminate and of 7 the status is uncertain.

Since Pillans ceased working on the group, some 40 more species have been discovered. These species have not yet been described, and their conservation status is unknown. It is likely that many of them are rare.

The major impacts recognized are prevalent on the lowlands, and are primarily due to ploughing and urban sprawl.

Prediction of future trends in the populations of Restionaceae depends on an understanding of the biology of the plants. As yet very little is known of the breeding systems, the reaction of plants to various fire regimes, the ability of plants to persist vegetatively, and the methods and efficiency and importance of seed dispersal.

17h00 14. PELLA SEEDBANK CHARACTERISTICS.

L. Raitt, Department of Botany, University of the Western Cape.

ABSTRACT

Soil collection, exposure in a glasshouse, and subsequent germination counts are being used to obtain some idea of the bank or store of fertile seeds in fynbos at Pella. Seed banks thus determined appear to be richest in Autumn. There is an apparent fire stimulation of germination, (or of seed bank size). Annuals predominate in these determinations.

SEASONAL (SESSION B)

TIME

14h30 15. FLOWERING PHENOLOGY OF *VIRGILIA*.

B-E Van Wyk, Faculty of Forestry, University of Stellenbosch

ABSTRACT

The genus *Virgilia* (Keur) occurs from the Cape Peninsula up to Port Elizabeth. Variation studies revealed interesting trends along this west-east gradient. One of these is the time and duration of flowering. When the colour of the flowers, the morphological development of the inflorescences and the presence of pollen and nectar guides are considered, three distinct groups of populations emerge. Each of these groups has a unique flowering phenology that seems to be part of the isolating mechanism preventing crosses between the groups. Taxonomically, the three groups are regarded as two species and two subspecies, namely *V. oroboides* subsp. *oroboides*, *V. oroboides* subsp. *ferruginea* and *V. divaricata*.

Speciation may have been caused by different pollinators operating at different times of the year.

14h40 16. PLANT WATER RELATIONS IN SUCCESSION IN FYNBOS - A PRELIMINARY ACCOUNT.

F. Kruger, South African Forestry Research Institute, Pretoria.

14h50 17. SEASONAL PROGRESS OF PLANT WATER RELATIONS IN FYNBOS.

P. Miller, San Diego State University, California.

ABSTRACT

Plant xylem pressure potential and leaf conductances to water loss were measured at Algeria, in the Cedarberg and at Swartboschkloof in Jonkershoek. The measurements were to test the hypothesis that the fynbos of South Africa was equivalent to the chaparral of southern California, therefore a period of plant water stress should occur in fynbos species during the dry summer. The measurements indicated that little or no plant water stress occurs in most species at both South African sites and that the sites were similar in plant water relations in spite of a more than twofold difference in annual precipitation. The minor differences can be explained in terms of different vegetation cover and differing vapour pressure deficits. The results support the conclusion that while the arid fynbos may be equivalent to chaparral, the majority of the fynbos is equivalent to coniferous and broad-leaved evergreen forest in California. Precipitation above 675 mm/year in both chaparral regions of southern California and matorral regions of central Chile are not associated with severe summer plant water stress.

15h00 18. LIMNOLOGY OF STANDING WATERS IN THE FYNBOS AREAS OF THE SOUTH-WESTERN CAPE.

A.J.C. Gardiner, Department of Zoology, University of Cape Town.

ABSTRACT

Lentic waters of the fynbos region are characteristically black, acid and low in nutrient. The dark colour derives from the decay products of the fynbos which incorporate high levels of plant secondary compounds (such as polyphenols). This project aims at investigating the relationship between these humic substances, the aquatic fauna and flora and the water chemistry and thus gain an understanding of the effect of the fynbos and its decay cycle on the functioning of the system. Six south-western Cape vleis varying in intensity of water colour, pH, and nutrient levels have been sampled monthly over a 15 month sampling period at seventeen fixed points for fauna, flora, water and sediment. The physico-chemical measurement have included temperature, water depth, pH, conductivity, water colour and analyses for NO_3, NO_2, NH_3, PO_4^-, Na, K, Fe, Ca and Cu and humic substances (including humic and fulvic acids, lignins, tannins and polyphenolic compounds) are in progress.

15h10 19. ANTELOPE IN FYNBOS: DO THEY BREED AT THE OPTIMAL TIME?

P. Novellie & P. Norton, Department of Nature Conservation, University of Stellenbosch, and Cape Department of Nature and Environmental Conservation.

ABSTRACT

Reproduction is costly in terms of nutrients; the protein requirements of female ruminants at peak lactation can be twice maintenance requirements. Thus conception is often timed so that births occur in the season of greatest food abundance, usually spring. The peak conception period is then normally autumn. Cape grysbok (Raphicerus melanotis) and klipspringer (Oreotragus oreotragus) in the western Cape can lamb at any time of the year but most births occur in the late winter, spring and early summer. As in many seasonally breeding ungulates, males exhibit seasonal variations in reproductive and associated behaviour. The frequency of courtship and scent marking behaviour in captive grysbok males reaches a peak in the autumn, thus coinciding with the expected peak conception period. We suggest that spring is the optimal birth season for large herbivores in fynbos because it offers the most favourable combination of adequate water availability, moderate temperatures and active plant growth.

15h20 20. LITTER FALL IN THE GROENKOP FOREST, GEORGE.

C.J. Geldenhuys & J.M. Theron, Saasveld Forest Research Station, George and Faculty of Forestry, University of Stellenbosch.

ABSTRACT

Litter fall in this evergreen forest was collected monthly over four years. Six sites were sampled with four circular traps of 0,25 m^2 at 1 m above soil level. The sites represented a moist forest, two stands of medium-moist forest, and two stands of dry forest. The sixth site represented an old, emergent tree of Podocarpus falcatus in a medium-moist forest (an abnormal stand).

Annual litter production averaged between 3164 kg/ha for dry forest and 4725 kg/ha for moist forest. The litter was composed of 80% leaves, 14% twigs and bark, 5% flowers and fruit, and 1% faunal material. The Podocarpus site produced 6000 kg/ha, composed of 57%, 33%, 7% and 3% of the respective components. Leaf fall peaked during Dec. - Feb., twig/bark fall between Apr. - Aug., while flowers/fruit fall occurred during Feb. - May and Sep. - Dec. Leaf fall of the deciduous Canthium mundianum peaked during Aug. - Oct.

15h30 - 15h50 T E A

15h50 21. LITTER-FALL UNDER COASTAL SCRUB ON THE CAPE FLATS.

A.B. Low, Cape Flats Nature Reserve, University of the Western Cape.

ABSTRACT

Litter-fall under five coastal scrub (strandveld) species on the Cape Flats was examined at four-weekly intervals over a period of two years. In all cases leaves (*Rhus crenata* = 5,28 - 47,72, *R. glauca* = 3,08 - 40,76, *R. lucida* = 2,68 - 114,72, *Euclea racemosa* = 2,60 - 45,24 and *Olea exasperata* = 2,84 - 32,32 $gm^{-2}wk^{-1}$) comprised the bulk of the litter-fall. Mean totals were in the order of 287, 269, 324, 220 and 112 $gm^{-2}y^{-1}$ respectively.

Each genus demonstrated specific seasonality with respect to leaf-, flowering structure- and fruit-, but not twig-fall. Reasons for this seasonality are discussed.

16h00 22. LITTER PRODUCTION AND DECOMPOSITION.

F. Coley, Department of Botany, University of Cape Town.

ABSTRACT

Data are presented showing seasonal variation of litter collected from three species (*Leucospermum perile*, *Protea repens* and *Thamnochortus punctatus*), and via random litter traps, in coastal fynbos. Litter decomposition of the above three species is shown and comparative data of litter input and decomposition of *Protea repens* in both coastal and mountain fynbos are presented. Changes in lignin and phosphorus content of litter are also shown.

16h10 23. NITROGEN CYCLING IN COASTAL FYNBOS: CLIMATE AS A REGULATING FACTOR.

W.D. Stock & O.A.M. Lewis, Department of Botany, University of Cape Town.

ABSTRACT

Environmental factors predominating in a region control the distribution of biological organisms and the range of biochemical processes involved in ecosystem function. This paper explores characteristics of the mediterranean climate type present in the S.W. Cape and its effect on N cycling processes in Coastal Fynbos. Wet and dry N precipitation inputs to the ecosystem are controlled by hydrologic inputs with the greatest quantity of N being deposited in association with precipitation during the winter months.

Soil mineral N accumulation relates to successional age of the community and seasonal influences are not detectable using point in time samples as used in this study.

Simulation of soil organic N mineralization reveals that water and temperature are the factors controlling N production. Interaction of these factors enhances or depresses the rate of mineral N production and maximum N mineralization is thought to occur in autumn and spring when conditions of soil moisture and temperature are optimal.

16h10 23..... Thamnochortus pantatus, a member of the Restionaceae has been studied and it appears that these plants are successful at internally recycling N for vital functions required in the life history of the plant, many of which are seasonally controlled.

16h20 24. SEASONAL VARIATIONS IN SOILS PHOSPHORUS IN COASTAL FYNBOS.

G. Brown, Department of Botany, University of Cape Town.

ABSTRACT

The seasonal patterns of changes in levels of the various forms of phosphorus and Organic Matter, moisture content, temperature and pH are presented. Resin extractable (available) phosphorus was the only form of phosphorus which varied seasonally, and occurred in the surface 10 to 20 cm of the soil profile. Soil temperature was the only physical parameter which varied significantly.

Resin extractable phosphorus reached a summer surface maximum of 4,3 μg Pg^{-1} dry soil which decreased to less than 1 μg g^{-1} dry soil in winter.

Soil temperature reached a mean maximum of 38^{o}C at the surface in SUMMER declining to 22^{o}C in WINTER.

The levels of resin extractable phosphorus were found to be related (via multiple linear regression) to soil moisture and temperature in the surface layers of the soil. As physical mineralisation of organic compounds appear not to occur, microbial mineralisation is thought to be responsible for this increase - resin extractable phosphorus.

16h30 25. SEASONAL CHANGES IN BIOMASS AND PHOSPHORUS IN LEUCOSPERMUM PARILE.

S.M. Jongens-Roberts, Department of Botany, University of Cape Town.

ABSTRACT

Whole-plant studies have been completed on a seed-regenerating proteoid species, Leucospermum parile, from 2 and 6 year old populations respectively, at the Pella Intensive Study site.

L. parile has a sparse tap root system (estimated by means of a proportional sampling method) which develops rapidly during the first two years of growth. The canopy accounts for most of the total plant biomass and the tap root for most of the root biomass in 6 year old plants. Major root growth of lateral and proteoid roots takes place during the moist winter/spring months which is out of phase with the summer canopy growth period. A steady increase in tap root mass occurs throughout the year. New proteoid roots may be produced whenever soil moisture is sufficient and the duration of these roots is 2-3 months. Proteoid roots predominate in the 0-30 cm soil levels during moist periods, but are found as deep as 70-80 cm during summer dry periods.

16h30 25..... The distribution of phosphorus in L. parile varies considerably during the growth cycle. In winter/spring lateral and proteoid roots reflect higher P concentrations than at other seasons which may indicate that maximum uptake of available P from the soil takes place at this time. Vegetative buds, flower buds, seeds and young shoots are strong "sinks" for phosphorus. The highest canopy P levels are found in developing flower buds (1,0 - 1,2 mg g^{-1} P) during winter and in mature seeds (5,0 - 6,0 mg g^{-1} P) in spring. The seasonal trends in phosphorus and biomass distribution in the whole plant are demonstrated.

PHENOLOGY IN THE S.E. CAPE

S.M. Pierce, Department of Botany, University of Cape Town.

ABSTRACT

The eastern Cape provides a convenient, situation of several vegetation types occurring on different substrates (Bokkeveld Shale, TMS, Recent Sand) within a small enough area to have a similar climate. Detailed studies on 27 species and 140 phenological observations were made to: determine phenophases of different growth forms; to test for temporal partitioning; and to suggest management plans for grasslands in the Humansdorp area.

Phenology of species occurring on more than one substrate allowed for determination of effect of substrate on phenophases. A range of growth forms including broad-leaved, sclerophyll, thicket shrubs, small leaved sclerophyll shrubs, geophytes, herbs and C_3 and C_4 grasses showed phenology to be similar across different substrate types. A slightly earlier response in phenophase was apparent for certain species occurring on shale, which may be related to soil moisture.

Temporal partitioning of resources within and between growth forms as a mechanism for maintaining species diversity was tested by means of phenology of members of growth forms such as graminoids; (restioids, sedges, C_3 and C_4 grasses); broad-leaved sclerophyll thicket shrubs; proteioid shrubs; small leaved sclerophyll low shrubs; geophytes; herbs and succulents. Results show distinct differences between growing seasons of C_3 and C_4 grasses and between C_4 grasses. Restioids tend to grow in the wettest months which also coincides with the growth season of many C_4 grasses studied. Proteioid shrubs grow in summer while broad-leaved sclerophyll shrubs show growth in early winter, as well as a summer peak. Implications of resource partitioning and sharing are considered.

Management of E. Cape fynbos and non-fynbos communities entails veld burning for grazing purposes. Phenology of important species (Themeda) and "pest plants" provide the same information for suggesting veld burning regimes for optimal results.

EARLY PASTORALISM IN THE S.W. CAPE.

A.B. Smith, Department of ARchaeology, University of Cape Town.

ABSTRACT

The known distribution of prehistoric archaeological sites is at variance with information on the historical distribution of herders in the Swartland and Strandveld. The reasons for this are only partially due to limited archaeological survey. More important is probably differential accumulation of cultural material throughout the area. The proposed project is to try to fill in the archaeological "void" by using potential resource availability, i.e. pasture and water, as a guide to prehistoric land use.

APPENDIX II

PHENOLOGY IN THE FYNBOS BIOME - 4th ANNUAL RESEARCH MEETING OF THE FYNBOS BIOME PROJECT, 11th JUNE 1982.

At this stage, almost the entire extent of the Fynbos Biome has been covered by phenological projects, from the W. Cape (Le Roux), the S.W. Cape (Glyphis, Durand, Kyriacou, Boucher, Sommerville, Low, Milton, Le Maitre, Kruger), along the S. Cape (Bond) to the S.E. Cape (Pierce). Some of this work was reported on at the Research Meeting. Periodicity studies have also been done in outlier areas to the Fynbos Biome : in Namaqualand (Van Rooyen et al, 1979), in the Little Karoo (Perry) and in the E. Cape (Palmer, 1982.)

An outcome of the meeting was the destruction of the myth that fynbos grows in summer, which is out of phase with the present mediterranean climate. The myth probably arose as an exaggeration of Levyns' (1964) vague statements concerning "several members" of the Cape flora which showed a summer growth rhythm "strangely ill-adapted to the present dry summers". A few overseas authors have gone to the extent of using this out-of-phase, summer growth as evidence of the recent onset of a mediterranean climate in the Cape. Firstly however, recent phenological data shows that the majority of fynbos species do not grow in summer. Secondly, the unreliability of the evidence is shown by the example of the two subtropical species, Sideroxylon inerme and Pterocelastrus tricuspidatus which grow in winter in the E. Cape, not in summer as would be predicted from their tropical origins. Furthermore, in the case of fynbos elements which do grow in summer, it may be factors other than macroclimate which determine the timing of growth. Growth is only one of many interrelated phenophases and it may be flowering, pollinators, dispersers or some other factor such as C fixation which is the determining factor.

To date, most of the phenology undertaken has been of a fairly descriptive nature, with broad inferences drawn between phenophases and climate. Lieth (1974) defined phenology as "the study of the timing of recurring biological events, the causes of their timing with regard to biotic and biotic forces and the interrelation among phases of the same or different species". In terms of this definition, most present work is inadequate, fulfilling only the first requirement. A synthesis is to be compiled on all phenology carried out within the Biome to supplement this information by determining the interrelations among phases of the same or different species. The synthesis will attempt to describe patterns, standardize methods and compare trends within the fynbos, with those in other mediterranean-type ecosystems. It will also indicate gaps in our knowledge and provide direction for future research. Apparent already is the need for more detailed case studies on causal relations between phenophases, such as the phenology of fynbos species correlated to water relations by Sommerville and soil and plant nutrients (Brown, Jongens, Stock). Also needed are studies on periodicity and rooting behaviour, pollinators and dispersers.

The ultimate aim of the Fynbos Biome Project is that of management. Detailed ecophysiological studies and parameters such as seed germination requirements, seed storage and viability and age at which plants flower, are required as complementary information before phenology can serve as an effective tool in management.

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