6TH ANNUAL RESEARCH MEETING OF THE FYNBOS BIOME PROJECT

Room 104, C G V Schumann Building, University of Stellenbosch
on 26 June 1984

6DE JAARLIKSE NAVORSINGSVERGADERING VAN DIE FYNBOSBIOOMPROJEK

Lokaal 104, C G V Schumann Gebou, Universiteit van Stellenbosch
op 26 Junie 1984

NATIONAL PROGRAMME FOR ENVIRONMENTAL SCIENCES
(TERRESTRIAL ECOSYSTEMS SECTION)
NP14/106/9L-5

FYNBOS BIOME PROJECT: SIXTH ANNUAL RESEARCH MEETING

PROGRAMME FOR RESEARCH MEETING TO BE HELD IN LECTURE THEATRE 104, C V G SCHUMANN BUILDING, UNIVERSITY OF STELLENBOSCH, ON TUESDAY, 26 JUNE 1984

08h00-08h30 REGISTRATION, POSTER ASSEMBLING AND COFFEE

08h30-08h40 WELCOME - Professor A A Theron (Department of Soil Science, University of Stellenbosch)

08h40-09h00 INTRODUCTION - Mr B J Huntley (CSIR)

SESSION 1 CHAIRMAN - Professor E J Moll (Department of Botany, University of Cape Town)

09h00-09h20 Palaeoecology - a report on research in the fynbos area
Mr Anton Scholtz (Department of Archaeology, University of Stellenbosch)

09h20-09h50 Australian heath and Cape fynbos: similarities & differences
Dr R M Cowling (Department of Botany, University of Cape Town)

09h50-10h10 Season of burn in western Cape fynbos
Mr D le Maitre (Jonkershoek Forestry Research Centre, Department of Environment Affairs)

10h10-10h30 Aspects of pollination biology in the fynbos biome
Mr A Rebelo (PFIAO, University of Cape Town)

10h30-11h00 **TEA**

SESSION 2 CHAIRMAN - Mr F J Kruger (SAFRI, Department of Environment Affairs)

11h00-11h20 Soil nitrogen in Coastal Fynbos
Mr W Stock (Department of Botany, University of Cape Town)

11h20-11h40 Fynbos vegetation: the cause of black water lakelets
Mr A J Gardiner (Department of Zoology, University of Cape Town)

11h40-12h00 Plant water relations at the arid fynbos succulent Karoo boundaries
Mr J Miller (Jonkershoek Forestry Research Centre, Department of Environment Affairs)

12h00-12h20 Aspects of biological control of invasive biota in the fynbos biome
Dr R Kluge (Plant Protection Research Institute, Stellenbosch)

12h20-12h40 Human and cost factors in Renosterveld conservation
Mr C MacDowell (School of Environmental Studies, University of Cape Town)

12h40-13h00 Concluding Comments

13h00-14h00 **LUNCH**

POSTER SESSIONS

14h00-14h10 Introductory Instructions

14h10-15h00 Viewing Session I
Convener: M L Jarman

15h00-15h15 Discussion

15h15-15h45 **TEA**

15h45-16h45 Viewing Session II
Convener: E Moll

16h45-17h00 Discussion

17h00-18h00 **COCKTAILS**

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POSTER ABSTRACTS

Alien plant regeneration at Pella
Beeston P
Department of Botany, University of Cape Town, Private Bag, RONDEBOSCH, 7700

ABSTRACT

The methods used in clearing and enumeration of aliens at the Pella Research Site are outlined. Results of alien density and species distribution to date are depicted in a table and in diagrams. The 1984 results are compared to those of Brownlie (1982), whose study included alien infestation on the site from 1938-1979. Future research to be completed in the project is described.

Pollination vectors of P. Repens (L.) L
Coetzee J H & Giliomee J H
Department of Entomology, University of Stellenbosch, STELLENBOSCH, 7600

ABSTRACT

The inflorescence of Protea repens (L.) L is the host of 45 insect species, of which 32 belong to the order Coleoptera. Individuals of Chirodica calcoptera and C. wollostoni (Halticidae) together have 70 percent of the total number of flower visitors represented. Formicidae and Apidae are also regular visitors to the inflorescence. The group of visitors feed on nectar and pollen, but some are also predatory. Pollen is found on the bodies of all kinds of beetles as well as on members of the family Apidae, but no pollen is found on the Formicidae.

The role played by birds and insects was investigated by covering certain flower buds with gauze and wire. Birds were kept away from the inflorescence by the wire casing whilst insects had free entry and the gauze kept out the insects as well as the birds. By means of this field experiment, it was ascertained that insects visiting the inflorescence can also act as pollinator vectors. Seed setting does not increase if the birds are also allowed to reach the flowers.

The "fynbos-like archipelago" : A component of a Trans-African Shrub/Scrub/Forest Mosaic Belt

Correia R I
PU-NTC Institute for Ecological Research, PU for CHE, POTCHEFSTROOM

ABSTRACT

The in-loco observation of the clear mosaic pattern of the vegetation between Kleinbrak River, Outeniqua Pass/Uniondale and Knysna, coupled with the image of a similar occurrence in Angola and also in the Eastern Transvaal, and a recent visit to a true patch of forest at Kirstenbosch surrounded by fynbos, pave the way to the realization that such discontinuous patches were part of a system linked to the physiography and climate of the escarpment zone of Africa, running from Ethiopia south to Cape Town by the eastern side and northwards widely discontinuous by the western side up to Cameroon.

The system, which is here referred to as "a mosaic of a shrub/scrub/forest" is identified with the strongly moved topography, including folded mountains and faults, creating contrasting micro-climates and soils.

The main three components of the mosaic are:

1. the "Ericoid Shrubland"
   (fynbos type, at higher altitudes in north and reaching sea level in the south due to difference in latitude and other factors);

2. the Transitional and/or ecotonal Scrub - Forest
   (with different facies including "Valley Bushveld" and the "Olea/Euclea/Rhus" scrub in the south); and

3. the Sub-Tropical - Montane (Temperate) Forest
   (very well characterized throughout by Ilex, Podocarpus, Kiggelaria, Halleria, Apodytes, Rapanea, etc)

Especially conditioned by physiography, micro-climate, mist and sea currents the proportion of the areas covered by the "Ericoid" and by the Forest elements inside the Mosaic respectively increase and decrease from north to south.

Further it is realized that the "Ericoid (fynbos) formation" in Southern Africa, due to its extention forms its own mosaic inside the general mosaic.

Reclamation of disturbed fynbos sites

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N Romoff
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ABSTRACT

The aim of this recently initiated project is to identify or develop procedures for the re-establishment of an indigenous plant cover on disturbed sites within the Fynbos Biome, with particular reference to roadsides.

A four-pronged approach is being adopted, consisting of:

1. An intensive literature survey

2. An investigation of existing experiments and revegetation attempts involving fynbos re-establishment

3. An evaluation of revegetation efforts carried out by the Roads Authorities, to determine the success or otherwise of indigenous vegetation establishment

4. A programme of experiments set up on disturbed sites to investigate various fynbos harvesting and establishment techniques

Information resulting from these investigations can be incorporated into Roads Department's specifications for new construction and rehabilitation works, but will also be relevant to areas disturbed by other means such as mining and development activities.

The effects of afforestation and clearfelling on a mountain stream

Day J A, King J M, Davies B R, Hawker P A & Stewart B A
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ABSTRACT

Many mountain catchments in the fynbos biome of the south-western Cape, South Africa, have been cleared of natural vegetation and planted with commercial timber crops, mostly the pine Pinus radiata. Biesievleirivier, a 27 ha sub-catchment of the Eerste River in the Jonkershoek Valley, is one such catchment (see poster on Langrivier, an adjacent catchment with natural vegetation).

Pinus radiata was planted in Biesievlei 25 years ago and stream discharge has decreased with growth of the trees to a 1983-level of about 0,009 m^3 sec^{-1} in winter (Directorate of Forestry data). Felling of riparian pines was carried out in February-March 1984 and this will be followed by clearfelling of the rest of the catchment in 1985. Some indigenous trees, notably the wild almond, Brabejum stellatifolium, remain in the riparian zone, but these are diseased and sickly. The small stream, with a mean width of 0,50 m and depth of 40 mm, is almost choked with decaying pine debris, including a large amount of timber. The substratum is silt to coarse sand (2,0 mm and smaller) in which a few pebbles are mixed.

Before clearfelling the riparian pines, some differences in water quality between Biesievleirivier and the adjacent undisturbed Langrivier, were apparent. Nutrient levels were higher in Biesievleirivier (NO_3-N, 10-30 μ mol 1^{-1}; PO_4-P, 0,5-2,0 μ mol 1^{-1}; SiO_3-Si, 5^3-30 μ mol 1^{-1}) as were levels of total alkalinity (0,3-0,4 μ mol 1^{-1}), conductivity (100-140 uS cm^{-1}) and total dissolved solids (60-110 mg 1^{-1}). Dissolved oxygen levels were generally lower (80-90% saturation) and water temperatures marginally higher (11,5-20,0°C), but pH levels were similar in both catchments.

The aquatic fauna consisted almost entirely of low numbers of the amphipod, Paramelita nigroculus, which seems to be characteristic of slowly-trickling waters in the mountain areas, and an occasional chironomid and simuliid.

Riparian trees were cleared only in February-March 1984. Two immediately obvious effects have been a slight increase in streamflow (the normal seasonal trend will have to be taken into account here) and an increase in the fine sand and silt fractions of the substratum. The organic content of the coarser fractions of the substratum has roughly doubled, from 10% or less (by weight) to 20-35%, while in the finer fractions, the organic content has increased from about 25% to 40%.

It is unlikely that streamflow will increase enough to scour the accumulated sediment from the stream bed, but when clearfelling is completed we expect the substratum to become much coarser and the organic content to drop to the low levels found in other very small catchments in mountain fynbos.

Biocontrol of Acacia longifolia

Dennill G B and Gordon A J
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ABSTRACT

A gall wasp, Trichilogaster acaciaelongifoliae was introduced from Australia to South Africa for biocontrol of Acacia longifolia. Comparisons of galled and ungalled branches showed that seed production was reduced by 99% and 95% at two sites. Correlation of percentage infested branches per tree and seed production per tree showed that seed production of trees was reduced by 85% when more than 50% of the branches on a tree were galled. In addition, galling suppressed vegetative growth markedly. Wasps have been released at 100 sites in the south-western Cape, such that each major recorded A. longifolia infestation is within a 10 km radius of a release point.

Research Plans for Population Genetics: Nuts and Bolts of Plant Conservation

Hall A V
Bolus Herbarium, University of Cape Town, Private Bag, RONDEBOSCH, 7700

ABSTRACT

The practical application of population genetics is a neglected aspect of the conservation of rare plants. Much of the present theory of the conservation of genetic variability rests upon data from animal populations, chiefly livestock and the fruit-fly, Drosophila. Among plants there are numerous puzzling departures from theory. Some plants are obligately self-fertilized, surviving massive inbreeding with great success. Others appear to be naturally confined to isolated natural poplations of a few tens of individuals, again apparently surviving what in animals would be strong inbreeding-depressing of fitness. The South-Western Cape, with its many rarities is a splendid area for exploring these and related questions. A co-operative research programme for this, based at Bolus Herbarium, is outlined. It is expected to provide some assistance in planning rescue and long-term survival actions for populations of rare and threatened plants.

What are the characteristics of a stream in mountain fynbos?

King J M, Day J A, Davies B R, Hawker P A & Stewart B A
Zoology Department, University of Cape Town, Private Bag, RONDEBOSCH, 7700

ABSTRACT

Fynbos is the sclerophyllous indigenous vegetation of the south-western Cape Province of South Africa. Mountain fynbos occurs on sandstone and granitic mountain slopes, on soils that are characteristically porous, acidic and low in nutrients. The vegetation has many mechanisms for coping with the low nutrient levels, including slow growth, retention of leaves for more than one year and the production of secondary compounds which can deter feeding herbivores. The character of the aquatic systems in the fynbos biome reflect the strong influences on them of the surrounding soils and vegetation (see also poster by A J C Gardiner on blackwater vleis in fynbos).

The catchment of Langrivier, a tributary of the Eerste River is 245,8 ha and receives a mean annual rainfall of 2 129 mm (Directorate of Forestry data). It lies on State Forest land in the Jonkershoek Valley, and having been protected from fire and other interference since 1943, it bears mature mountain fynbos. The stream is perennial, with a flow pattern of high discharges in winter (0,4 m^3 sec^{-1}) and low in summer (<0,3 m^3 sec^{-1}), that is typical of the winter rainfall area. The bedrock of the stream is partly strewn with boulders, some small pebbles and coarse sand.

Marginal vegetation is absent and the rare aquatic plants consist largely of mosses and small ferns. The water is highly potable, light brown in colour and very low in nutrients (PO -P 0,5 µ mol 1^{-1}; NO_3-N <10 µ mol 1^{-1}; SiO_3-Si <3 µ mol 1^{-4}). Other chemical variables are also very low (e g total alkalinity, 0,02 m mol 1^{-1}; conductivity, 20-60 µS cm^{-1}; total dissolved solids, 10-50 mg 1^{-1}), and pH levels as low as 4,3 have been recorded. Annual water temperatures range between 8-19°C, and dissolved oxygen levels are always close to saturation. Movement of particulate organic matter in the water as CPOM (>80 um) and FPOM (<80 um) is low during winter despite high current speeds, and increases during summer. Exports of CPOM (0,02-0,26 mg 1^{-1}) and FPOM (up to 0,03 mg 1^{-1}) are of the same magnitude as those recorded in afforested streams in the northern hemisphere.

A canopy of riverine trees covering the stream is the source of most energy input in the form of leaf litter. Unlike forests in the northern hemisphere, with their autumunal leaffall, litterfall from these trees occurs in summer, at which time peak levels of allochthonous detritus are found on the river bed. Most of this is swept away as discharge increases in autumn, with the main retention mechanism being leaf packs that form behind and between boulders. The aquatic invertebrates are diverse in species but relatively low in numbers, probably because of the high frequency of spates. Most appear to be detritivorous (see also poster by J M King on life cycles of invertebrate detritivores in the stream), and are thus largely dependent on the input of leaf litter; many species are endemic to the fynbos biome.

Though leaf litter from fynbos generally decomposes notoriously slowly (years rather than weeks), leaves from riparian trees can be completely processed by the aquatic fauna in a little as 4-6 weeks. However, the animals either cannot, or preferentially will not, process leaves of some tree species, such as the alien oak, Quercus robur (see also poster on afforestation of a fynbos catchment with Pinus radiata).

An experimental design for plant succession with particular reference to bird-dispersed species

Knight R
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ABSTRACT

In many ecosystems of the world birds play important roles as the dispersers of angiosperms, and in so doing contribute to successional processes. In the fynbos biome, both coastal littoral and the thicket/forest vegetation are dominated by woody species possessing fleshy fruits. Since these fleshy fruits are mostly small, they are normally associated with bird-dispersal. An experimental design is presented for determining the importance of bird-dispersed species in plant succession, and the importance of perch sites for promoting recolonization of these species.

Reproductive strategies for plant species occurring in fynbos

Knight R
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ABSTRACT

This study investigates the floristic similarity of coastal fynbos, mountain fynbos, strandveld, renosterveld and afromontane thicket/forest vegetation types. Key species representing each of these vegetation types are determined using information statistic tests. These key species are then investigated in terms of bird, ant and wind-dispersal agents.

Microbial ATP, CO_2 evolution (for biomass determination) and populations of nitrifying and nitrate-reducing microorganisms in two Swartbosch Kloof soils

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ABSTRACT

Microbiological studies have been conducted with a Clovelly and a Glenrosa soil (derived from sandstone and granite, respectively) from beneath Protea neriifolia on similar sites in Swartbosch Kloof. Microbial ATP and populations (MPN) of nitrate-reducing microorganisms have been consistently higher in the Glenrosa than in the Clovelly soil (sampled monthly March-May); CO_2 evolution from non-fumigated and chloroform-fumigated soils (for biomass determinations) and populations (MPN) of denitrifying bacteria have usually been higher in the Glenrosa soil. No autotrophic denitrifying bacteria have been detected in any of the samples. Factors for the conversion of ATP and respired microbial carbon values to microbial biomass have to be determined by the use of internal standards (microbial cells added to the soils), as there is a discrepancy in the biomass results (also reported by others) if the usual factors are used. The pH values of the two soils were similar (pH 4,83 - 5,06 in water).

A Renosterveld conservation case study
McDowell C
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ABSTRACT

To plan and establish a Renosterveld reserve: the critical factors ...

A chronological description of an applied conservation case-study whereby the steps taken to establish a Renosterveld reserve on privately held land is presented:

1) Threat factor The discovery of the pending destruction of the veld for crop planting by the land owner acts as a stimulus to "spark off" the conservation campaign.

2) Ecosystem value factor Ecosystem attributes are defined for the area to illustrate its conservation merit.

3) Conservation cost factor Independant estimates of realistic purchase or lease costs required for conservation of the area are presented.

4) Fund resources factor Relevant public and private sector conservation authorities are formed into a committee and presented with details of 1),2),3).

5) Land owner factor The land owner is visited by a conservation Sub-committee delegation to determine his needs (the most critical factor) for a conservation settlement.

End result: The veld is saved for at least two years pending a possible financial long-term lease.

Swartboschkloof Burn; 1987
McDonald D J
B R U, P O Box 471, STELLENBOSCH, 7600

ABSTRACT

The Fynbos Biome Project mountain fynbos research site, Swartboschkloof will be burnt in March 1987. Research at this site is encouraged before and after the burn, centered around the theme "Fire and Fynbos ecosystem stability". Main aspects to be considered are effects on (a) stability of vegetation boundaries (b) regeneration strategies among fynbos plants (c) availability of resources in the catchment.

The vegetation of Swartboschkloof
McDonald D J
B R U, P O Box 471, STELLENBOSCH, 7600

ABSTRACT

Swartboschkloof is the mountain fynbos research site of the Fynbos Biome Project. A vegetation survey of the area was required to classify, describe and map the plant communities. The Braun-Blanquet method was used. Two vegetation types were recognized; Mountain Fynbos and forests. Sixteen fynbos communities and five forest communities were identified. The map of the vegetation of Swartboschkloof is presented.

Is fynbos a heathland?
Moll E J
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Jarman M L
Council for Scientific and Industrial Research, University of Cape Town, Private Bag, RONDEBOSCH, 7700

ABSTRACT

The recently expressed view that Cape Fynbos is in fact a heathland, as defined by southern hemisphere ecologists, and not a true mediterranean-type shrubland is elucidated. The coincidental overlap of fynbos in the Cape's mediterranean-type climatic region has been the factor which has led to this confusion, both amongst South African and overseas researchers concerned with mediterranean-type ecosystems. The suggestion is made that researchers, particularly those interested in convergence, should take careful note of this fact. The situation in Australia with respect to heathlands versus true mediterranean-type shrublands also needs to be clarified.

Factors that determine the distribution of lizards in the fynbos ecosystem
Mouton P L N, Mostert D P & Baard E H W
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ABSTRACT

Distribution patterns of lizards in the fynbos ecosystem west of the Cape Folded Mountains, are being examined. To date 33 species have been documented in the study area, the majority of which show well defined patterns of distribution. Both historical and ecological factors seem to be responsible for the observed patterns. The effect of prehistoric geomorphologic and physiographic changes appears more readily observable in the distribution patterns of species showing a high degree of habitat preference as compared to species showing low habitat preference. Thermoregulatory requirements seem to be a limiting factor in the distribution of at least some species, while rainfall, substrate type or vegetation appear to, individually or collectively, limit the distribution of other species. Hypotheses pertaining to observed distributional patterns, where applicable, are being experimentally tested.

Hybridisation and habitat selection in Xenopus laevis and Xenopus gilli

Picker M D
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ABSTRACT

In the Cape of Good Hope Nature Reserve Xenopus gilli occurs sympatrically with X. laevis. Populations of pure X. laevis and X. gilli are each present in 3 of the 14 larger water bodies in the Reserve, with mixed hybrids populations occupying the other 8 water bodies. Each of the 3 taxa are shown to breed in ponds of significantly different pH and water colour (water colour and pH are significantly correlated). Pure populations of X. laevis and X. gilli exist in spite of the ponds being only 1 km apart. Habitat selection is invoked to explain the species distribution. X. laevis occurs characteristically in ponds of extreme habitat disturbance, high pH, and light water colour, with X. gilli occupying ponds of low pH, deeply pigmented water, and undisturbed production by man of intermediate habitats.

Extraction of water from mountain-top cloud by fynbos vegetation

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ABSTRACT

Research work on the availability of water in mountain catchments has primarily been concerned with rainfall as being the sole source of moisture contributing to the water balance of such areas.

The aim of the present study is to establish whether fynbos vegetation extracts moisture preferentially from mountain-top cloud (mist) and/or the unsaturated atmosphere with high relative humidities.

The amount of mist precipitation extracted by certain plant species which reaches the ground via plant-drip and stem-flow is considered.

Five experimental sites have been selected for the study on the Back Table of Table Mountain . Direct observations of any moisture extraction by particular plants in situ were made.

Measurements taken include air temperature, relative humidity, wind speed and direction, leaf temperatures, catch in rain-gauges and fog-catchers, plant-drip and stem-flow quantities.

Results to date have revealed that moisture extraction is more from a physical interception of mist droplets by the plants than condensation onto the leaves. Tall, fine leaved plants such as Psoralea pinnata being better suited than low growing, broad leaved plants for intercepting this moisture.

Quantitative measurements of plant-drop and stem-flow show a definite increase in the amount of water reaching the ground beneath plants in comparison to unvegetated control plants.

These results indicate the importance of taking mist precipitation, which is not recorded in standard rain-gauges, into consideration when studying the moisture availability in mountain-catchments.

Germination of fynbos species

Van de Venter H A & Esterhuysen A
Margaretha Mes Institute for Seed Research, University of Pretoria, PRETORIA, 0002

ABSTRACT

Studies were conducted on germination of Erica sessiliflora, E. hebecalyx and Watsonia fourcadei.

All three species showed low temperature optima for germination. This phenomenon is strategically beneficial, ensuring maximum germination during winter when sufficient moisture is available for successful establishment.

Although no absolute requirement for light was found, germination of E. hebecalyx and W. fourcadei was stimulated by light while it proved to be slightly inhibitory in the case of E. sessiliflora.

Application of gibberellic acid had a decided beneficial effect at higher temperatures. A tendency of GA_3 to inhibit germination at low temperatures suggests formation of this compound under these conditions.

Significant interactions were found between temperature, light, seed age and gibberellic acid.

Fire behaviour in fynbos vegetation

Van Wilgen B W & Le Maitre D C
Jonkershoek Forestry Research Centre, Private Bag 5011, STELLENBOSCH, 7600

ABSTRACT

Fire behaviour data from 14 fynbos fires are presented. Measured flame lengths, rates of spread and fire intensity are compared to predictions from Rothermel's fire model. Comparisons with fire behaviour data from other shrubland vegetation types are also presented for comparison.

Variations in the availability of different forms of Phosphorus and Nitrogen added to Clovelly soil at Pella in relation to wheat seedling growth

Witkowski E T F and Mitchell D T
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ABSTRACT

Wheat seedlings (c v Vernal) were grown under environmental control conditions in polystyrene cups containing Clovelly soil from Pella. After seven days, the soils were fertilized with either 1,0 g P m^{-2} (KH_2PO_4, Ca_3 $(PO_4)_2$, Ferric orthophosphate or sodium-inositol phosphate) or 10 g N m (KNO_3, NH_4 Cl, NH_4 NO_3 or Urea). Pots were watered to maintain holding capacity. The pots were harvested 94 days after sowing. The soils were analyzed for available phosphorus (resin-extractable and Bray No 2), total phosphorus, ammonium, nitrate, total nitrogen, pH and organic matter. Shoot and root dry weights, phosphorus and nitrogen contents were also analyzed and related to each fertilizer treatment. The wheat seedlings responded best to the additions of the more available forms of phosphorus salts.

Sandveld-Swartland environmental inventory

Gasson B
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ABSTRACT