AN ANALYSIS OF THE EDUCATION POTENTIAL OF SITES IN THE CAPE PENINSULA FOR SECONDARY SCHOOL FIELD-WORK IN ENVIRONMENTAL STUDIES

by

CHARLES S. NIGHTINGALE

Submitted to the University of Cape Town in part fulfilment of the requirements for the degree of Master of Arts in Environmental Studies October, 1977

ABSTRACT

In South African secondary schools much less fieldwork is undertaken than in a number of other countries despite fieldwork being required by some school syllabuses and the fact that, in many areas, suitable sites are ready to hand. In an attempt to assess the nature of future demands for fieldwork sites, this study reviews developments in education which lead to increasing emphasis on teaching outside the classroom, and the reasons why so little fieldwork is being done are analyzed. A methodology is developed for selecting fieldwork sites taking into account educational priorities and practical constraints. This is worked out in practice by drawing up a fieldwork syllabus for a particular school, and selecting sites in the Cape Peninsula for field studies. Finally, the educational potential of a sample of these sites is indicated by means of exercises prepared for secondary school children.

PREFACE

This study, undertaken as part of the requirements of a Masters Degree in the School of Environmental Studies at the University of Cape Town, comes at a time when efforts are being made to establish fieldwork in schools in South Africa and when the need for Environmental Education is being more widely recognized. It is hoped that it will make a practical contribution to education in this country.

In some countries fieldwork has been regarded for many years as an integral part of the teaching of such subjects as Geography and Biology; but, despite a long history, environmental education is an emergent concept in the early stages of its development. It has received little attention in South African secondary schools, but there are indications of a growing interest in environmental education on the part of some educational authorities in this country.

In the first section of this study an attempt is made to set out a system whereby sites can be selected for fieldwork in a particular area, in this instance the Cape Peninsula. The intention is not to make a detailed listing of possible sites for field studies in the area, but rather to provide a methodology for the selecting of sites, and, having made the selection, to indicate their educational potential by means of exercises prepared for secondary school pupils. An attempt has been made to validate a fieldwork syllabus taking into account not only the material presently taught in secondary schools in this country, but also possible developments in environmental education.

Though a large literature exists on fieldwork and on environmental education, little has been written about the criteria for the selection of sites in the outdoors. This was confirmed by a literature search and by corresponding with a large number of individuals and organisations involved in fieldwork in several countries.

The writer gratefully acknowledges the suggestions and critical appraisal of Prof. R. Fuggle who supervised the project, and the help of Dr. J. Grindley, particularly with regard to the biological aspects of the study. Mr. W. Diepeveen has been a constant source of encouragement to the writer and others involved with the promotion of fieldwork. Teaching colleagues who have made helpful suggestions include Mrs. H. Isaacs, and Messrs. H. Symonds and N. Veitch. I am grateful for the skill of Mr. Behr who drew the diagrams, Miss J. Brandt, Mrs. J. Paul and Mrs. J. Muller who

typed this report, and Mrs. O. Nightingale who assisted with the proof reading.

TABLE OF CONTENTS

CHAPTER 1.	INTRODUCTION		1
1.1.	The Problem		1
1.2.	The Objectives		1
1.3.	The Approach		1
CHAPTER 2.	ENVIRONMENTAL EDUCATION IN SCHOOLS		5
2.1.	Towards a Definition of Environmental Education		5
2.2.	The Aims and Objectives of Environmental Education		8
2.3.	Environmental Education and Fieldwork		10
2.4.	A Survey of Environmental Education in Selected Countries		11
	2.4.1.	Early beginnings	11
	2.4.2	Environmental education in Great Britain	11
	2.4.3.	Environmental education in the U.S.A.	11
	2.4.4.	Environmental education in Australia	12
2.5.	Environmental Education in South Africa		14
	2.5.1.	Environmental education in South African schools	14
	2.5.2.	Government institutions providing for education in the outdoors	17
	2.5.3.	The role of private organisations in environmental education in South Africa	17
	2.5.4.	The future of environmental education in South African schools	19
CHAPTER 3.	FIELDWORK IN SCHOOLS		22
3.1.	Fieldwork - A Definition		22
3.2.	The Aims and Objectives of Fieldwork		22
3.3.	The Two Main Approaches to Field Studies		26
	3.3.1.	The traditional fieldwork approach	26
	3.3.2.	Field research	27
3.4.	Conclusion		29

CHAPTER 4. PRESENT CONSTRAINTS ON FIELDWORK IN SCHOOLS 30

4.1. Logistic Constraints 30

4.1.1. Limitations imposed by time 30

4.1.2. The cost factor 32

4.1.3. Zoning restrictions 33

4.1.4. Other factors 33

4.2. Educational Constraints 35

4.2.1. The constraints imposed by existing subject curricula 35

4.2.2. The constraints imposed by public examinations 36

4.2.3. Constraints imposed by teachers expertise 37

4.3. Conclusion 38

CHAPTER 5. SELECTING SITES FOR FIELDWORK 39

5.1. Developing a Resource Perception Model 39

5.2. Adapting the Model for the Selection of Sites 39

5.3. Steps in the Selection of Sites 41

5.3.1. The opportunity Factor 41

5.3.2. Determining demand 41

5.3.3. Perception 47

5.3.4. The constraints 47

5.3.5. The resource 48

5.4. The Potential of Selected Sites 48

CHAPTER 6. CONCLUSION 58

REFERENCES 61

APPENDICES 67

APPENDIX A Selection of Fieldwork Exercises for Pupils 67

APPENDIX B Examination Questions on Geographical Fieldwork 153

APPENDIX C Proposed Adapted Standard VIII Geography Syllabus 141

APPENDIX D Assessment of Sites for Outdoor Education 163

LIST OF TABLES

Table 2.1.	Environmental awareness and the school syllabus	15
Table 5.1.	Fieldwork requirements based on subject syllabuses	42
Table 5.2.	Fieldwork requirements based on examination questions	46
Table 5.3.	Fieldwork syllabus, Rondebosch Boys' High School	52

LIST OF FIGURES

Fig. 2.1.	Model of activities related to fieldwork	7
Fig. 3.1.	The two approaches to field studies	25
Fig. 4.1.	Areas in the Cape Peninsula where fieldwork activities are restricted	34
Fig. 5.1.	A model of how an opportunity becomes a resource as applied to the selection of sites for fieldwork	40
Fig. 5.2.	The Cape Peninsula, sites selected for fieldwork	48
Fig. A.1.	Movements while making a pot of tea	70
Fig. A.2.	Flows of pedestrians in a school at change of periods	74
Fig. A.3.	Moving pedestrian count recording sheet	147
Fig. A.4.	Changes in land use with distance from the city centre	148

CHAPTER ONE

INTRODUCTION

1.1. The Problem

In most secondary schools in the Republic of South Africa little or no fieldwork is being carried out despite:

(i) some syllabuses currently in use requiring fieldwork to be undertaken (Joint Matriculation Board, 1977 pp. 279, 282, 284);

(ii) fieldwork being regarded by many educationists as an integral part of enlightened teaching (Long and Roberson, 1966);

(iii) the fact that in many parts of the country opportunities abound for work in the field.

The reasons for this situation are numerous, but one of them is the fact that little work has been done to identify the fieldwork requirements of secondary school pupils in this country, and few attempts have been made to locate local sites suitable for fieldwork.

1.2. The Objectives

The primary aim of this study is to provide a set of guidelines for selecting sites in the Cape Peninsula for secondary school fieldwork in those subjects which handle topics which might be subsumed under the title environmental education.

Secondary objectives are to indicate, by means of specific worked examples, the role that fieldwork can play in both environmental education and specific related subjects and to illustrate how the educational potential of particular sites can be utilized.

1.3. The Approach

In order to achieve these objectives the nature and aims of environmental education and of fieldwork will be considered, together with their role in education (Chapters 2 and 3). The constraints presently operating against the use of the outdoors for educational purposes in South African secondary schools will be examined (Chapter 4). Criteria for the choice of sites for fieldwork will then be devised taking into account not only

educational requirements but also logistical considerations, such as the time and money available for fieldwork. Sites will be selected, and some indication given of the educational potential of these sites (Chapter 5). The appendices contain worksheets prepared for pupils working at some of the selected sites, thus giving a practical demonstration of how these sites can be used.

In undertaking this study not only have the aims and objectives of different disciplines and the subject matter set out in the syllabuses been examined, but a search of the literature on environmental education and on fieldwork has been made in order to establish criteria for the identification of sites. Actual studies have been made on selected sites in order to assess their fieldwork potential. Worksheets for use in the field have been prepared and used with secondary school pupils in order to validate the choice of sites and to ensure that the material provided is of practical use.

1.4. Sources of Information

Much of the literature on both fieldwork and environmental education has been prepared in England. Fieldwork has been practised in Europe for a considerable period but became commonplace after the Second World War (Diepeveen, 1977, p.147). Considerable research is presently being carried out in Environmental Education in many countries including Great Britain, the United States, Australia and neighbouring Rhodesia.

Journals (most of which are published in the United Kingdom) that contain a wealth of material on fieldwork and environmental education are: Teaching Geography, The Classroom Geographer, Bulletin of Environmental Education, Environmental Education and The Australian Science Teachers Journal. Numerous monographs contain relevant material e.g. Bulletin of Environmental Education Offprints, the Series One Practical Guides of the National Association for Environmental Education, and Teaching Geography Occasional Papers. Books dealing with fieldwork techniques have been consulted, these include general texts: Archer and Dalton, 1968; Cross and Daniel, 1968; Haddon, 1974; Sauvain, 1964; Wheeler and Harding, 1966; Dodd, 1969 ; Briault and Shave, 1960; Hopkins, 1968. Books which specialize in urban fieldwork are: Bull, 1969; Haddon, 1971; Walsch,1971; Briggs, 1970. Texts dealing with fieldwork in rural areas include: Haddon, 1964; Martin, 1973; Walsh, 1971. Books on Biology

fieldwork include: Clark, 1973; Simmons, 1975; Miles, 1974. Texts dealing with environmental education are: Martin and Wheeler, 1975; Ward and Fyson, 1973; Carson, 1971; Unesco, 1974; Watts, 1969; Schools Council, 1974a and 1974b; Martin and Turner, 1972. Most of this literature was published in Great Britain and though some of the material is not directly applicable it has nevertheless been found useful.

Material published in Australia includes articles by Baldock, 1973; McDonald, 1973a and 1973b; Pratt, 1973; Truvan, 1973; Smith, 1975; Andrewartha, 1970; Linke, 1976. And there is a valuable contribution to the literature from Rhodesia; Parker, 1975.

The publication Sourcebook for Environmental Studies (Berry, 1975) is a valuable review of the types and sources of information available in England on environmental education. It lists books, films and other audio visual material, organizations, journals and periodicals under headings such as ecology, field studies, air pollution, and gives the approximate age-range for which the material is best suited. An article in the journal Geography (Wilks, 1973) reviews recent books about fieldwork.

Most of the material on fieldwork which has been written in South Africa appeared in South African Geographer and its predecessor the Journal for Geography. These include articles by: Marker, "School Geography through Fieldwork", September 1970; Morton, "Fieldwork", September 1969; Reinke, "Ekskursies in Geografie - onderrig: Enkele Gedagtes", September 1972; Nicol, "Teaching Settlement Geography", April 1976; Nightingale, "Field Studies - Marine Action and Resultant Landforms", April 1976; Pirie - "Small Town Demography - Pilgrim's Rest Case Study", April 1977.

Literature on the Cape Peninsula of a popular and semi-popular nature is readily available, as are technical publications on the geology, fauna, flora, archaeology and history of the area. The most useful general reference is Mabbutt, The Cape Peninsula, 1952. Among many other references which could be cited are: Davies, Land Use in Central Cape Town, 1965; Collier, Portrait of Cape Town, 1961; Hughes, Walking Through History, 1972; Picard, Gentlemen's Walk: The Romantic Story of Cape Town's Oldest Streets, Lanes and Squares, n.d.; Picard, Grand Parade: the Birth of Greater Cape Town, 1969; Honickman, Cape Town: City of Good Hope, 1966, (a collection of articles covering such topics as Cape Town's history,

architecture, climate). Du Plessis, The Cape Malays, 1972, (their history, religion, traditions, folk tales, the Malay Quarter). Franck et al, District Six, 1967; Levyns, Guide to the Flora of the Cape Peninsula, 2nd rev. ed. 1966; and books by Burman: Where to Walk in the Cape Peninsula, 1967; and Safe to the Sea, 1962; and by L.G. Green, I Heard the Old Men Say, 1964; Tavern of the Seas, 1947, and A Taste of South-Easter, 1971.

Other sources of information on the Cape Peninsula are Doctorial and Masters' Theses and Dissertations written by students of the University of Cape Town, Working Papers of the Cape Town City Council, such as Crime Statistics, and reports and other documents housed in the data bank of the Divisional Council of the Cape.

CHAPTER TWO

ENVIRONMENTAL EDUCATION IN SCHOOLS

What is environmental education? Why should it be taught? Where is this teaching best carried out? Is teaching concerning the environment likely to be given a more prominent place in schools in this country in the future? What forms should environmental education take? These questions are fundamental to this study as the answers will help to determine:

(a) the nature of the fieldwork which should be undertaken and how much emphasis should be placed on field studies.

(b) where fieldwork is best carried out.

In order to provide answers to these questions various definitions of environmental education are analysed and differing views of the form which environmental education should take are discussed. This is followed by a brief review of the provisions made for environmental education in selected countries, with a concluding review of the position of environmental education in secondary schools in South Africa. This discussion forms the basis for an assessment of the present and future need for fieldwork in this country.

2.1. Towards a Definition of Environmental Education

Defining environmental education is difficult for a number of reasons:

First, confusion arises from the variable uses of the term environmental studies. Sometimes it is used as a synonym for environmental education, sometimes to describe a method of study within a particular discipline, and sometimes as the name of a new and developing subject in its own right (Council for Environmental Education, 1970).

Second, the objectives of environmental education vary according to the values and interests of various protagonists, for the aims of conservationists and educationists do not always coincide. Conservationists usually stress the bio-physical elements of the environment while educationists may wish to see a greater emphasis placed on the built environment and social issues. The former are concerned with the quality of the environment whereas the latter focus attention on the need to improve the quality of life (Martin, 1969).

Third, the word environment has different connotations for different

people. To some it means man's bio-physical or natural surroundings, while others see the term as including social interrelationships. The terms natural environment, living environment, human environment and total environment occur in debate about the spirit and purpose of environmental education (Martin, 1975).

The title Environmental Education is considered by the Council for Environmental Education (1970) to embrace environmental studies, environmental science, rural studies and rural science, as well as the use of the environment as a teaching medium. The term outdoor education has wider connotations (see Fig. 2.1), as it includes recreational activities and programmes whose major emphasis is character building and leadership development through exposing pupils to natural hardships (Diepeveen, 1977 p. 54).

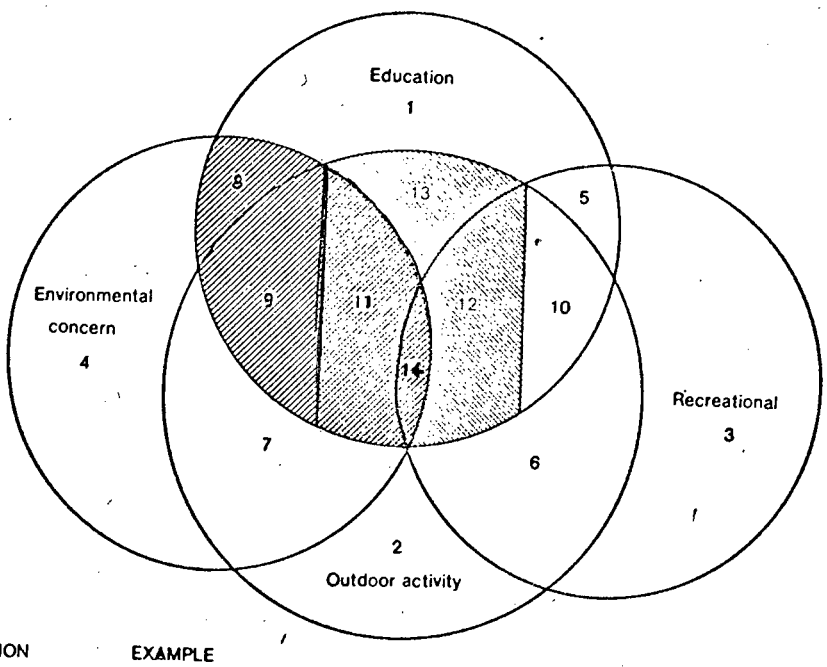
To date the most widely accepted definition of environmental education is that put forward by the International Union for the Conservation of Nature and Natural Resources (IUCN) in 1970:

> Environmental education is the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the inter-relatedness among man, his culture and his bio-physical surroundings. Environmental education also entails practice in decision-making and self-formulation of a code of behaviour about issues concerning environmental quality.

This is essentially a conservationist's definition as are those of others such as Mellowes (1972) and Selby who asked that children be trained to "think conservation" (1970). Martin (1975) claims that until about 1970 environmental education was equated with conservation education.

This environmental ethic has come under attack from two quarters. First, third world spokesmen have charged that this is conservation by, and on behalf, of the middle classes of the developed world (this argument was used at the United Nations Conference on the Human Environment at Stockholm in 1972). Second, some educationists contend that overmuch stress is being laid on the bio-physical elements of the environment and rural areas, they wish to see a greater emphasis on the built environment and on social issues (Ward and Fyson, 1973).

To a large extent these criticisms are being met by extending the concept of environment to include the human environment, the human habitat which is not only a world of objects but also a world of values (Martin,



CLASSIFICATION	EXAMPLE
1. E.	Formal lesson in Mathematics
2. O.	Cycling to school
3. R.	Playing dominoes
4. C.	Preparing propaganda material for 'Save Sandy Bay' campaign
5. E/R	Playing chess
6. O/R	Cycling for pleasure
7. O/C	Participating in Hackia hack
8. E/C	Classroom lesson on pollution
9. E/O/C	Litter clean-up on mountain
10. E/O/R	Playing rugby
11. E/O/C/F	Field study of man's impact on a coastal dune system
12. E/O/R/F	Excursion by canoe down the Berg River, study of stream processes and resulting landforms
13. E/O/F	Field study of the geomorohology of a stretch of coast line
14. E/O/R/C/F	Biology students back-packing along the Otter trail and studying inter-tidal Fauna

E = educational activity O = outdoor activity R = recreation C = environmental concern

9 - 14 Outdoor education Fieldwork Environmental education

NOTE. Nuances of presentation determine the position of some activities in this model

MODEL OF ACTIVITIES RELATED TO FIELDWORK

Fig. 2.1.

1975). Thus the bio-physical view of the environment has been expanded to include a social science element.

A definition of environmental education which would accommodate the views of both the conservationists and the social activists is that contained in the U.S. Environmental Education Act 1970 :

> Environmental education is an integrated process which deals with man's interrelationship with his natural and man made surroundings, including the relation of population growth, pollution, resource allocation and depletion, conservation, technology, urban and rural planning, to the total human environment.
>
> Environmental education is a study of the factors influencing ecosystems, mental and physical health, living and working conditions, decaying cities, and population pressures. Environmental education is intended to promote among citizens the awareness and understanding of the environment, our relationship to it, and the concern and responsible action necessary to assure our survival and to improve the quality of life.

Linke (1976) considers this to be perhaps the most authoritative and comprehensive definition of environmental education and lists a number of authorities such as Helgeson et al, Saveland and Reid as having accepted it as a valid and definitive interpretation of environmental education. This will serve as the working definition for the purpose of this study.

2.2. The Aims and Objectives of Environmental Education

In reviewing definitions of environmental education some statements of intent have inevitably been made, a further discussion of the aims and objectives of environmental education follows.

The definitions given above contain a common core of three essential elements, these were identified in a model proposed by Linke(1976) and are set out in here in a summarized and modified form.

First, and of primary importance is the awareness of the inter-relationship between man and his total environment, and the understanding of both the nature and implications of human impact (Linke, 1976 p. 5). Second, environmental education seeks to promote a concern for the quality of life. Third, environmental education should lead to a commitment to the principle of environmental conservation.

The first of the aims, namely to deepen the pupil's understanding of

the essential oneness of man and his environment is a pressing need, for the population explosion and rising standards of living are greatly increasing ecological demand. It is becoming increasingly apparent that "the two worlds of man - the biosphere of his inheritance, the technosphere of his creation - are out of balance, indeed potentially in deep conflict" (Ward and Dubos, 1972, p. 47), consequently one of "the most critical problems facing humanity today is an ecological one of relating human societies harmoniously to their environments" (Ripley and Buechner, 1971 p. 134). Education has a vital role to play in confronting people with these problems and their implications. Perrot (1975) considers that much of our scientific teaching (and research) should "consider science in relation to the affairs of mankind". By directing attention to real problems and manifestly important issues, education for environmental concern will not suffer, as does so much of our teaching, from appearing to be irrelevant.

This study of environmental issues requires a co-operative and comprehensive interdisciplinary approach, but a holistic and integrative outlook characterizes such established disciplines as geography and ecology, what then would be the distinctive contribution of environmental education to a pupil's education? That which distinguishes environmental education from these other disciplines is the second and third elements listed in Linke's model namely the promotion of a feeling of concern for the quality of life and a commitment to environmental conservation.

Gold (1972) emphasises the importance of the second part of Linke's model when he states that environmental education is a collaboration of disciplines to improve the quality of life. Linke argues that it is the application of the knowledge rather than the knowledge itself that characterizes it as environmental education. Environmental education stands apart from other integrative disciplines in that its central concern is environmental impact and the quality of life. Ward and Fyson (1973) point out that the pupil's concern for the quality of life must start with a sympathetic understanding of his home environment, which for most will be one of man's creation - a built environment.

The third fundamental aim of environmental education was emphasized at the European Working Conference on Environmental Conservation Education held in 1972, namely that environmental education should seek to:

> create a responsible attitude among the entire population towards the use and care of natural resources, and the protection of the environment as a whole against damage from pollution and other dangers (IUCN , 1970).

O'Neill (1970) has similarly proposed that environmental education should "stimulate a sense of individual responsibility for the physical and aesthetic quality of the total environment".

Ward and Fyson, in their important work Streetwork: the Exploding School (1973), state that this should logically lead to an issue based approach. They urge the adoption of a conflict centred curriculum oriented towards understanding community issues in an urban context, arguing that while the effects of man's activities on the land have long been considered proper material for study, the activities of man as the creator of other men's environments have been largely ignored. Such studies would be conducted in the district and community in which the pupil lives and learns, involving the pupil in the problems of his own locality. This "streetwork" aims at making the pupil not only aware of "how things are" in his environment but also what he as a citizen could do about them.

Ward and Fyson (1973) claim that these studies form the bridge between 'school life' and 'real life' for which teachers and parents are searching, and that they provide important training in citizenship. Pupils would thus be prepared for their future roles as participants in environmental decision making. Indeed, they see society moving from a formal democracy to a full participatory democracy, one in which people cherish their environment because it is theirs to create and conserve.

Environmental education, then, is characterized more by the attitudes it seeks to develop than by cognitive skills, it aims at commitment to a philosophy. From this outline of its objectives it would seem that the claims of environmental education for a significant role in the education of secondary school children should be given serious consideration. Furthermore it has been shown that much of the teaching should take place outside of the classroom in the immediate environment of the child.

2.3. Environmental Education and Fieldwork

The need for fieldwork to be an integral part of environmental education is recognized by many educationists (Linke, 1976), for they argue the objectives of environmental education are best achieved where learning is based on first-hand experience. Bird (1966) states that:

> The best way of dealing with practical conservation problems is to study them in the field, where relevant environmental factors and ecological processes can be examined at first hand.

The role of fieldwork will be discussed at greater length in the next chapter but some indication of the part it should play in environmental education is appropriate at this juncture. Lucas (1972) proposed a model which emphasizes the need for fieldwork in environmental education (his model accords well with Linke's model discussed above). It identifies three classes of environmental education - education about the environment, for the environment, and in the environment. Linke (1976) points out that:

> Education about the environment could well define the cognitive domain, in the taxonomic sense of Bloom (1956), of interrelationships between man and environment. It includes both the provision of information on environmental issues and the teaching of appropriate technical and intellectual skills required for investigating environmental problems. Education for the environment covers the affective concern for the quality of life and commitment to environmental conservation.

Education in the environment refers to a particular pedagogical technique i.e. fieldwork. Thus acceptance of this as a valid model of environmental education involves the recognition of the vital role of fieldwork in this form of education.

2.4. A Survey of Environmental Education in Selected Countries

Some indication of the importance which is likely to be accorded to environmental education in South Africa can be gained by examining the role it plays in education in other countries. Furthermore, reference to the prestigious history of environmental education provides an additional argument for its adoption in schools.

2.4.1. Early beginnings

Environmental education has been advocated and practised by many of the great educationists (Watts, 1969, p. 31). It was the fusion of the ideas of men like Herbart, Froebel and Pestalozzi that gave rise to the Heimatkunde (Local studies) of German schools which won wide acclaim during the late 19th century. 'Naturalism' a more radical but immensely influential educational philosophy espoused 'nature as a teacher', this was given popular appeal by Jean Jacques Rousseau (ob. 1778). Charles

Darwin (ob. 1882) not only laid the foundations of modern biology, but under his influence, studies of and in the environment, gained a new respectability (Watts, 1969 p. 40). Later Adamson, influenced by the writings of Darwin, William James and John Dewey, wrote his much read book The Individual and the Environment (1921)

Patrick Geddes (ob. 1933) Founding Father of Environmental Education and student of Le Play sociology, opened a unique educational establishment, an urban field studies centre known as the Outlook Tower. He saw education as a vehicle of urban rejuvenation (Wheeler, 1975 p. 3). Unhappily his ideas were misrepresented and watered down by members of the post World War Le Play Society. His true successors are men such as Anthony Fyson and Colin Ward whose arguments for a brand of environmental fieldwork which they call 'streetwork' - issue based studies in urban environments, have already been mentioned.

2.4.2 Environmental education in Great Britain

Despite the importance attached to environmental education by great educational philosophers of the past, it was not until 1968 that it was taken serious by the teaching profession in England (Wheeler, 1975 p. 10). In 1970 the Schools Council set up their Project Environment, and more recently the Sussex University Environmental Education Research Project was formed. During the present decade environmental studies courses have proliferated; candidates sat the first A level examination in Environmental Studies in 1975 (Carson, 1971), and several more C.S.E. 'O' and 'A' level syllabuses have been devised (NAEE, 1976). Additional momentum was provided by the European Conservation Year 1971 and the efforts of organizations such as the National Association for Environmental Organization, the Council for Environmental Education, and the Town and Country Planning Association. Furthermore there has been a growing interest in outdoor education - including canoeing, camping, orienteering - which has been encouraged by the creation of Outdoor Study Centres by Educational Authorities.

2.4.3 Environmental education in the United States of America

In the United States public pressure resulting in government legislation has imparted considerable impetus to environmental education. During the late 1960's and early 70's there was a sharp rise in the number of citizens who experienced a decreasing quality in their lives due to a

deterioration of their environment, and citizen concern forced the government to enact a number of measures to protect the environment. Among these was the Environmental Education Act which identified as a national educational priority:

> the educational process dealing with man's relationship with his natural and man made surroundings including the relation of population, pollution, resource allocation and depletion, conservation, transportation, technology, and urban and rural planning to the total human environment (Aldrich and Blackburn, 1975 p. 170).

The results of this Act have not been altogether satisfactory for not only have conscientious educators and scientists been hard pressed to meet this unparalleled educational challenge, but, unfortunately the situation has also precipitated the widespread production of largely useless materials and programmes labelled "environmental education" by opportunists taking advantage of the situation. As Aldrich and Blackburn (1975) point out:

> While there has been a lot of activity in the United States under the Environmental Education label there has been little progress towards the kind of education that is needed.

There have been some excellent programmes but these represent only segments in a continuum, segments because most of the programmes have stemmed from some individual's or group's desire to promote their interests. The grand aim of the Environmental Quality Education Act has not as yet been achieved, it pointed to the need for the American people to redirect their attitudes and behaviour, but education is not as yet playing an important part in this process.

2.4.4. Environmental education in Australia

Developments in Australia are of particular interest because of the many similarities between that country and South Africa. In Australia there has been a strong upsurge in Environmental Education in recent years (Australia Conservation Foundation, 1976) which has been supported both by private conservation organizations such as the Gould League and (in contrast to this country) by State Education Departments. No national policy is discernible for there is no national organization superintending environmental education and since school education (as in this country) is in the hands of State (Provincial) authorities the individual states are developing their environmental education in different ways. In some states

private organizations provide the major thrust, thus the Gould League has over a million members in Victoria and some 80 000 junior members in New South Wales. In others State Education Departments have taken a lead: in Queensland a network of Field Study Centres has been established in each region across the state; and an Environmental Assessment Team has also documented the resources near to each State high school, and a team of nine advisory teachers has been seconded to produce modules for primary school programmes. In South Australia, Aubury Park has been opened as the state's first Outdoor School. The Education Departments also support numerous groups working in the area of environmental education such as the School Forestry Camps Branch, Curriculum and Research, and Zoo and Museum educational services. The National Parks and Wildlife Service have a team of professional officers and teachers, and a number of regions have appointed advisors or inspectors of Environmental Studies.

Environmental Science has also been introduced into secondary schools either as optional one year courses or as full matriculation courses. Units complete with books, audio visual material and case study kits, habitat kits and other multi-media packages have been developed, some as part of the curriculum development programmes. There is now a strong move towards the co-ordination of materials production. In Victoria INSPECT produced up-to-date newsletters reporting on issues such as uranium mining, the Urban Creeks Campaign (they also supplied testing kits) and Public Transport, these gained considerable attention from school and youth groups. Numerous in-service training programmes are run for teachers both by the state and private organizations.

This outline of developments in environmental education in schools elsewhere has been given in order to provide a backdrop for a discussion of developments in this country. It appears that there has been most action in the U.S.A. but that much of this effort has been wasted because of a failure to establish priorities and map out definite policies. Australia seems to be following much the same path, there too there is a need for co-ordination if the efforts expended on experimental programmes are to have maximum impact. In Australia the State Education Departments, together with other government departments and some private organizations are actively promoting experimentation in environmental education; whereas in the United States private enterprise, often with a strong profit motive has played a leading role. In England progress is slower and on a

limited scale, carefully controlled research programmes indicate a cautious but thorough approach.

2.5. Environmental Education in South Africa

The position of environmental education in South Africa is now assessed, consideration being given first to provisions made for it in schools by Educational Authorities, and second to the role of private organizations in promoting conservation education.

2.5.1. Environmental education in South African schools

None of the subjects taught in South African schools has environmental education as a primary aim, nor do official statements of the basic aims of education set out by the various education authorities make any reference to promoting environmental concern. A subject entitled Environmental Studies is taught in the third year (standard one) in primary schools, but such environmentally orientated teaching as is undertaken takes place as part of Geography and Biology (including Practical Biology), Agriculture, and to a lesser extent in Art and English. Table 2.1 shows in summary form the provision made in various subject syllabuses for topics related to conservation. This is based on the core syllabus prepared by the Joint Matriculation Board, which forms the basis of all the syllabuses used in schools in South Africa. The various Education Departments base their own courses on these core syllabuses, deviating little from them, so that virtually the same syllabuses are used throughout the country for all pupils.

The table shows that most secondary school pupils are taught some ecology as part of their General Science course in standard seven, and for those pupils that take Biology and Geography they will again encounter some ecology in their final year at school (standard ten). It must be remembered, however, that large numbers of pupils never reach standard ten, and that at this level both Biology and Geography are optional subjects. The Practical Biology Course for standards nine and ten has considerable environmental content, but as this course has been designed for children of low I.Q. it involves few children. Thus, though individual teachers may emphasize matters of environmental concern, it is apparent that most pupils receive little environmental education in South African schools.

Table 2.1: Environmental Awareness and School Syllabuses

Selected topics that may relate directly to Environmental Education

Standard or Form	Environment Study	Gardening	Biology	Geography	Agriculture
Std. 1	Shelter, water, food; Changes in the seasons	Soil conservation. Caring for trees. Compost making.			
Std. 2	Weather studies. Plants & animals of my district.				
Std. 3		Soil types. Soil conservation. Tree Planting Beautifying the environment.	Animals: Habits & habitats. Plant Morphology. Useful plants.	Climatic regions. Seasons. Soil (farming). Plants & Animals during the year.	
Std. 4			Insects, arachnids, reptiles, plants. Nature conservation. Conservation of air and water.	Climatic regions. Plants & Animals in home region. Beauty & wonder of our country.	
Std. 5			Animals of South Africa (Vertebrate & Invertebrate). Plant variety. Types of Plants.	Climatic regions of South Africa. Homeland environment.	Soil science. Tree planting. Plant nutrition.

Table 2.1: (Contd.)

Standard or Form	Environment Study	Gardening	Biology	Geography	Agriculture
Std. 6			Sorting & Classifying. Animal & plant keys.	Climatology. Temps., pressure, winds, rain. Natural regions of the world.	Soil science. Plant nutrition.
Std. 7			Plant nutrition, animal nutrition. Role of water with living organisms. Nature conservation Ecology.	Geomorphology - erosion. Climatology - pressure & winds. Natural regions Settlements & physical environment.	Conservation farming.
Std. 8			Plant-water relationships. Physical & chemical concepts. Angiosperms.	Climatology, soil vegetation, Geomorphology. Population Geog. (stress links with nat. regions)	Soil science. Plant nutrition. Animal nutrition.
Std. 9			Energy & energy pathways. Photosynthesis. Respiration Human nutrition.	Weather processes (pressure & winds) Geomorphology (Fluvial cycles). Farming & Physical environment.	Soil science. Plant & animal protection.
Std. 10			Plant diversity. Animal kingdom. Nutrition, respiration reproduction of animals. Ecosystems.	Climate: atmospheric models, regional explanations. Geomorphology: drainage basins, topography & strata: Slopes & slope form. Evolution of landscapes. Soils. Urban areas & their problems Ecosystems	Soil microbiology. Plant nutrition, animal nutrition. Plant & animal reproduction. Ecology Conservation farming.

(Based on Hurry, 1976).

2.5.2. Government institutions providing for education in the outdoors

There is some provision for environmental education, including fieldwork, to be conducted outside the classroom. The Transvaal Education Department have established an environmental awareness centre near Middelberg, where a group of up to 100 standard nine and ten pupils can spend a week-end at a constituted camp. They have also purchased twelve farms as part of their Youth Preparedness programme. (This is a loosely defined general purpose programme which can cover such subjects as first aid, fire fighting and sometimes includes some teaching aimed at environmental awareness). In Natal a number of fieldwork centres have been established by the Provincial Education Authorities, in Durban, Pietermaritzburg and at Wagendrift near Escourt. Natal also has a fieldwork inspector and a team of field officers manning these centres. The Department of National Education has a Land Service scheme, a programme aimed at conservation awareness, which also introduces children to rustic crafts. Its Regional Directors and field staff control numerous well appointed camp sites where children sleep under canvass. They also organize expeditions for school children to such places as the Cedarberg and the Fish River Canyon. Some Provincial Education Authorities also encourage primary school pupils to make use of the facilities and expertise offered by approved private organizations and other government institutions such as Cedara Agricultural College.

Secondary school pupils are seldom allowed to take more than a single day off school for fieldwork in any one year, so can only use these facilities over week-ends and during school holidays. Primary school pupils, on the other hand, are allowed five full school days per annum for outdoor education, and in Natal some financial assistance is available for these pupils.

2.5.3. The role of private organizations in environmental education in South Africa

Much valuable work is being done by private organizations which have seen the need to teach conservation to the young. The Wilderness Leadership School founded in 1957 by Player (Richards and Walker, no date p. 127) has gained world wide recognition. This Durban based organization which operates in conjunction with the Natal Parks Board runs courses which aim to bring home to participants (both school children and

adults) the intrinsic value of wilderness and wildlife. A similar organization, the South African Mountain Leadership School, founded by Salmon, based at Clarens in the Orange Free State, had as its stated aim 'leadership through outdoor education experience'. It has, however, recently ceased operation.

The South African Wildlife Society is active in conservation education. The Umgeni Valley Ranch, an environmental school, which now operates under its auspices, was established in 1974 by Richards who had been involved in the work of the Wilderness Leadership School. Based on the Umgeni Valley Ranch (which is being purchased by an independent trust) in Natal, this organization has six field officers. Courses extend over two to four days, and pupils receive instruction in nature awareness, nature conservation and ecology. The Wildlife Society of Southern Africa is staffing another venture, the African Conservation Education Programme (ACE), based on a private farm, Twinstreams, in Natal. This organization has undertaken the important task of teaching conservation to Black teachers. The Wildlife Society of Southern Africa has recently (September 1976) formed a Nature Conservation Awareness Programme to promote and co-ordinate its activities in this field, and it is currently investigating running courses similar to those based on the Umgeni Valley in each of the provinces of the Republic of South Africa, Swaziland and Botswana (Richards, 1976).

The South African Exploration Society founded by Clayton operates from a farm near Villiersdorp in the Cape Province. Besides holiday camps this organization runs School-in-the-Wilds, a three day course which introduces primary school children to country life and teaches conservation. This venture receives support from the Provincial Education Department in the form of two teachers seconded to assist with instruction.

A number of other organizations which work among South African youth have environmental components as part of their outdoor education programmes. These include Veld 'n Vlei, the Boy Scouts and Girl Guides, Voortrekkers, Die Jeug Trust, and the Junior Section of the Mountain Club of South Africa. In addition some museums have environmental awareness programmes for children. The Star (a daily newspaper) runs regular articles to keep the public aware of matters of environmental concern.

At the tertiary level research and teaching on matters of environmental concern are carried out as part of the coursework in such univer-

sity departments as Botany, Zoology, Geography, Forestry, Agriculture and Urban and Regional Planning. Recently a School of Environmental Studies was established at the University of Cape Town to promote research at post graduate level on environmental problems.

In South Africa it is the private organizations such as the Wildlife Society of Southern Africa and individuals with the missionary's vision, zeal and dedication that have done much of the pioneering work in conservation education. Despite an obvious need little provision has been made for environmental education in schools. Unhappily, though they have much in common, the aims of education planners and of conservationists do not coincide, so that there has not always been close co-operation between the Education Departments and private organizations. The position is changing, however, and as a result schools are making more use of the expertise offered by private organizations. The need for the training of teachers in environmental education is evident, but as yet little provision has been made for such training in South Africa.

2.5.4. The future of environmental education in South African schools

Consideration is now given to the part which environmental studies could play in the schools of this country.

If it is accepted that the environment is both an important object of education and a medium of learning then far reaching implications must be faced. The need for the revision of some syllabuses becomes apparent, so too does the fact that provision will have to be made in school organization for the sort of activities which would be an integral part of environmental education. The question thus arises as to the form which environmental education should take. Should it be regarded as a separate subject, or should it be an interdisciplinary subject catered for by a team of teachers, or should it be an educational approach within a total curriculum.

The working party reporting the views of influencial environmentalists and educationists in the publication The Human Habitat: How do You Want to Live (HMSO, 1972) while stressing the need for environmental education, expressed doubts that its real purpose could be fulfilled by the development of a new subject called Environmental Studies. While being welcomed as "the most revolutionary form of study within living memory", environmental studies have been described as "more a way of learning than an educational subject" (Wheeler, 1975).

The authors of the publication Project Environment: Education for the Environment (SCPE, 1974) stress the need for a multidisciplinary approach in which environmental education becomes part of the overall school policy to which, as a result of careful planning, each department makes its contribution. Environmental education, it holds, is everyones responsibility. In educational literature the need to cut across traditional subject barriers is often expressed and environmental education offers every opportunity for bridging the gaps between a number of subject disciplines and for integration through team teaching.

Nevertheless, given the present subject oriented system, this same publication advocates the introduction of a special subject to be taught by specially trained individuals. This, it states, is necessary as a backbone to environmental education. It can only be a backbone however, for teachers in other fields must be involved (SCPE, 1974). A parallel is drawn with English. It is accepted that every teacher is a teacher of English but the need is still felt for a distinct discipline complete with specialists equipped with the necessary skills and enthusiasm.

Furthermore this publication points out that if we are to achieve our ethical objectives our pupils must meet an environmental style of learning not only across a large part of the curriculum but throughout the length of their schooling, it must be a continuous process. Martin (1975) has suggested that:

> While it is difficult to generalize on such an issue it would seem that teachers in Primary and Middle Schools use Environmental Education as an educational approach, some teachers in the Upper Schools wish to develop it as a subject in its own right, but many of these suggest that it needs team work by specialists in other subjects.

Though environmental studies has not been recognized as a separate subject in Secondary Schools in South Africa, some of the aims of environmental education can be promoted by simply placing greater emphasis on matters of environmental concern.

There are good reasons to believe that Environmental Education might receive a greater recognition in the future in this country than is the case at present. This optimism is based on the following facts:

First, not only has the general public been awakened to the fact of the so called environmental crises, but in South Africa conservation, particularly soil conservation, has been a major concern of the government for

many years. Any attempt to engender an environmental ethic in the young is thus likely to be looked upon with favour by officialdom.

Second, the need for conservation, and hence of teaching which will make pupils aware of this need, becomes the more apparent as population pressures increase. Education must be seen as a key to gaining public support for measures aimed at the wise and frugal use of scarce resources.

Third, a greater flexibility in what up to now has been a rigid and tradition bound education system is becoming apparent. The Project Schools experiment and recent drastic changes in, for example, the Geography Syllabus are evidence of this.

Fourth, the development of Environmental Studies courses and outdoor education in countries such as Great Britain and the U.S.A. are being watched with interest by local education authorities (Diepeveen, 1977).

Fifth, the Educational Authorities are now showing an increasing interest in, and in some cases are actively supporting, private organizations which have done pioneering work in environmental education in this country.

It is evident however, that South Africa has fallen far behind such countries as Great Britain, the United States and Australia insofar as environmental education is concerned. Despite the increasing awareness of the need for an environmental component in the school curriculum which is evident in other parts of the world; and the pioneering work carried out by people of vision such as Player, Richards and Clayton, education authorities in South Africa do not appear to have formulated a policy regarding the position of environmental education. Until provision is made for the necessary research to be carried out; for the training of teachers; and until adequate provision is made for environmental education in this country's schools, this important aspect of education will continue to be neglected.

CHAPTER THREE

FIELDWORK IN SCHOOLS

A necessary preliminary to the selection of sites for fieldwork and evaluating their educational potential is a consideration of the role of fieldwork in Secondary Education. In this chapter a definition of fieldwork will be given, its importance to the child assessed, and the two main philosophical approaches to fieldwork examined.

3.1. Fieldwork - A Definition

The term fieldwork means different things to different people. Some of the terms used to indicate on-location study of phenomena outside the classroom are : fieldwork, field studies, field teaching, field research, local studies, direct observation, outdoor work and outdoor education. In the present context the term fieldwork is chosen to indicate formal study outside the classroom undertaken by school children as part of their academic work. Fieldwork is not synonymous with outdoor education (defined in the previous chapter), and field research has a more particular meaning (discussed later), but the remaining terms listed above are considered to be synonymous with fieldwork, with minor nuances reflecting differing teaching objectives when pupils are taken into the field.

3.2. The Aims and Objectives of Fieldwork

In a growing literature on field studies numerous arguments are put forward for pupils to be taken outside the confines of the classroom for academic study. Some of these are discussed below.

Fieldwork is an integral part of all natural sciences. It can provide a training in the methodology of the natural sciences and, indeed, in scientific method.

Field studies are an important means of developing the critical faculty of pupils. All too often they are spoon fed with ready made concepts, generalisations and conclusions which they accept unquestioningly. Some teachers insist that pupils be taken to documentary material, statistical data, maps and photographs, and that they be encouraged to formulate their own generalisations and conclusions. But even this material is second hand, for the environment and not the map or statistical table is the primary source. If pupils gain information at

first hand they will learn a number of important lessons :

> They will realise that for the natural scientist the field is a laboratory, and that fieldwork equates with laboratory work (Marker, 1970).
> Pupils will learn how to obtain information for themselves, to go out into the field and observe, count, record and process data. Thus they will begin to develop the skills of the research workers who obtained the information which is now in their textbooks.
>
> They will become aware of how easily inaccuracies creep into scientific work (a salutary lesson), that wrong conclusions may result from inaccurate or faulty'factual' information. That the accuracy of a set of statistics may be effected by the expertize, prejudices or conscientiousness of enumerators. They will realise how approximate many statistics are and how quickly they date. Thus through fieldwork they develop that critical attitude which is the hallmark of a mature educated person.

Fieldwork also assists pupils in gaining a genuine understanding of terms and concepts which they may otherwise use with little understanding. Introducing them to concrete examples provides them with a ready frame of reference and assures common standards of comparison within a group. Terms like undulating or open woodland may mean different things to different pupils. Indeed, some phenomena can only be appreciated when viewed at first hand. One of the tragedies of schooling is the barrier between the accumulation of facts in the classroom and their meaning in the field. (Strom, 1970)

Field studies enable teachers of natural sciences to make their subjects come alive for what is learnt rests upon the foundations of reality. Wooldridge (Board, 1963) points out that over a great range of studies reality is the field. Strom, (1970) contends that

> it must be the intention of the school excursion and consequent field studies, to ensure that no concept in natural science or geography is attempted in teaching without an effort to relate it to student experience in reality.

This lofty ambition, he maintains, can be achieved if a pupil is so trained as "to undertake personal and purposeful observation and investigation for

himself as the felt need arises" (Strom, 1970 p. 2).

One of the main objectives in field teaching in geography is that of developing an eye for country, an ability to read the scenery, for as Marsch put it "sight is a faculty, seeing is an art" (Board, 1963 p. 208). This training in intelligent observation which fieldwork provides is an important part of a child's education.

In several other important respects fieldwork constitutes sound educational practice. Marker (1970) states that :

> It has been established that learning is most efficient when the three faculties of hearing, seeing and doing (or experiencing) are brought into play, thus practical work is the most efficient teaching method and it follows that time spent on fieldwork is time well spent.

Fieldwork gives the opportunity to begin with particular observation and thus to retain a sense of adventure. It is sound educational technique to begin with the local and the familiar before going on to study subjects outside the pupil's experience. (Long and Roberson, 1966). Furthermore, in the field children "learn by doing" a term which epitomises much of what was enjoined by John Dewey. The element of discovery and the opportunity to use their own initiative and ingenuity both add to the interest and value of fieldwork. Field studies lend themselves to group and project work allowing pupils to work at their own speed and to develop a sense of responsibility.

A number of spin off benefits can also be claimed for fieldwork. It can lead to improved teacher pupil relationships, offer the occasion for healthy outdoor exercise, introduce pupils to new and worthwhile leisure activities, play a part in character building and be a means of introducing the town child to the countryside and the town to the plattelander. Some fieldwork can also have a vocational aspect as people are observed in various types of employment.

It was shown in the previous chapter that many who are concerned with the broader aims of environmental education consider fieldwork to be an important means of furthering these aims. Fieldwork is seen as playing an important role in producing in pupils a concerned interest in the environment in which they live, which will often mature into a commitment to conservation and a sense of responsible citizenship.

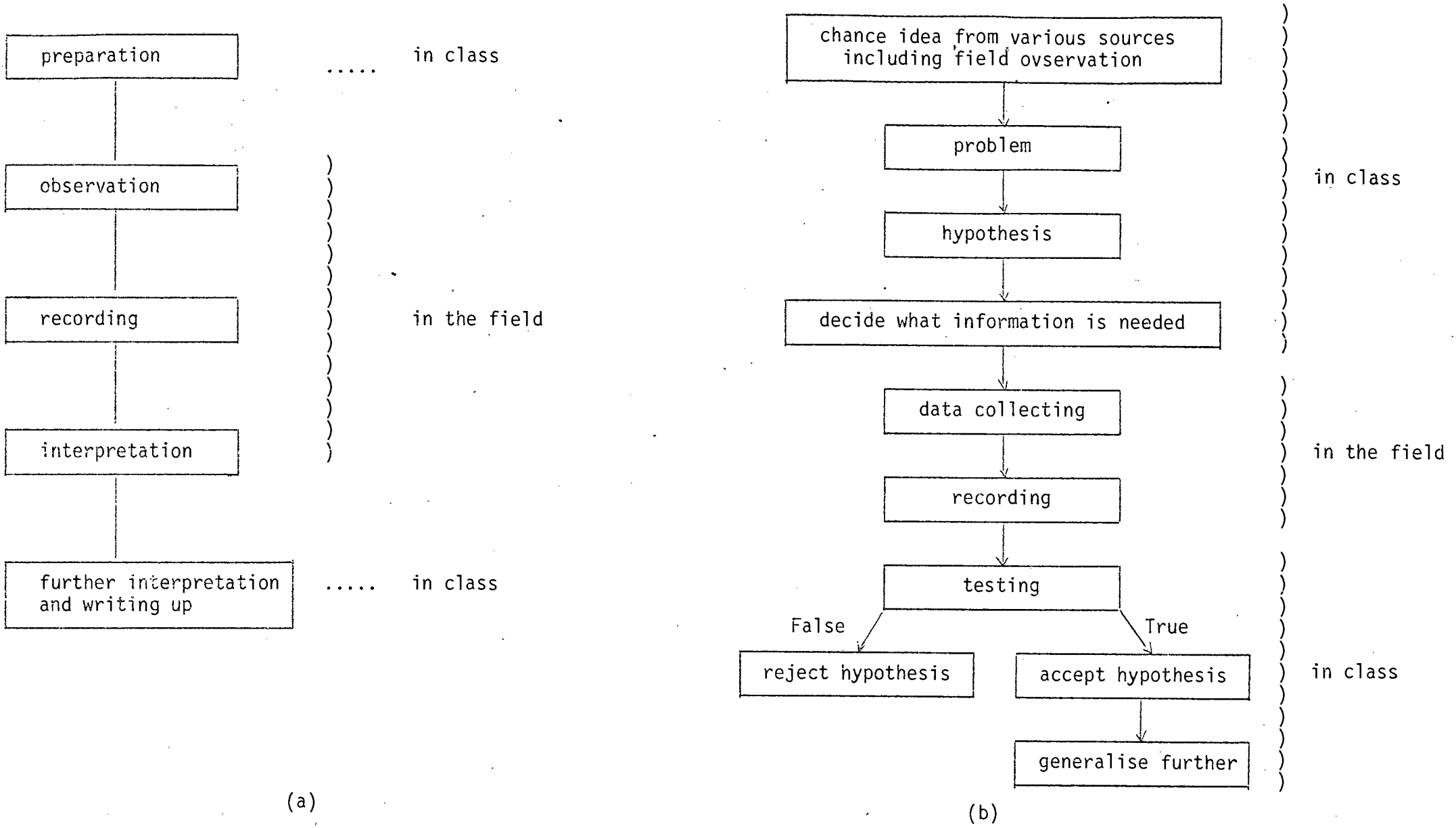


Fig. 3.1. The two approaches to field studies. (a) Fieldwork. (b) Field research.

In the light of what has been said above a strong case can be made for affording fieldwork a more significant role in education in this country. The case is strengthened by fieldworks' long and prestigious history, for as indicated earlier, it was enjoined by such leading educationists as Froebel, Pestalozzi, Rousseau, Geddes, Dewey and Adamson (Wheeler and Harding, 1966). In countries such as Great Britain and the United States the importance of fieldwork has been recognised and it is accepted as an integral part of education. Pupils in this country are the losers because of the tardy recognition given to this important form of education.

3.3. The Two Main Approaches to Field Studies

Two main approaches to field studies have been distinguished by Board (1965) and Everson (1973): a traditional fieldwork approach and field research. When choosing sites for field studies some consideration must be given to the type of fieldwork to be conducted at that location.

3.3.1. The traditional fieldwork approach

The traditional approach owes much to British geographers such as Wooldridge and Stamp. Everson has represented this approach by means of a flow diagram (Fig. 3.1.a.). The different steps will now be examined.

Preparation : to provide a background for studies in the field, resource material such as maps, aerial photographs and written publications can be consulted. Teachers may prepare questionnaires or assignment work cards for highly structured field studies, or on the other hand little attempt may be made to dictate to students, more opportunity being left for personal discovery.

Observation : Everson (1973) points out that this stage lies at the heart of this approach. Briault and Shave (1968) state that "good fieldwork is accurate observation accurately recorded". Teachers may guide observation verbally, by means of questionnaires or by planning for the performance of specific tasks.

Recording : this can be done in a variety of ways described in some detail by Long and Roberson (1966 pp. 134-148). Field sketches, tables, matrixes, graphs, transects and photographs may be utilised. This recording is an important step for it transforms what might otherwise be a holiday jaunt into a true field exercise, focusing attention on significant features and assisting both observation and interpretation.

Interpretation : this is carried out in the field and in the classroom.

Follow-up procedures : these vary considerably ranging from a mere tidying up of material recorded in the field to elaborate projects. With young children this stage should not be prolonged, for their interest span is limited. If pupils are instructed to use means other than writing for presenting the material, the work at this the most tedious stage is made more interesting and challenging.

This traditional approach to fieldwork has significant shortcomings. It concentrates on what is readily observable in the field, indeed it has been said that a feature of good field teaching is to restrict the discussion to that which is visible. Relationships may be sought and found but just how real they are is often open to question for no experiments are made to test the validity of the conclusions drawn (Everson, 1973). Usually it is the facts rather than processes that will be discerned in the field (Long and Roberson, 1966 p. 129). This approach leads to a concentration on the simple and the obvious, and a neglect of the more complex phenomena and relationships. Thus in geography, rural areas were studied and more complex urban areas neglected. This lends force to the charge that this approach leads to a naive superficiality - to a neglect of such factors as the very considerable influence of planning, agricultural subsidies and freight charges on land use. Such fieldwork may be useful in giving the child an overall picture of the landscape or the life of a stream, it may encourage a positive attitude towards conservation, and it will most certainly increase the motivation of pupils, but, as Powell (1975) points out :

> whether a basic concept, an explanation, has been added to the cognitive structure of the pupil is much harder to assess. Common sense tells us that fieldwork should have a real sense of purpose.

It is this lack of a clearly defined aim, which is so often absent that is provided by field research.

3.3.2. Field research

Fig. 3.1.b. summarises the main steps in field research. These are well defined by Everson (1973).

The idea generation stage could be traditional fieldwork, or an idea

suggested by the textbook, general reading or chance observation. This leads to the identification of a problem - often thrown up as a result of discussion in the classroom. The next step is to provide a theory or model which will provide a theoretical explanation of the phenomenon. The theory may be derived from the accepted body of theory of one or other of the sciences, or be made up by the pupils (or teacher); Everson (1973) argues that the former is preferable for the results of the verification of hypotheses should be relevant to the main body of theory.

This is followed by the formulating of a hypothesis, based on theory, which can be considered as an answer to the problem. The hypothesis should preferably be suggested by the pupils. Decisions must be made as to what information is required in order to test the hypothesis, and how this information can best be obtained. So far most of the work has been done in the classroom with the pupils involved at every stage.

It is now time to take the pupils into the field. Recording is done in one or more of the variety of ways alluded to in the discussion of traditional fieldwork, but with this important difference; the pupils now have a clearly defined aim for their activities - that of testing the validity of a particular hypothesis. If the hypothesis proves to be correct, it is accepted and then becomes the basis for further generalisation; if it proves to be wrong, this is recognised as an equally valid result and attempts are made to formulate new hypotheses taking into account the knowledge gained.

Everson (1973 p. 111) comments that many teachers are concerned that this approach places too much emphasis on problems and too little on observing phenomena; that children will become too bogged down in the minutia of testing and recording; and that as a result, pupils will get less of a thrill and excitement from these studies and even, some contend, of understanding, than they would from the old approach. That these dangers do exist is conceded, but, as Everson argues, children using the field research method are operating in the same way as research scientists and they are

> consequently providing general statements which in this form of the study are objective not subjective assessments of the answer. These conclusions are comparable with the results obtained elsewhere from similar studies. The techniques are firmly placed and are not studied for their own sake, as can happen in many less controlled pieces of work. Lastly, the fieldwork is structured towards a conclusion and is not

> represented by inert, factual information included just because it happens to occur in the area studied. It is also a method which thrives on so-called difficult areas and it concentrates interest on process.
> (Everson, 1973 p. 111).

There need be no conflict between the two approaches discussed as their objectives differ and each is valid. The scale of the study, the age of the children, and the distinct objectives in view will all help to decide which method should be used. If a quick overview is required, and much of the relevant material is readily observable in the field, then the traditional method will be employed. It aims at developing perceptual experiences, but, as Everson points out, the child and teacher must be aware of the weak nature of the simplistic explanations made after this type of study. If, however, there is a greater complexity of material, and the factors coming into play are less apparent then the greater sophistication of field research may be needed in order to get to the heart of the problem.

Both methods can be used at any stage in the child's career, the first method is better suited to the earlier years and increasing emphasis should be given to field research as the pupil moves on to more advanced and exacting work. This will be taken into account when preparing a curriculum for fieldwork and choosing sites for activities in the field.

3.4. Conclusion

In this chapter the important contribution which fieldwork can make to the general education of the child has been emphasised. It has been argued that field studies not only contribute to a pupil's understanding of a subject, and help to create a lively interest in such subjects as Biology and Geography, but they can often result in an appreciation of man's role as an agent of change in the environment, and to the pupils developing a conservation ethic. It has also been shown that some types of fieldwork provide a training in the methodology of science. Such consideration should encourage teachers in South Africa to follow the lead given by their colleagues elsewhere to make better use of the opportunities afforded by their local environment for teaching purposes. Should this happen, large numbers of pupils will be engaged in fieldwork in the Cape Peninsula. In choosing sites for outdoor studies, the different approaches to fieldwork must be borne in mind, as well as many other factors which form the subject of subsequent chapters of this study.

CHAPTER FOUR

PRESENT CONSTRAINTS ON FIELDWORK IN SCHOOLS

A number of factors are limiting the amount of fieldwork which is being undertaken in South Africa. These will be analysed, for in choosing sites for fieldwork, it is necessary to take into account not only the nature of the work which will be carried out in the field, but also those factors which hinder fieldwork. Some suggestions are made as to how these constraints can be made less limiting. They fall into two main categories: logistic constraints, for example time and cost, and educational constraints, such as those imposed by syllabuses and examinations.

For the sake of those who are unfamiliar with the school system in South Africa, details of school organisation should be given. Pupils enter secondary school in Standard 6 (at approximately 12 years of age), those who complete the Secondary School course matriculate in Standard 10. Pupils are grouped into classes, and the classes of a particular year's intake are classified as a standard. With a few exceptions (e.g. those pupils taking Latin or Modern Languages), each pupil follows the same course in Standards 6 and 7, the coursework being prescribed by the Junior Secondary Course syllabuses. Pupils following the Senior Secondary Course (Standards 8 to 10) are restricted to six subjects, the choice being made from a number of options.

Since subjects like Geography and Biology are optional subjects in Standards 8 to 10, the pupils in any one Geography lesson are likely to be drawn from a number of classes and these pupils are only a subset of the children in that standard.

4.1. Logistic Constraints

4.1.1 Limitations imposed by time

In conversation with teachers during in-service training courses with which the writer has been involved, lack of time has often been identified as a major problem. Increasing demands are being made upon the time of teachers and pupils. These is competition for formal teaching time and, in some schools, a full and varied extra mural programme makes great demands on the time of both teachers and pupils.

Consideration will now be given as to how, by the careful choice of sites, the time available for fieldwork can be put to best use. Both pupil and teacher time are taken into account, and problems associated with time-tabling are discussed.

Pupil time: units of time which pupils could use for fieldwork include the single lesson (35 - 45 minutes), the double lesson (70 - 90 minutes), an afternoon, either after school (about 3 hrs.) or including the afternoon session (about 5 hrs.), a whole day (9 hrs.), a week end, or several days during the school holidays. In addition to this, pupils could do fieldwork as part of their homework assignments, the time spent on this varying from a single homework period (about 30 minutes) to major assignments which from personal observation involves pupils in some 20 hours of work.

It is difficult to estimate how much time pupils can reasonably be expected to spend on fieldwork, this will depend on a number of factors not the least of which is the type of time unit required. The number of week-ends or whole days available will be very limited, they must consequently be used as efficiently as possible. If fieldwork is carried out in the immediate vicinity of the classroom, and if exercises are devised which centre on the home locality and the pupils journey to work, there will be a considerable saving of time. Most local fieldwork can be done during a double period or short afternoon. While it will often be impossible to get whole classes into the field for a weekend, this may not apply to smaller groups operating on a voluntary basis.

Teacher time: most fieldwork involves the teacher in much time consuming preparation and every effort must be made to maximise this use of time by highly trained specialists. Successful field excursions can be repeated year after year. Material prepared by one teacher should be made available to others. Teachers' Centres can play an important role here, they could become repositories of material for use in the local area - a bank from which teachers can draw. The work of a single teacher can be reduced through team teaching and co-operation between teachers from neighbouring schools. In Australia a team of four teachers travel to different centres evaluating the fieldwork opportunities in the area, compiling a list of relevant source material, and advising the teachers on the best use of local opportunities. (Australia Conservation Foundation, 1976). Such a team, building on work already done in the Cape Peninsula,

could provide teachers with material which they have neither the time nor the expertise to prepare.

Time-tabling: school organisation imposes constraints on fieldwork and these become more severe in the senior classes. The system of options outlined earlier in this chapter means that in Standards 8 to 10, withdrawal of pupils from normal school activities for more than a scheduled double period causes a major disruption to the work of the whole standard. The consequent loss of teaching time is viewed with disfavour particularly where pupils working for public examinations are involved. These disruptions are not felt so acutely in the lower standards where teachers take whole classes and the pressure of examinations is not as great. Unfortunately, however, (as will be shown later), it is for work with the more senior pupils that the longer time units are required. The problem of day release can sometimes be alleviated by doing fieldwork either during or immediately after examination sessions when such interruptions are more likely to be tolerated.

A double period per week should be time-tabled for each subject in which a significant amount of fieldwork is done, preferably during the afternoon session for Standards 9 and 10, so that pupils can have full afternoons for fieldwork. Teachers have often showed themselves willing to take pupils on extended fieldwork expeditions during school holidays and in the United Kingdom many schools travel to Europe and farther afield. If adequate facilities were provided, the Cape Peninsula would provide excellent opportunities for extended visits by country schools whose environments lack many of the features found in that area.

4.1.2. The cost factor

This second logistic constraint is becoming an increasingly important consideration as travel costs rise. Unfortunately it is the pupil from the disadvantaged social groups who will be the most severely affected.

Finance for travelling expenses can be raised in a number of ways: a direct contribution may be made by children or school funds could be used, (it should be noted that transport costs incurred in connection with sport are often liberally funded from this source). In Natal a Provincial Government subsidy amounting to R2 per pupil per annum is made available for fieldwork outings - it is to be hoped that other South African education authorities will follow this lead. Country schools in particular would benefit greatly from such provision, as this would assist them to

finance journeys to environmentally rich areas, such as the Cape Peninsula.

Costs can be kept to a minimum if as much fieldwork as possible is done in the immediate locality of the school. This is yet another reason for emphasising the importance of local fieldwork. The range of really cheap travel can be extended by the use of bicycles. The use of public transport helps to reduce costs, and for this reason wherever possible the sites to be discussed in this study have been chosen close to the line of rail.

4.1.3. Zoning restrictions

The choice of sites is further limited by the distribution of privately owned land, forestry reserve and other restricted areas. In South Africa some areas are reserved for members of a particular race group. In other areas such as nature reserves and forestry areas restrictions may be placed on certain types of activity. Fig. 4.1. shows the more important areas in the Cape Peninsula to which such restrictions apply.

4.1.4. Other factors

Besides the constraints of time and cost there are other factors which must be taken into account when choosing sites for fieldwork. The number of pupils involved is an important factor. Because of school organisation it is often necessary to take all the pupils taking a particular subject in any one standard (possibly a hundred or more pupils) into the field at one time, on the other hand groups may be as small as ten pupils. There is a need, therefore, to identify sites suitable for large numbers while not overlooking the less constricting demands of the smaller groups. It is important that, particularly with the sites chosen for use by large parties, they should be such that they will not be readily damaged. Overuse is proving a problem in England where large numbers are visiting certain prime sites (Schools Council, 1974b p. 23). Not only are natural systems being strained, but some inhabitants of popular areas are reacting against over frequent interrogations by pupils using questionnaires. Work on the prime sites should be restricted to the type of activity for which the site is best suited. Facilities, such as parking for buses, toilets, and to a lesser extent shelter, should be taken into account. Safety is also an important consideration when choosing sites for fieldwork. It involves such considerations as the age of the pupils, the size of the party for which the site is chosen, and the training and experience of the leader.

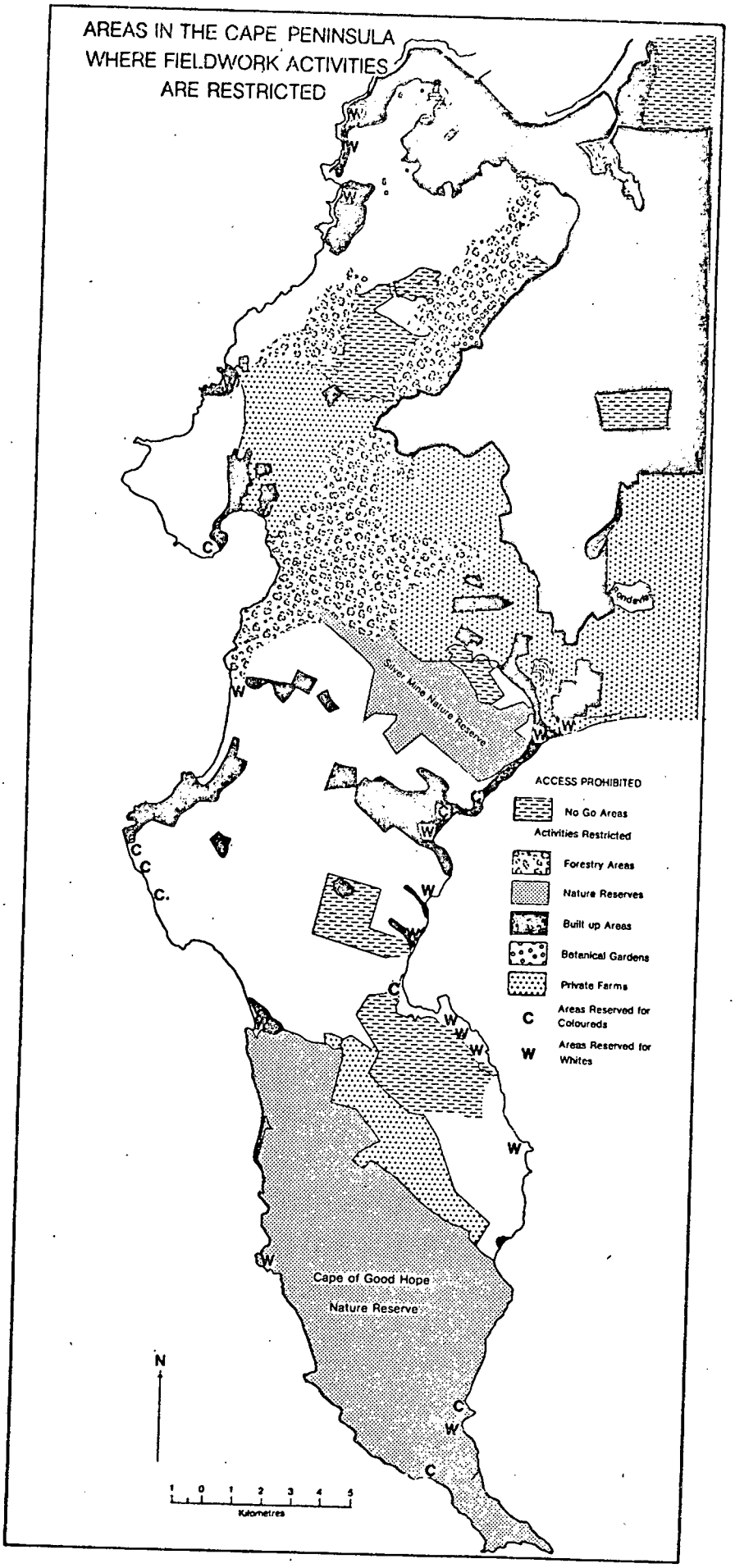

AREAS IN THE CAPE PENINSULA
WHERE FIELDWORK ACTIVITIES
ARE RESTRICTED
Silvermine Nature Reserve
Cape of Good Hope
Nature Reserve
ACCESS PROHIBITED
No Go Areas
Activities Restricted
Forestry Areas
Nature Reserves
Built up Areas
Botanical Gardens
Private Farms
C Areas Reserved for Coloureds
W Areas Reserved for Whites
N
1 0 1 2 3 4 5
Kilometres

Fig. 4.1.

4.2. Educational Constraints

Subject syllabuses and public examinations constitute further important constraints on fieldwork. In a country where externally set school leaving examinations appear to determine much of what is taught in the classroom, and where teachers are often loath to depart from what is laid down in the subject syllabuses, these constraints are very real. At in-service teacher training courses run by the writer, it became apparent that large numbers of teachers would only undertake fieldwork which is intimately related to the syllabus and which can be expected to lead their pupils to obtain better public examination results. It is true, however, that some experimentation is now being officially encouraged through the Project School system. Some freedom in the interpretation of syllabuses is being allowed in the Project Schools.

4.2.1. The constraints imposed by existing subject curricula

A list of topics, drawn from existing subject syllabuses, which could be studied in the field is given in Table 5.1. The discussion below draws attention to the negative or restricting influence of these syllabuses on fieldwork.

History: those who constructed this syllabus appear to have considered that fieldwork does not have an important role to play in school history, for apart from suggesting that pupils include some local history as part of their project work in the Junior Secondary Course, no mention is made of fieldwork in either the Junior or the Senior Secondary courses.

Art: this subject, too, places little emphasis on the need to make pupils aware of the aesthetic qualities of their environment, and overlooks the part which fieldwork can play in developing this awareness. Though one of the general aims is said to be:

> To enrich the child through his awareness of his environment and to enable him to develop a sense of aesthetic discrimination (Joint Matriculation Board, p. 204).

Yet nowhere does the syllabus indicate the need for teachers to take their pupils into their environment.

Biology: at the Junior Secondary stage Biology is taught, along with other science subjects under the title General Science. It appears as a full subject only at the Senior Secondary stage. This Senior Biology

course is highly theoretical, though several of the aims given in the introduction imply the desirability of fieldwork, (see the Department of Education Senior Secondary Course Syllabus for Biology, p. 2 and 3), for example the requirement that "instruction should in the main be based on the pupils' own observation within the environment", yet nowhere in the itemised topics is fieldwork enjoined or mentioned. It appears that in this regard the syllabus has failed to provide the incentive for teachers to carry out its declared aims. Biology teachers particularly appear to find it necessary to limit themselves to the material laid down in the syllabus, because of the large volume of work which they are expected to cover and because the final examination examines the work covered in Standards 10, 9 and part of 8. No doubt this partly explains why little fieldwork is being undertaken by Biology teachers in Secondary Schools in the Cape Peninsula area. Until this syllabus is revised, and some of the pressures produced by what many teachers regard as an overfull course are relieved, there seems little chance of much biological fieldwork being carried out in the higher standards of Secondary Schools.

The Biology part of the Junior Secondary General Science course does not suffer from the same constraints, indeed in two places (p. 21 and 22) the syllabus states that particular studies must be undertaken out-of-doors. Much of the fieldwork done in Biology can therefore be expected to be done by pupils in Standards 6 and 7.

Geography: in contrast to Biology, though no mention is made of fieldwork in the general aims, in the itemising of topics, both Junior and Secondary Senior Geography syllabuses require teachers to undertake work in the field.

4.2.2. The constraints imposed by public examinations

Perhaps even more restricting than the subject of syllabuses are the public examinations which White pupils sit at the end of Standard 10 and Coloured pupils in Standards 8 and 10. Since drastic changes have recently been made to many subject syllabuses, the effect of the examinations on fieldwork must remain a matter of conjecture. So far no questions have been set in public examinations in South Africa which specifically examine fieldwork, if however, (as seems likely) they do appear they will provide not only a powerful incentive to teachers to undertake teaching in the field, but they will also guide the direction that these studies take. It is reasonable to expect that in the near future such questions will appear

and that they will be very similar to those which have been set for many years in some countries overseas. A selection of typical examination questions set by a number of examining boards in England has been analysed in order to determine the direction fieldwork, as determined by the examinations, might take. The results of this analysis are summarised in Table 5.2 and the questions themselves appear in Appendix C.

4.2.3. Constraints imposed by teachers expertise

The last of the constraints affecting the use of sites is the limited expertise in fieldwork methods which most teachers trained in this country possess. This was identified as one of the major factors accounting for the limited use which is being made of fieldwork opportunities, during a recent seminar organised by the Western Cape Branch of the South African Geographical Society. In the past, fieldwork has not been an important part of the geography courses offered by most of the local universities and teacher training colleges. As a result teachers feel insecure when faced with the prospect of teaching in the field. Furthermore, though much can be learnt from the extensive literature on fieldwork, only a limited amount of material has appeared written with the specific needs of teachers in this country in mind. Without the traditional prop of the textbook, and with little guidance from other sources, most teachers of Geography and Biology seem loath to venture outside the walls of the classroom, and the educational potential of a rich environment such as the Cape Peninsula remains, for the most part, untapped.

Furthermore, it appears that an important reason for the failure to undertake fieldwork, is that teachers have been unaware of the wealth of opportunity that the Cape Peninsula offers. This is a failure in perception, a failure to recognise a resource which is to hand. The problem of perception becomes even more real when teachers are called upon to assess the potential of the area where most fieldwork should be carried out - namely the grounds of the school in which they teach. It is one thing to identify prime sites, it is another to be able to determine the best use that can be made of the much more limited potential of the immediate surroundings of a typical suburban school. An important element in teacher training must be directed at enabling teachers to perceive and utilise the school grounds and the local neighbourhood in their teaching.

In-service training can help to redress this position. Many such courses are held in England (see advertisements in the journal Teaching

Geography). These are often based on a Fieldwork Centre. The writer was responsible for a course for teachers based on a Teachers' Centre which has resulted in a number of schools utilising the sites and the material prepared for the course. These courses, however, are mere stop-gaps. The important constraint imposed by ignorance of fieldwork techniques on the part of teachers will not be eased until the universities and other teacher training institutions in the vicinity make adequate provision for the training of prospective teachers in fieldwork methods.

4.3. Conclusion

In this chapter it has been argued that limited use has been made of the rich potential of the Cape Peninsula for fieldwork because of a number of constraints or bottlenecks. These have been identified as being largely of a logistical kind - such as time, money and school organisation - or educational - coursework as detailed in the subject syllabuses, the influence of public examinations, and the limited expertise of teachers. It has been suggested that some of the educational constraints would prove less restricting if teachers were to be trained in fieldwork techniques. The revision of some syllabuses would appear to be necessary before some of the other restrictions are removed. It is possible that if, for example, teachers of Geography were to show that the greater freedom allowed to them resulted in a richer educational experience for the children they teach, those responsible for the revising of other syllabuses will take cognisance of this fact, and,that this will provide encouragement for fieldwork to be carried out in subjects such as Biology. The demands of those concerned with the broader aims of Environmental Education will, no doubt, add strong support to such a move. It has also been shown that many of the logistic constraints disappear or become less restricting if maximum use is made of the immediate environment of the school. Every possible effort must be made to perceive and to develop the fieldwork potential of the school grounds and the surrounding areas.

CHAPTER FIVE

SELECTING SITES FOR FIELDWORK

The steps involved in the selection of sites for fieldwork in the Cape Peninsula are now described. If these sites are regarded as a resource then the process by means of which they are identified and utilised will follow the same general pattern as the process which results in the utilisation of any resource. The different stages in this process are best examined by means of a model.

5.1. Developing a Resource Perception Model

Fig. 5.1. is a suggested model of how an opportunity becomes a resource, which has been adapted for the purpose of selecting sites for fieldwork. The more general Resource Perception Model will be discussed before consideration is given as to how it was applied to site selection.

For anything to become a resource it must first be discovered and assessed as useful to man. Stocks (material components of the environment) become resources when they are regarded as being of some value to individuals. The essential steps which have to be undertaken prior to the utilisation of a particular resource are :

First, a stock (opportunity) must exist. This is usually a material component of the environment e.g. coal.

Second, there must be a demand, a need which this particular resource can meet e.g. for heating.

Third, the opportunity must be perceived - the opportunity must be matched to the demand, it must be recognised e.g. that it could be used as a fuel for heating processes.

Fourth, problems which could prevent or limit the utilisation of the use of the stock must be identified and overcome. In the case of coal a technology developed to enable it to be mined and distributed.

Only then does the stock (opportunity) become useful to man, i.e. a resource.

5.2. Adapting the Model for the Selecting of Sites for Fieldwork

This model has been adapted for use in selecting sites for fieldwork. In this instance the stock (opportunity factor) consists of the potential

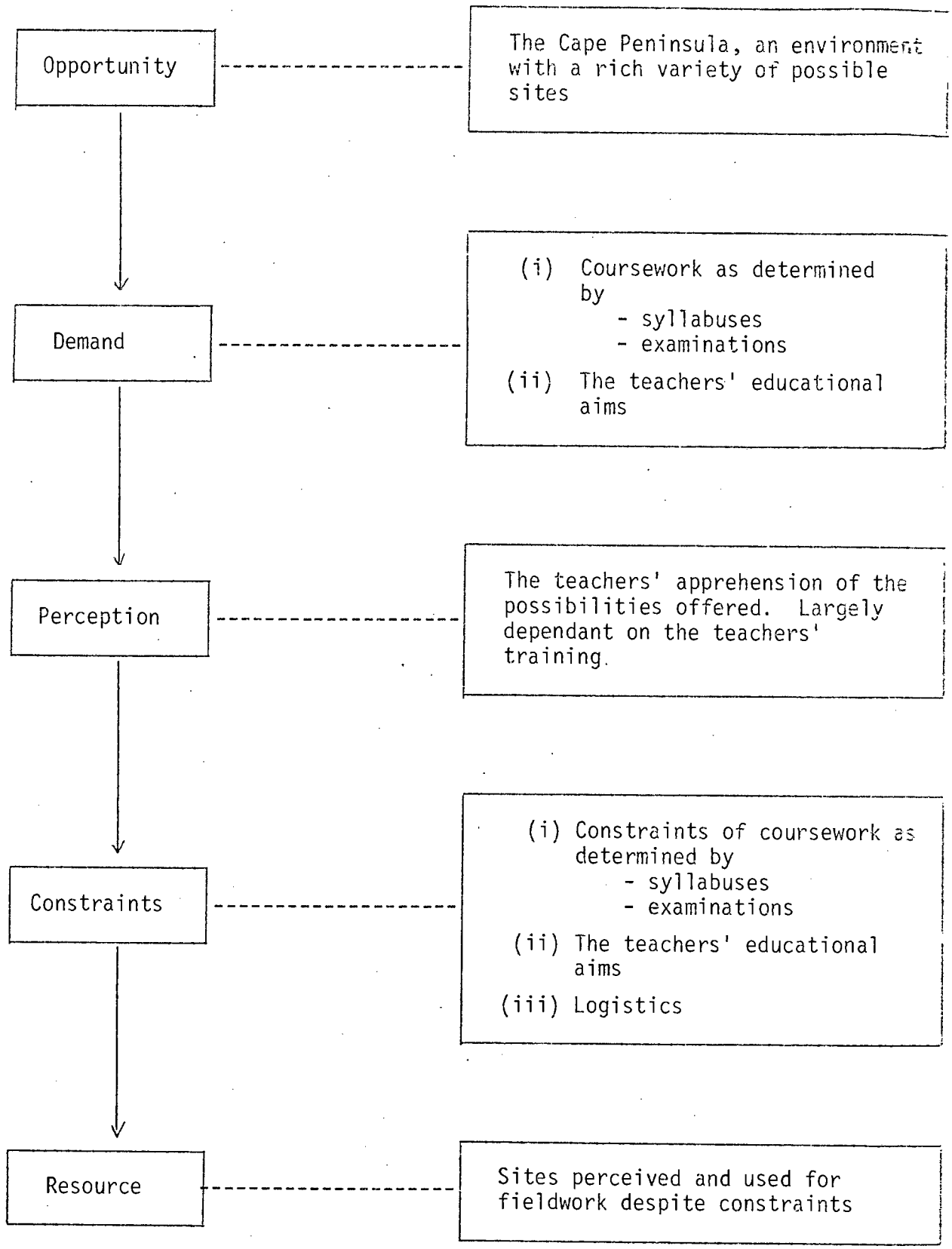


Fig. 5.1. A model of how an opportunity becomes a resource as applied to the selection of sites for fieldwork.

fieldwork sites in the Cape Peninsula. Recently there has been an increased demand for fieldwork sites as developments in education result in greater emphasis being placed on schoolwork in the outdoors. Not only has it been necessary to gauge the strength of the demand, but the nature of the demand must be identified in order to match the fieldwork sites as exactly as possible to the needs of secondary school pupls. The third of the steps outlined above, that of the perception of opportunities has necessitated the identification of large numbers of sites for fieldwork in the Cape Peninsula. It has, however, been recognised that certain criteria will limit fieldwork activities so that only certain of these sites will be utilised. These limiting factors will include such practical considerations as the time and money available for fieldwork activities as well as educational considerations such as subject curricula. All these factors must be taken into account before sites are selected which will, in practice, prove useful.

Using this model as a mechanism of site selection, the processes involved will now be considered in detail. :

5.3. Steps in the Selection of Sites

5.3.1. The opportunity factor

The enormous potential of the Cape Peninsula with its rich variety of natural and man made features has already been alluded to. Geological phenomena such as the famous contact zone at Bantry Bay; granite and sandstone cliffs; the unconformity and faults exposed by the road cutting at Chapman's Peak; varied coastal scenery; a unique and exceedingly rich flora; a major port; the Mother City of South Africa, with the richest architectural heritage in the country; all of these concentrated in a small area, present teachers with unrivalled opportunities for fieldwork.

5.3.2. Determining demand

The demand for fieldwork sites has been assessed by analysing the curricula of those subjects which might need to utilise fieldwork sites. The coursework is set out in the core syllabuses for History, Biology and General Science, Geography and Art. In addition, some consideration is given to the demands of environmental education, the aims of which were discussed in the second chapter, thus anticipating a possible future trend in education in this country. Those topics which are being taught in

Table 5.1: Field Work Requirements Based on Subject Syllabuses

Topics as per Subject Syllabus	Subject
Standard 6:	
Mapwork: Direction and bearing (using compass, watch, sun)	G
Scale (e.g. size of school distance to local landmarks)	
Conventional signs (1:50 000 topographic sheet of locality)	
Representation of height above sea-level by means of contours	
Recognition of simple land forms	
Weather observations and records	G
The compiling of simple keys with reference to known groups of animals	S
The use of simple keys for the identification of plants and animals	S
Direct observation of the external structure and relationship to dispersal of seeds showing the advantages of dispersal	S
Examples of vegetative reproduction in plants showing the advantages of vegetative reproduction and perennation	S
Standard 7:	
Mapwork: Elementary interpretation of 1:50 000 maps	G
Geomorphology: Study of land forms resulting from water, wind, waves	G
The processes of transport and deposition	G
Urban settlement: Study of an important urban settlement with reference to major land use zones	G
A farm study	G
Soil Studies: Examination of loam soil. Experiments to investigate constituents	S
Comparisons of sand, clay, loam	
Living organisms in soil samples (including litter)	
Ecological Studies: Observations and recording of physical factors, e.g. slope, shade, soil types, humidity: their influence on populations being studied	S
Observations of the consequences of disturbances in the balance of nature, e.g. indiscriminate use of sprays	
Soil erosion	
Judicious utilization of natural resources and the control of pollution	
How our country is governed - visits to Houses of Parliament, etc.	H
Topics for independent study which could involve fieldwork: Weather forecasting	G
Modern means of communication	G
Ocean transport	G
Air transport	G
Fishing in South African & S.W.A. Waters	G
An important hydro-electric or irrigation project	G
The significance of existing monuments (e.g. historical buildings, passes, roads).	H

Table 5.1: (Contd.)

Topics as per Subject Syllabus	Subject
Standard 8:	
Field study techniques: Map making, plane tabling, compass traverse, chain survey	G
Levelling	
Sampling - quadrat, expanded quadrat, line & bell transect	
Geology: study of rock exposures:	
- Rock types and associated relief	G
- Faulting, jointing, folding, stratification, unconformities, contact zones, etc.	
Meteorology: simple cloud classification	G
A study of earthworms and snails	B
Standard 9:	
Geomorphology: Fluvial action	G
Marine action	
Wind action or solution processes	
Meteorology: Influence of relief on air circulation, temperature, precipitation	G
Studies of families of plants listed in the syllabus: their distinguishing characteristics, habitat, mode of nutrition, life cycle, significance as regards energy pathways and nutrient cycling	B
Standard 10:	
Geomorphology: slopes and slope forms	G
Soils: simple zonal types	G
Soil forming processes (interaction between parent material, climate and vegetation)	
Soil erosion and soil conservation (leading to ecosystem and environmental balance)	
Meteorology: Interpretation of weather records, identification of fronts, etc.	G
Valley climates (effect of aspect, heating and and cooling, local winds and temperature inversions, frost and fog).	
City climates (contrast between city and rural surroundings, temperature and radiation differences, characteristics of urban climates - increased fog, air pollution, rainfall heat islands)	
Studies of rural settlement: Types - nucleated (including sub-types), dispersed	G
Factors influencing location and form	
Studies of urban settlements: Factors influencing location and form	G
Urban morphology and land use zones	
Models of urban structure (concentric, sector and multiple nuclei)	
Distribution of urban centres:	
Sphere of influence	
Urban hierarchies & simple central place theory	
Urban expansion (sprawl, ribbon development etc.)	

(Standard 10 contd. overleaf)

Table 5.1: (Contd.)

Topics as per Subject Syllabus	Subject
Standard 10 (Contd.)	
Studies of urban settlements:	
Urban problems (congestion, centralization, blight urban decay, pollution and environmental despoilation)	
Urban land use mapping. Transect studies	
Water resources and some general resource problems	G
Use and conservation of local water resources	
Factors influencing the location and development of manufacturing industries. Problems of industrial decentralization, border industries and new growth areas	G
Detailed study of a major port - Cape Town	G
Ecology: The concept of an ecosystem	B
The changing structure of an ecosystem, with emphasis on the relationships of the components with the whole.	B
Abiotic components; physical factors viz. temperature, light, water, atmospheric gases, edaphic and physiographic factors	
Biotic components; producers, consumers, herbivores, predators, omnivores; decomposers	B
Food chains and ecological pyramids	B
Energy flow; nutrient recycling; nitrogen and carbon cycles	B
Interaction in the ecosystem:	
Competition, natural selection, territorialism dominance and submissiveness	
Symbiosis; mutualism, commensalism, parasitism	
Predation	
Periodicity in the ecosystem	B
Man and the ecosystem: maintaining the balance between natural resources and man's needs	
The problem of pollution	
The need for nature conservation (nature utilization).	
G = Geography	
B = Biology	
H = History	

Secondary Schools which present opportunities for fieldwork have been determined by scrutinizing syllabuses currently in use in this country and examination questions. This material is set out in tabular form (Tables 5.1 and 5.2 and in Appendix C).

The demand for a particular school (Rondebosch Boys' High) has been determined by preparing a fieldwork syllabus. This takes into account the requirements of various subjects, as well as the constraints on fieldwork which were discussed in the previous chapter. This syllabus appears in the concluding chapter. A list of school subjects with their particular fieldwork requirements follows.

The need for some fieldwork may be identified in connection with History, as the Junior Secondary History Course calls for projects which "should include assignments in regard to local history and the significance of existing monuments, (e.g. historical buildings, mountain passes, roads etc.); and visits to the Houses of Parliament, Council Chambers etc. should be considered when dealing with the section entitled "How our Country is Governed" (Provincial Administration, 1973, p. 9).

Further, the Junior Secondary General Science syllabus demands outdoor work on two occasions: "Digging out of a soil sample and recording of the plant and animal life in it" (p. 21); and "the concept of ecosystem; an ecological study of a particular area." This is further elaborated in the syllabus. In a number of other places work is called for which would be enhanced by fieldwork (see Table 5.1.).

The Senior Secondary Biology syllabus does not expressly insist on any fieldwork being carried out but topics which might be taught in the field include : work on earthworms and snails; the identification of groups of animals in the field; plant / water relationships - the structure and physiological features of hydrophytes and xerophytes; and ecological studies which, because listed at the end of the syllabus, are usually taught as the final part of the course in Standard 10.

The greatest demand for fieldwork is, and is likely to continue to be, by teachers of Geography. The syllabus insists that in each of the Standard 7, 8 and 9 years at least one fieldwork excursion should be undertaken, (see the Junior Secondary Course Syllabus for Geography, p. 11 and 12, and the Senior Secondary Course Syllabus for Geography, p. 3, 6 and 9), and numerous topics are listed which could in part be handled in the field. Further, as already indicated, in Geography the pressure of the final examination is not as real a constraint to fieldwork

Table 5.2. Field Work Requirements (based on Geography Examination Questions)

A. Topic studies

Studies of physical processes and associated landforms
- fluvial action and associated landforms
- marine action and associated features
- the relation of relief to geology
- tors
- exposures of limestone

Studies of urban processes and resulting features
- blight: urban decay, pollution and enviornment despoilation

Studies of cultural features
- communications, shopping centres, manufacturing sites

B. Detailed holistic studies of a particular local area (10 - 250 sq. km. in area)

The following should be studied in this area
- landforms, relationship between relief and geology
- land use and factors influencing it

C. Other area studies

- small settlements: site, patterns of development, present land use functions now and in the past
- land use studies of urban areas
- industrial landscapes
- agricultural landscapes
- the rururban fringe of large settlements

as it is in Biology, for only the final years work is examined in the Senior Certificate Examinations.

The demand for fieldwork sites will be strengthened when questions on fieldwork appear in the Public Examinations. Since, however, it was recognised that they would also act negatively, tending to limit fieldwork to the demands of the examinations, the role of the examinations was discussed in the previous chapter.

Should there be a move towards a greater emphasis on environmental education, the demand for outdoor sites will be greatly increased, because, as was shown in Chapter 2, fieldwork is an integral part of environmental studies.

5.3.3. Perception

This involved the recognition and identification of the sites for fieldwork. Possible sites were identified in a number of ways: The potential of areas for fieldwork was constantly born in mind when travelling around the Cape Peninsula; more formal visits were made to promising areas, often in the company of someone with complementary skills, in order to seek new sites; a group of teachers and university staff with an interest in environmental education was canvassed; and finally a questionnaire (see Appendix D.) was distributed to individuals whom it was thought might be able to identify possible sites. Included in this group were university students and senior school pupils.

All or most of these methods could be used by teachers to locate fieldwork sites in any area.

5.3.4. The constraints

Having identified a wide variety of potential sites, the next step in determining which could be put to the best use was to consider them in the light of the constraints identified in Chapter 4.

Logistics have been an important consideration in choosing the actual fieldwork sites. Where possible, exercises were devised involving pupils in work close to the classroom which could be undertaken during a double period. This ensures the most efficient use of time, places the least strain on the organisation of the school, and minimizes costs. Examples of this type of study are given in Appendix A.

In choosing sites for fieldwork further afield the importance of

logistics has not been overlooked. Where possible sites have been chosen which are close to the line of rail, or failing this to a major road (see Fig. 5.2. Consideration has also been given to such factors as parking for buses, availability of toilets, safety, and the ability of sites to withstand trampling. Apart from the Nature Reserves no attempt has been made to locate sites in areas of restricted access.

The limitations imposed by the syllabus and examinations have been an important consideration when choosing sites for fieldwork. Likewise the writers educational aims have influenced his choice of sites, causing him to favour some (e.g. sites where ecological principles can be demonstrated) and reject others (e.g. sites useful only for taxonomic exercises).

5.3.5. The resource

Sites for which a demand has been established, have been located (perceived), and, after due consideration has been given to limiting constraints, a selection has been made. These sites indicated in Fig. 5.2. can be grouped as follows :

First: Those situated in the immediate neighbourhood of the school. This includes the school buildings, grounds, and the area situated not more than 2km from the school.

Second: The pupils' home, immediate home area, and the routes which they follow on their journey to school.

Much of the work done in these areas can be undertaken during a double period or as a homework task, and no travel costs are incurred.

Third: Fieldwork sites further afield for which special travel arrangements must be made. A short afternoon is the minimum time period required for these studies.

5.4. The Potential of the Selected Sites

Having selected the sites for fieldwork it now remains to show their potential. This will be done by listing the fieldwork activities at each site or group of sites; by indicating some of the features and concepts which can be studied at these sites; and by giving a selection of fieldwork exercises, together with their educational aims, which have been prepared for use in the chosen areas. (See Appendix A.)

The School Grounds : topics to be studied in the school grounds

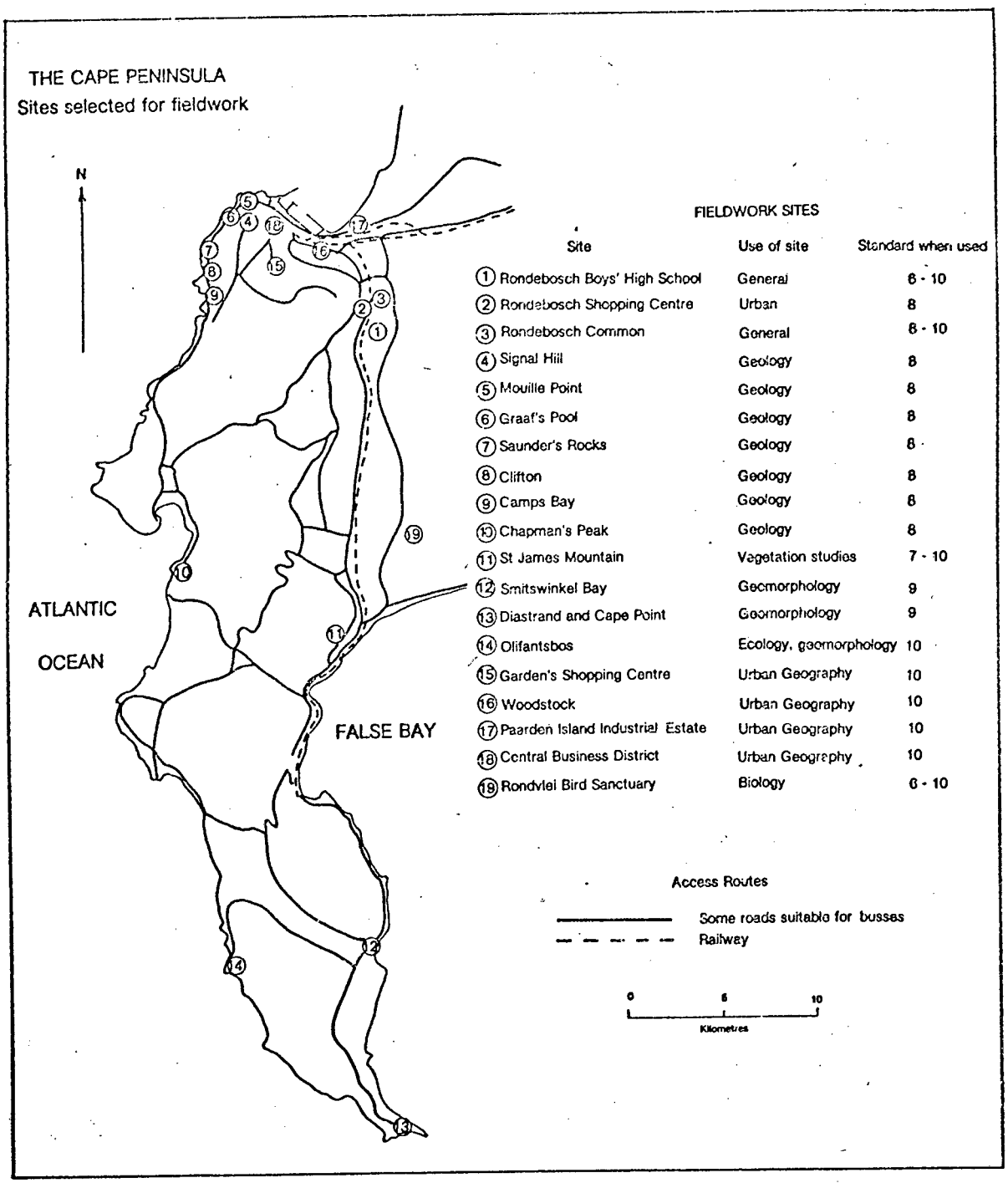

THE CAPE PENINSULA
Sites selected for fieldwork
N
ATLANTIC
OCEAN
FALSE BAY
FIELDWORK SITES
Site | Use of site | Standard when used
1 Rondebosch Boys' High School | General | 6 - 10
2 Rondebosch Shopping Centre | Urban | 8
3 Rondebosch Common | General | 6 - 10
4 Signal Hill | Geology | 8
5 Mouille Point | Geology | 8
6 Graaf's Pool | Geology | 8
7 Saunder's Rocks | Geology | 8
8 Clifton | Geology | 8
9 Camps Bay | Geology | 8
10 Chapman's Peak | Geology | 8
11 St James Mountain | Vegetation studies | 7 - 10
12 Smitswinkel Bay | Geomorphology | 9
13 Diastrand and Cape Point | Geomorphology | 9
14 Olifantsbos | Ecology, geomorphology | 10
15 Garden's Shopping Centre | Urban Geography | 10
16 Woodstock | Urban Geography | 10
17 Paarden Island Industrial Estate | Urban Geography | 10
18 Central Business District | Urban Geography | 10
19 Rondvlei Bird Sanctuary | Biology | 6 - 10
Access Routes
Some roads suitable for busses
Railway
0 5 10
Kilometres

Fig. 5.2

include map reading and interpretation, making and recording weather observations, micro-climatic studies, soil analysis, studies of local flora and fauna, ecological studies, land use and communication networks within the school, and if there is a stream flowing through the school grounds, hydrological studies. The school grounds should also be used for learning fieldwork techniques - field mapping, field sketching, levelling, sampling, collecting, classifying and labelling flora and fauna.

The Local Area :immediately outside the school grounds fieldwork possibilities include studies of local landforms, drainage features, buildings (their function, age and architecture), land-use and factors influencing it, the provision of services, communication networks and transportation problems, studies based on local shopping centres and factories, urban problems - congestion, blight, pollution, environmental despoilation, ecological studies and features of historical interest.

Selected Localities : Sites for ecological studies : these sites are particularly significant for they will be used by pupils taking General Science, Biology and Geography, and their importance will be enhanced if environmental education receives more attention in years to come. Ecological studies can to a limited extent be conducted in the school grounds. Observations and records can be made of physical factors e.g. slope, shade, soil types, humidity, and their influence on the populations of the area studied (see Junior Secondary Course Syllabus for General Science 1973, p. 22). This indicates that other sites are required which demonstrate certain ecological principles more clearly. These concepts include the zonation of plant and animal life, the role of pioneers, the concepts of seral communities and climax vegetation. An area of coastal dunes and rock pools has been selected because in these relatively simple ecosystems important ecological concepts can be readily demonstrated. In addition, coastal areas lend themselves to the examination of the parameters influencing species type, distribution, cover and diversity, such as : soil moisture, pH, nutrients, exposure to salt spray, and light intensity; and to a study of the role of vegetation in initiating and binding dunes, and supporting animal life; and to the results of interference by man. Furthermore, the skills required in order to identify, analyse and record, for example broad belts of dune vegetation, can be acquired by most school pupils.

Selected locations for urban studies : While certain aspects of urban geography can be readily studied in the vicinity of the school it is

usually necessary to travel further afield in order to find examples of such features as a Central Business District, ribbon development,and industrial estates. The central area of Cape Town has been chosen for a number of reasons. This part of the city is well suited to fieldwork encompassing holistic studies showing the interrelationship of relief, patterns of communication, and settlement. The area chosen exhibits the main elements of the townscape including the full hierarchy of shopping centres; a zone of mixed land use with the problems typical of areas peripheral to the commercial heart of the city; residential areas differing in age and housing a variety of communities; and contrasting types of industrial development. This area gives the opportunity for an examination of the results of : bid-rent, demand thresholds, functional magnetism, centripetal and centrifugal forces, and barriers to pedestrian movement. The problems afflicting urban areas such as congestion, blight, pollution and crime are most apparent in this area. This is the historical core of the Cape Peninsula with much of interest in terms of historical sites, fossilized street patterns and architecture. Furthermore it is readily accessible using public transport.

Some studies will, of course, be carried out outside the locations mentioned above, but these groups of sites have been chosen as those which will serve most of the requirements of Cape Peninsula teachers who wish to give fieldwork the place it deserves in the educational experience of secondary school pupils. This selection has been made on the basis of the criteria discussed in this study, taking into account both educational aims and logistic constraints.

Table 5.3: Fieldwork syllabus, Rondebosch Boys' High School

Standard	Topic	General Aim	Source of Educational Criteria			Logistic Constraints	
			Syllabus	Public Exam questions	General Aims Environmental Education	Locality/ distance	Time allocated
6	Mapwork: Direction and bearing (using compass, watch, sun).	Map reading skills.	Geography			School grounds	Double period
	Scale (e.g. areas in school grounds, distance to local landmarks, maps of different scale).	Understanding scale; conceptualizing distances, areas.	Geography			School grounds	Double period
	Conventional signs (1:50 000 topographical sheet of locality).	Map reading skills.	Geography	Various		School grounds	Double period
	Contours. Human contour exercises.	Introducing concept of contours	Geography			School grounds	Double period
	Studying local landforms - comparing map and ground truth.	Elementary interpretation of contour patterns.	Geography	Various		School grounds	Double period
	Orienteering.	Map reading skills.				School grounds	Short afternoon
	Weather observation and recording.	Weather observation and recording meteorological data.	Geography	Various	Environmental awareness	School grounds	Single period
	The compiling of simple keys with reference to known groups of animals.	Concepts of Families, genera, etc.	General Science		Environmental awareness	School grounds	Double period
	The use of simple keys for the identification of plants and animals.	Use of keys.	General Science		Environmental awareness	School grounds	Double period
	Direct observation of the external structure and dispersal mechanism of seeds.	Demonstrate the nature and advantage of different types of dispersal mechanism.	General Science		Environmental awareness	School grounds	Double period
	Direct observation of vegetative reproduction and pererration.	Demonstrate advantages of vegetative reproduction and pererration.	General Science		Environmental awareness	School grounds	Double period
	Efficiency of movement at home.	Spacial awareness.	Oxford Geog. Proj.			Home	Homework period
	Movement in school.	Concepts - networks and nodes.	Oxford Geog. Proj.			School building	Double period
	Microclimate and vegetation of home garden.	Appreciate influence of microclimation vegetation.	General Science		Environmental awareness	Home	Homework period
	Suburban town trail.	Environmental awareness.			Environmental awareness	2 km	Short afternoon
	Bus trip through S.W. Cape.	Regional synoptic study.	Geography	Various	Environmental awareness	± 300 km	1 Full day

Table 5.3: (Contd.)

Standard	Topic	General Aim	Source of Educational Criteria			Logistic Constraints	
			Syllabus	Public exam questions	General Aims Environmental Education	Locality/ distance	Time allocated
7	Mapwork. Further studies of local landforms, drainage features and cultural features on local 1:50 000 map.	Map reading and interpretation.	Geography	Various	Environmental awareness	School grounds	Double period
	Geomorphology. Study of local stream-valley features. Study of stream load. Water velocity studies. Processes of erosion, transport and deposition and resulting formations.	Concepts - processes and forms associated with the work of running water.	Geography	Various		School grounds	Double period
	Urban geography. Study of Claremont with reference to major land use zones.	Concepts - zonation in urban areas.	Geography	see exam questions Appendix 3	Environmental awareness	Claremont 5 km	Long afternoon
	Soil studies. Examination of loam soil. Comparisons of sand, clay, loam. Living organizms in soil (including litter).	Study of properties of soil.	Geography	see Appendix 3	Environmental awareness	School grounds	Double period
	Ecological studies: Study of stands of deciduous, coniferous and eucalyptus trees. Comparison of litter and fauna found beneath each vegetation type.	Recognition of characteristics of vegetation types. Concept - interrelationship between Forest type, soil, fauna and flora.	Geography General Science		Environmental awareness Environmental awareness	School grounds	
	Compaction of soil and the effect on vegetation.				Environmental awareness	School grounds	Double period
	Vegetation species ensembles on the playing field - relationship of vegetation to edaphic factors and trampling regimes.	Concept - the influence of physical factors on populations.	General Science		Environmental awareness	School grounds	Double period
	The effect of lime lines on vegetation.	Methods of measurement of various parameters.					Double period
	Study of fauna associated with large stone left in stream.						
	Observation and recording of physical factors e.g. slope, shade, soil types, aspect, edaphic factors and their influence on various populations including vegetation.	As above			Environmental awareness	School grounds	Double period
	Contrast of vegetation on opposite sides of the canal.	As above.	General Science		Environmental awareness	School grounds	Double period
	Observation of the consequences of disturbances e.g. clearing the ground, fire.	Concept - successions.	General Science		Environmental awareness	School grounds	Prolonged period of observation
	Judicious utilization of natural resources e.g. cycling of wastes, making of compost.	Attitudes - conservation of natural resources.	General Science		Environmental awareness	Home/School	Homework
	Control of pollution.	Attitudes - the quality of life.	General Science		Environmental awareness	Home, School, Local area	Homework

Table 5.3: (Contd.)

Standard	Topic	General Aim	Source of Educational Criteria			Logistic Constraints	
			Syllabus	Public Exam questions	General Aims Environmental Education	Locality/ distance	Time allocated
7	A farm study. Observation of the consequences of disturbances in the balance of nature e.g. soil erosion, use of spray.	Concepts - e.g. crop rotation. Concepts e.g. the balance of nature.	Geography	see Appendix 3	Environmental awareness	± 100 km	Whole day
	How our country is governed. Visit to Houses of parliament, Council chambers, etc.	Concepts - e.g. Parliamentary rule, democracy, local government.	History			± 10 km	Long afternoon
	Topics for independent study which could include Fieldwork: Weather forecasting. Modern means of communication. Ocean transport. Air transport. Fishing in South Africa and South West African waters. An important hydro electric or irrigation project. The significance of existing monuments e.g. historical buildings, passes, roads.	To develop initiative and self-discipline. To introduce pupils to research methods.	Geography				Homework - Holiday Task

Table 5.3.: (Contd.)

Standard	Topic	General Aim	Source of Educational Criteria			Logistic Constraints	
			Syllabus	Public Exam questions	General Aims Environmental Education	Locality/ distance	Time allocated
8	Field study techniques: Map making - plane table survey, compass traverse, chain survey, levelling.	Skills	Geography	see Appendix 3	Techniques for recording observations.	School grounds	Double period
	Sampling quadrant, expanded quadrant, line and belt transect.					School grounds School grounds	Double period Double period
	Geology: Field sketch of Table Mountain showing major geomorphological features.	Concepts - e.g. jointing, stratification, metamorphism.	Geography	see Appendix 3	Environmental awareness	School grounds	Double period
	Study of rock exposures: Rock types and associated relief; faulting, jointing, folding, stratification, unconformities, contact zones, etc.					Northern Cape Peninsula	Whole day
	Meteorology: Simple cloud classification.	Concepts - different cloud types.	Geography			School grounds	Double period
	Calculation of height of clouds.						
	Wind velocity and constancy (tatter flag test).					School grounds	Double period
	Contrasting the albedo of different surfaces - e.g. grass and tar using light meter and visual intensity index.	Concept - albedo.	Geography			School grounds	Double period
	A study of earthworms and snails.		Biology		Environmental awareness	School grounds	Double period

Table 5.3: (Contd.)

Standard	Topic	General Aim	Source of Educational Criteria			Logistic Constraints	
			Syllabus	Public Exam questions	General Aims Environmental Education	Locality/ distance	Time allocated
9	Geomorphology: Hydrological studies: Water budget calculations; the contribution of the drainage from the school playing fields to the flow of the river.	Skills - conducting hydrological studies. Concepts - e.g. water budget.	Geography		Environmental awareness	School grounds	Double period
	The relationship between water levels in the river and rainfall in the catchment.		Geography			School grounds	Double period
	Fluvial action: Studies of processes and resulting formations in local river.	Concepts - e.g. rejuvination, graded reaches.	Geography	see Appendix 3		10 km	Long afternoon
	Marine Action: Detailed study of process and form resulting from wave action along a short stretch of coastline.	Recognition of landforms and explanation of their mode of formation.	Geography			± 50 km	Whole day
	Wind action: Studies of process and form.		Geography			± 10 km	Long afternoon
	Meteorology: The influence of relief on air circulation, temperature and precipitation.	Concepts - e.g. instability, arabatic winds.	Geography	see Appendix 3		± 10 km	Overnight
	Plant studies: The distinguishing characteristics, habitat, mode of nutrition, life cycle, significance as regards energy pathways of selected plants listed in the Biology syllabus.	Concepts - e.g. niche, energy pathway.	Biology			School grounds	Double period

Table 5.3: (Contd.)

Standard	Topic	General Aim	Source of Educational Criteria			Logistic Constraints	
			Syllabus	Public Exam questions	General Aims Environmental Education	Locality/ distance	Time allocated
10	Geomorphology: Analysis of slopes and slope forms.	Concepts - e.g. pediplanation.	Geography			Table Mountain 8 km	Long afternoon
	Soils: Soil forming processes (interaction between parent material, climate and vegetation). Soil analysis. Soil erosion and soil conservation (leading to ecosystem and environmental balance).	Concepts - e.g. living soil. Skills - e.g. soil testing. Attitudes - conservationist.	Geography + Biology	see Appendix 3	Environmental awareness	School grounds School grounds	Double period
	Meteorology: Interpretation of weather records, identification of Fronts, etc. Valley climate (effect of aspect, heating and cooling, local winds and temperature inversions, Frost and Fog). City climates (contrast between city and rural surroundings, temperature and radiation differences, characteristics of urban climates - increased Fog, air pollution, rainfall, heat islands).	Concepts - e.g. katabatic winds, heat island.	Geography	see Appendix 3	Environmental awareness	School grounds 20 km 20 km	 Afternoon and evening Long afternoon
	Studies of a rural settlement: Factors influencing location and form.	Concepts - e.g. central place, sphere of influence.	Geography + History	see Appendix 3		100 km	Whole day
	Studies of urban settlement: Factors influencing location and Form. Urban morphology and land use zones. Mapping of urban land use and transect studies. Explanation of land use patterns in terms of models of urban structure (consentric section and multiple nudei).	Concepts - e.g. urban renewal, blight. Skills - e.g. urban land use mapping. Attitudes - e.g. preservation of historic buildings, participation in efforts to improve the quality of life. Concepts - land use models - their uses and shortcomings.	Geography + History Geography Geography Geography	see Appendix 3	Environmental awareness	C.B.D. 10 km C.B.D. C.B.D.	Short afternoon Long afternoon
	Distribution and hierarchical ordering of commercial areas. Spheres of influence. The character and problems of the C.B.D.	Concepts - hierarchy. Concepts - range, threshold. Study of urban problems.	Geography Geography Geography	see Appendix 3	Environmental awareness	Rondebosch shop.area 4km C.B.D. 10 km	Short afternoon Short afternoon Short afternoon

Table 5.1: (Contd.)

Standard	Topic	General Aim	Source of Educational Criteria			Logistic Constraints	
			Syllabus	Public Exam questions	General Aims Environmental Education	Locality/ distance	Time allocated
10	Studies of an urban settlement continued: Patterns of residential land use: suburban development, residential segregation, squatter settlements, zones of mixed land use. Studies of industrial areas and individual industries: Industries near the city centre, industrial estates, heavy industry.		Geography	see Appendix 3		Paarden Island	Long afternoon
	Urban problems: Congestion, centralization, urban sprawl, ribbon development, blight-urban decay, pollution, environmental dispoilation.		Geography	see Appendix 3		C.B.D. 10 km	Short afternoon
	Transportation studies.	Concepts - network, nodes, Flow.	Geography			Local area 4km	Short afternoon
	Factors influencing the location and development of industries. Problems of industrial decentralization border industries and new growth areas (Atlantis).	Concepts - locational analysis, decentralization.	Geography	see Appendix 3		Atlantis 50km	Long afternoon
	Ecology: The concept of an ecosystem. The changing structure of an ecosystem, with emphasis on the relationships of the components with the whole. Abiotic components: Physical factors viz. temperature, light, water, atmospheric gases, edaphic and physiographic factors. Biotic components: Producers, consumers. Herbivores, predators, omnivores; decomposers. Food chains and ecological pyramids. Energy flow; nutrient recycling: Interaction in the ecosystem: Competition, natural selection, teritorialism; dominance and submissiveness; symbiosis; mutualism, commensalism, parasitism. Predation.	Concepts - e.g. ecosystem, balance of nature. Attitudes - e.g. resource management, conservation, preservation of wilderness.	Biology + Geog.	see Appendix 4	Environmental awareness	Cape of Good Hope Res. 100km	Whole day
	Periodicity in the ecosystem.	Concepts	Biology		Environmental awareness	School grounds	Prolonged Obser.
	The ecology of a log.	Concepts -	Biology		Environmental awareness	School grounds	Double period
	Energy budgets on playing fields.	Concepts - skills - calculations of energy budgets and mass budgets.	Biology			School grounds	Short afternoon
	Mass budgets on playing fields.		Biology			School grounds	Short afternoon
	Man and the ecosystem: Disturbed habitats.	Attitudes - thinking conservation.	Biology + Geog.	see Appendix 4 Appendixes 3,4		Cape of G.H.Res. 100km	
	The impact of alien vegetation.					C.B.D.	Short afternoon
	The problem of pollution.					Cape of G.H.Res. 100km	
	The need for nature conservation.	Attitudes - thinking conservation.					

Note: Distances given are for a return trip.

Several of the topics listed separately may be handled on the same day.

CHAPTER 6

CONCLUSION

This study has attempted to establish a system for identifying useful sites for fieldwork in the Cape Peninsula and, having identified them, to assess their educational potential. In order to do this it has been necessary to ask and to attempt to answer three questions:

First: Why should work be carried out in the field? The answer to this question was shown to lie partly in the aims and the nature of Environmental Education (as outlined in the second chapter) and partly in the role which fieldwork can play in traditional school disciplines such as Biology and Geography. This was dealt with in Chapter Three.

Second: What kind of work should be done in the field? What particular insights and skills should teachers be aiming to impart to their children through fieldwork? The second chapter attempted to give some guidelines for the answering of this question taking into account, not just the course work of subjects which are currently being taught in South African schools, but developments elsewhere in Environmental Education.

Third: What are the constraints which limit the amount of fieldwork undertaken by schools? In Chapter Four they were identified as being both logistical (time, costs etc.) and educational - the constraints imposed by course syllabuses and examinations.

The answers to these questions, as set out in these chapters, indicate the considerations which must be borne in mind when choosing sites for fieldwork. The process by means of which the sites were selected was outlined in Chapter 5. Appendices, by giving worked examples of field studies based on the chosen sites, show how the educational potential of these sites is utilised, as well as giving some indication of the role of fieldwork in Environmental Education.

In this study no attempt has been made to make an inventory of sites in the Cape Peninsula which are suitable for fieldwork, but rather to produce a selection of sites, together with a fieldwork syllabus which has been validated from an educational point-of-view and is practicable as to logistics. That there are many sites with considerable potential for fieldwork which have not been considered is obvious to anyone conversant with the rich diversity of the Cape Peninsula, but this study has

attempted to show how the busy school teacher, faced with such a range of possibilities, can set about choosing those sites which are best suited to his purpose. The map (Fig. 5.2) and the syllabus outlined (Table 5.3.) are thus the end product towards which this study has worked. It is felt that they demonstrate that a workable system has been devised for the selection of sites for fieldwork, one which could be used, not only by teachers in the Cape Peninsula but also in other parts of the country.

The fieldwork syllabus set out in Table 5.3. indicates how the logistic constraints have been taken into account. It also shows in summary form some of the educational aims of the individual studies.

The syllabus is not a final product. It is a basis from which to work and will be adapted with time and experience. No attempt is made to indicate to the teacher either what should be taught or where, but rather what has been done is to set out the parameters which should be taken into account when choosing fieldwork sites. Appendix A gives examples of what could be done at those sites. The situation and circumstances of different schools differ, so do the interests, expertise and even the educational aims of different teachers. These must influence what fieldwork will be undertaken and where. In a particular school a simple change such as the purchase of a school bus or the freeing of pupils from sporting commitments over particular weekends, could materially change what fieldwork could be attempted in that school. Those teachers who espouse the aims of Environmental Education as set out in Chapter 2 will find that this will influence what they wish to teach in the field and consequently their choice of sites. This syllabus is then, a starting point rather than an end product, it is forward looking in that it attempts to make provision for a possible increase in emphasis on Environmental Education.

It appears that further research is required in two main areas:

(i) Fieldwork in primary schools. As in these schools timetables are more flexible, classes are taken for most of the week by a single teacher, and there is not the pressure of public examinations, many of the logistic constraints to fieldwork fall away. Furthermore the children are at a very impressionable age, a time when desirable attitudes to the environment might most readily be formed.

(ii) There is a need for research on Environmental Education in the South African context. An assessment of the amount and nature

of Environmental Education presently being carried out in this country should be carried out, careful consideration should be given to the ways and means of increasing environmental awareness among pupils in this country, and to the form which this Environmental Education should take.

(iii) Research should be undertaken on promoting environmental awareness among the general public, of producing that heightened consciousness of man's dependence on limited resources and vulnerable ecosystems without which all efforts to protect this 'fragile land' must fail. The urgent need for such research is apparent for as Rabie (1976) has pointed out, this protection cannot be afforded by legislation, unless public opinion supports conservation measures they must fail. Education, particularly environmental education could play a key role in this essential task of transforming the public's attitude to its environment.

REFERENCES

Adamson, J.E., 1921: The Individual and the Environment, cited by K. Wheeler in "The Genesis of Environmental Education", G.C. Martin & K. Wheeler (eds.). Insights into Environmental Education, Oliver & Boyd, Edinburgh, p.4.

Aldrich, J.L. & A.M. Blackburn, 1975: "Environmental Education in the United States", in G.C. Martin & K. Wheeler, (eds.), Insights into Environmental Education, Oliver & Boyd, Edinburgh, pp. 167-176.

Andrewartha, H.G., 1970: Introduction to the Study of Animal Populations, Chapman & Hall.

Archer, J.E. and T.H. Dalton, 1968: Fieldwork in Geography, (2nd Ed.), Batsford, London.

Australian Conservation Foundation, 1976: Guide to Assessment of Outdoor Education Sites, unpublished cyclostyled report, Wattle Park Teachers Centre, Adelaide.

The Australian Science Teachers Journal, quarterly, Acacia Press, Blackburn.

Baldock, R.N., 1973: "Biology Excursions", in The Australian Science Teachers Journal, Vol. 19, No. 1, pp.13-32.

BEE, Bulletin of Environmental Education, Monthly, T. & C.P.A.

Berry, P.S., 1975: Source book for Environmental Studies, George Philip, London.

Bird, E.C.F., 1966: "The Role of Field Studies in Conservation Education" in S. Cavernor & D.H. Whitelock (eds.) Conservation in Education, Department of University Extension, University of New England, Armidale.

Bloom, B.S. (ed.), 1956: Taxonomy of Educational Objectives: The Classification of Educational Goals, Handbook I: Cognitive Domain, Longmans, Green & Co., New York.

Board, C., 1965: "Fieldwork in Geography, with Particular Emphasis on the Role and Land-use Surveys", in R.J. Chorley & P. Hagget (eds.), Frontiers in Geography Teaching, Methuen, London.

Briault, E.W.H. and D.W. Shave, 1960: Geography in and out of School, Harrap, London.

Briggs, K., 1970: Fieldwork in Urban Geography, Oliver & Boyd, Edinburgh.

Bull, G.B.G., 1969: A Town Study Companion, Hulton, London.

Burman, J., 1962: Safe to the Sea, Human & Rousseau, Cape Town.

1967: Where to Walk in the Cape Peninsula, Human & Rousseau, Cape Town.

Carson, S. McB., (comp.), 1971: Environmental Studies, The Construction of an "A" Level Syllabus. National Foundation for Educational Research in England and Wales, Slough.

Chappalaz, D.P., 1970: Hypothesis Testing in Field Studies, Geographical Association, Sheffield.

Clark, E., 1973: Fieldwork in Biology: An Environmental Approach, MacMillan, Bassingstoke.

Clarke, G.R., 1971: Study of Soils in the Field (5th Edition), Oxford University Press, London.

Classroom Geographer; 8 issues p.a., cyclostyled, 3 Winsleydale, Luton.

Collier, J., 1961: Portrait of Cape Town, Longmans, Cape Town.

Council for Environmental Education, 1970: DELTA (The Directory of Environmental Literature and Teaching Aids), CEE, College of Estate Management, University of Reading, Reading.

Cross, M.F. & P.A. Daniel, 1968: Fieldwork for Geography Classes, McGraw-Hill, London.

Davies, D.H., 1965: Land Use in Central Cape Town, Longmans, Cape Town.

Department of Education, Provincial Administration of the Cape of Good Hope.

1973: Junior Secondary Course Syllabus for Geography.

1973: Senior Secondary Course Syllabus for Geography (Higher Grade).

1973: Senior Secondary Course Syllabus for Biology (Higher Grade).

1973: Junior Secondary Course Syllabus for General Science (Standard Grade)

1973: Junior Secondary Course Syllabus for History.

1975: Practical Course Syllabus for Biology Standards 9 and 10.

Cape & Transvaal Printers, Cape Town.

Diepeveen, W.M., 1977: In-Service Training of Teachers in Outdoor Education: Report and Recommendations, cyclostyled unpublished report, Cape Town Teachers' Centre, Cape Town.

Dodd, J.P., 1969: Investigating Geography, Heinemann, London.

Du Plessis, I.D., 1972: The Cape Malays, Balkema, Cape Town.

Environmental Education, annual publication, NAEE, Heinemann.

Everson, J.A. & B.P. Fitzgerald, 1972: Inside the City, ("Concepts in Geography" series), Longman.

Franck, B. et al., 1967: District Six, Longmans, Cape Town.

Gold, S.M., 1972: "Environmental Studies: An Educational Prospectus, International Journal of Environmental Studies, Vol. 3, No. 1, pp.55-64, cited by R.D. Linke, Environmental Education in Australia, Part 1, Final Report on A 'National Survey of Environmental Education in Australia' 1973/74, cyclostyled, Flinders University, Bedford Park.

Green, L.G., 1964: I Heard the Old Man Say, Timmins, Cape Town.

1971: A Taste of South Easter, Timmins, Cape Town.

1973: Tavern of the Seas, Timmin s, Cape Town.

Haddon, J., 1964: Local Geography. Geographic Survey in Rural Areas, Philip, London.

1971: Local Geography in Towns, Philip, London.

1974: The Human Element (Fieldwork in Geography, Book 2), Wheaton, Exeter.

1976: Country Coast and Town (Fieldwork in Geography, Book 3), Wheaton, Exeter.

HMSO, 1972: How Do you Want to Live? A Report on the Human Habitat, HMSO, London.

Honickman, A.H., 1966: Cape Town, City of Good Hope, Timmins, Cape Town.

Hopkins, M.F.S., 1968: Learning Through the Environment, Longmans, London.

Hughes, B., 1972: Walking Through History, Timmins, Cape Town.

IUCN, 1970: Final Report on International Working Meeting on Environmental Conservation Education, in the School Curriculum, IUCN Publications, Morges.

Kent, A. et al., 1974: The Local Framework (Oxford Geography Project), Oxford University Press, London.

Levyns, M.R., 1966: Guide to the Flora of the Cape Peninsula, 2nd rev. ed., Juta, Cape Town.

Linke, R.D., 1976: Environmental Education in Australia, Part 1. Final Report on a National Survey of Environmental Education in Australia, 1973/74, cyclostyled, Faculty of Education, Monash University, Monash.

Long, M.& B.S. Roberson,: Teaching Geography, Heinemann, London.

Lucas, A.M., 1972: Environment and Environmental Education: Conceptual Issues and Curriculum Implications, Ph.D. Dissertation, Ohio State University, Columbus, cited by Linke, R.D. op.cit.

Mabbutt, J.A. (ed.), 1952: The Cape Peninsula, Maskew Miller, Cape Town.

Marker, M.E., 1970: "School Geography Through Fieldwork" in J. Geogr., Vol. 3, No. 7, pp.773-778.

Martin, G.C., 1969: "Towards a Definition", SEE, Vol. 1, No. 2.

1965: "A Review of Objectives for Environmental Education, in G.C. Martin & K. Wheeler (eds.) Insights into Environmental Education, Oliver & Boyd, Edinburgh, pp.20-32.

Martin, G.C. & E. Turner, 1972: Environmental Studies (Blond's "Teacher's Handbooks"), Blond Educational, Plymouth.

Martin, G.C. & K. Wheeler, eds., 1975: Insights into Environmental Education, Oliver & Boyd, Edinburgh.

McDonald, K.S., 1973(a): "Coastal Sand Dune Plant Ecology: Field Phenomena and Interpretation", The Australian Science Teachers Journal, Vol. 19, No. 1.

1973(b): "Multi-media Field Studies - A Development Earth Science Teaching", The Australian Science Teachers Journal, Vol. 19, No. 1.

Mellowes, C., 1972: "Environmental Education and the Search for Objectives" in Environmental Education: the Present and Future Trends, Occasional Paper No. 6, Society for Environmental Education, Portsmouth.

Miles, P.M. & H.B., 1974: Freshwater Ecology, (rev. ed.), Biological Field Studies, Hutton, Amersham.

Morton, J.G., 1969: "Fieldwork", in J. Geogr. Vol. 3, No. 5, pp.519-522.

Mottershead, P., 1974: Practical Biogeography, Geographical Association, Sheffield.

National Association of Environmental Education, 1976: Environmental Education: a statement of Aims, NAEE, Birmingham.

Nicol, I.G., 1976: "Teaching Settlement Geography", in J. Geogr. Vol. V, No. 1, pp.62-66.

Nightingale, C.S., 1976: "Field Studies - Marine Action and Resultant Landforms", in J. Geogr. Vol. V, No. 3, pp.255-260.

O'Neill, B.E., 1970: "Environmental Education in Australian Schools", in (eds.) J. Evans and S. Bryden, Education and the Environmental Crisis, Australian Academy of Science, Canberra.

Parker, S., 1974: Studies in School Ecology, Science Education Centre, University of Rhodesia, Salisbury.

Perrot, E., 1975: Man and His Environment (Biology: An Environmental Approach), Murray, London.

Picard, H.W.J., n.d.: Gentleman's Walk: The Romantic Story of Cape Town's Oldest Streets, Lanes and Squares, Struik, Cape Town.

1969: Grand Parade: The Birth of Greater Cape Town, Struik, Cape Town.

Pirie, G.H., 1977: "Small Town Demography - Pilgrim's Rest Case Study" in J. Geogr. Vol. 5, No. 5.

Powell, E., 1975: "Field Work Versus Field Research: An Example in the Umhlatuze Valley", in J. Geogr., Vol. 5, No. 2, pp.152-155.

Pratt, C., 1973: "Excursions in Geology" in the Australian Science Teachers' Journey, Vol. 19, No. 1, pp.47-51.

Rabie, A., 1976: South African Environmental Legislation, Institute of Foreign and Comparative Law, University of South Africa, Pretoria.

Reinke, S., 1972: "Ekskursies in Geografie - onderrig: Enkele Gedagtes", J. Geogr., Vol. 3, No. 10, pp.1085-1087.

Richards, D., 1976: "The Umgeni Valley Project", in IUCN Proceedings: Conservation Education Symposium, cyclostyled, pp.45-62.

Richards, D. & C. Walker, n.d.: Walk Though the Wilderness, Purnell, Cape Town.

Ripley, S.D. & H.K. Buechner, 1971: "Ecosystem Science as a Point of Synthesis" in J.A. Day, F.F. Frost, P.R. Rose (Eds.), John Wiley & Sons, New York, pp.134-142.

Sauvain, P.A., 1964: A Geographical Field Study Companion, Hulton, Amersham.

1970: Man and Environment (Hulton's Practical Geography Series Book 3), Hulton, Amersham.

Schools Council Project Environment, 1974(a): Education for the Environment, Longman, London.

1974(b): The School Outdoor Resource Area, Longman, London.

1974(c): Learning from Trails, Longman, London.

Selby, G., 1970: "Think Conservation", Dialogue, Schools Council Newsletter No. 6.

Simmons, I.G., 1975: The Ecology of Natural Resources, Edward Arnold, London.

Smith, D.L., 1975: Environmental Education in Australia, in G.C. Martin & K. Wheeler (eds.), Insights into Environmental Education, Oliver & Boyd, Edinburgh.

Strom, A., 1970: School Excursions, Field Studies and Conservation Education, cyclostyled, A.C.F., Melbourne.

Teaching Geography, bi-monthly, Geographical Association, Longman, Edinburgh.

Truvan, J.M., 1973: "The Field Studies Group at Melbourne High School", The Australian Science Teachers Journal, Vol. 19, No. 1, pp.57-62.

UNESCO/UNEP, 1974: The Belgrade Charter, A Global Framework for Environmental Education, Connect, the UNESCO/UNEP Education Newsletter, Issue 1, Unesco Environmental Education Division, Paris.

Walsch, J.W., 1971: Urban Studies (Environmental Studies Assignment Books No. 3), Schofield & Simms, London.

Ward, B. & R. Dubbs, 1972: Only One Earth, The Care and Maintenance of a Small Planet, Penguin, London.

Ward, C. & A. Fyson, 1973: Streetwork: The Exploding School, Routledge & Keegan Paul, London.

Watts, D.G., 1969: Environmental Studies, Routledge & Keegan Paul, London.

Wheeler, K.S. & B. Waites, 1975: Environmental Geography, Rupert Hart Davis, London.

Wheeler, K.S. & M. Harding (eds.), 1966: Geography Fieldwork: A Handbook, Blond Educational, London.

Wilks, H.C., 1973: "Recent Books About Fieldwork: A Review", in Geography, Vol. 58, Part 4, pp.355-359.

APPENDIX A.

A selection of guides for fieldwork activities is given in this appendix. The material has been selected to demonstrate principles set out in this study. Examples include:

1. Elementary studies to be undertaken in the school buildings and grounds and the pupils' homes. These introduce important concepts and map reading skills. This fieldwork can be undertaken during a double period, or for homework.

2. An example of a Suburban Town Trail (for Standard 6 pupils) which serves as an introduction to part of the grounds and the immediate environs of the school. A full afternoon is required for this fieldwork.

3. The study of a local suburban shopping centre, undertaken as part of the urban geography course in Standard 7. The fieldwork can be completed in a short afternoon.

4. A group of studies undertaken by Standard 9 pupils during a whole day excursion to the Cape of Good Hope Nature Reserve. Though the major emphasis of this fieldwork is coastal geomorphology, the biological interests of some of the pupils is catered for, and the bus journey is seen as an opportunity to introduce pupils to aspects of social geography and more general environmental issues.

5. More advanced ecological studies occupying a full week-end are undertaken by Standard 10 pupils studying either Biology or Geography. Pupils are housed in a field station located in the reserve. This presents pupils with the opportunity to undertake fieldwork in an area where certain major ecological concepts are more clearly exemplified than in the home area, and to use standard field procedures in relatively uncomplicated situations.

6. Studies in Cape Town's Central Business District using both traditional fieldwork methods and field research. These form part of the Urban Geography course for pupils in Standard 10.

Some study outlines are given in the first person, others in the third, depending on whether or not the instruction leaflet is given to the pupils.

Elementary Fieldwork in the School/Home Environment

The first three fieldwork exercises are planned for pupils in Standard 6. Together with the following two exercises, they exemplify the type of work which can be carried out in the school buildings and grounds during double periods, and at home as homework assignments.

The aims of the following units are considered together:

1. Efficiency of movement at Home
2. Movement in School
3. Calculating an Amenity Index for your Home.

General Aims

The aims of the first three fieldwork exercises are:

1. To build on and refine pupils' understanding of the concepts of distance, area and scale; and to introduce them to such concepts as centrality, connectivity, accessibility, flows, networks and nodes.

2. To assist pupils to develop a spatial awareness of their environment.

3. To introduce pupils to elementary fieldwork and statistical techniques.

As a result of these studies pupils should:

1. Have a greater understanding of the concepts of scale.

2. Understand the meaning of, and appreciate something of the significance of concepts associated with the movement of men, materials and ideas;

3. Be better able to plan efficient routes;

4. Be able to draw simple maps to scale;

5. Be able to make a simple classification of land use;

7. Understand the concept - amenity;

8. Have some familiarity with such elementary statistical procedures as the drawing and interpreting of bar graphs, scatter graphs, flow maps.

EFFICIENCY OF MOVEMENT AT HOME

Introductory exercises:

Study Fig. A.1 and complete the following exercises.

1. How long and how wide is the kitchen in metres?

2. Work out how far a person, using this kitchen, has to move in order to make a pot of tea. Take both arm and foot movements into account.

Homework:

3. Draw a similar plan of your kitchen at home. This must be drawn accurately to scale. A suitable scale might be 2 cm represents 1 m.

4. Record the movements of someone making a pot of tea as in the diagram above. Calculate the total distance moved.

5. Add a title, scale, an arrow pointing north and a key. All plans and maps should have these pieces of information.

6. Suggest how the kitchen could be re-arranged in order to shorten the movements.

7. Compare your result with those of others in your class. Whose mother's kitchen has the best (most efficient) arrangement for making tea? Try to work out why this should be so.

Reference: Kent, A., et al., 1974: The Local Framework (Oxford Geography Project), Oxford University Press, London.

MOVEMENTS TAKEN WHILE MAKING A POT OF TEA

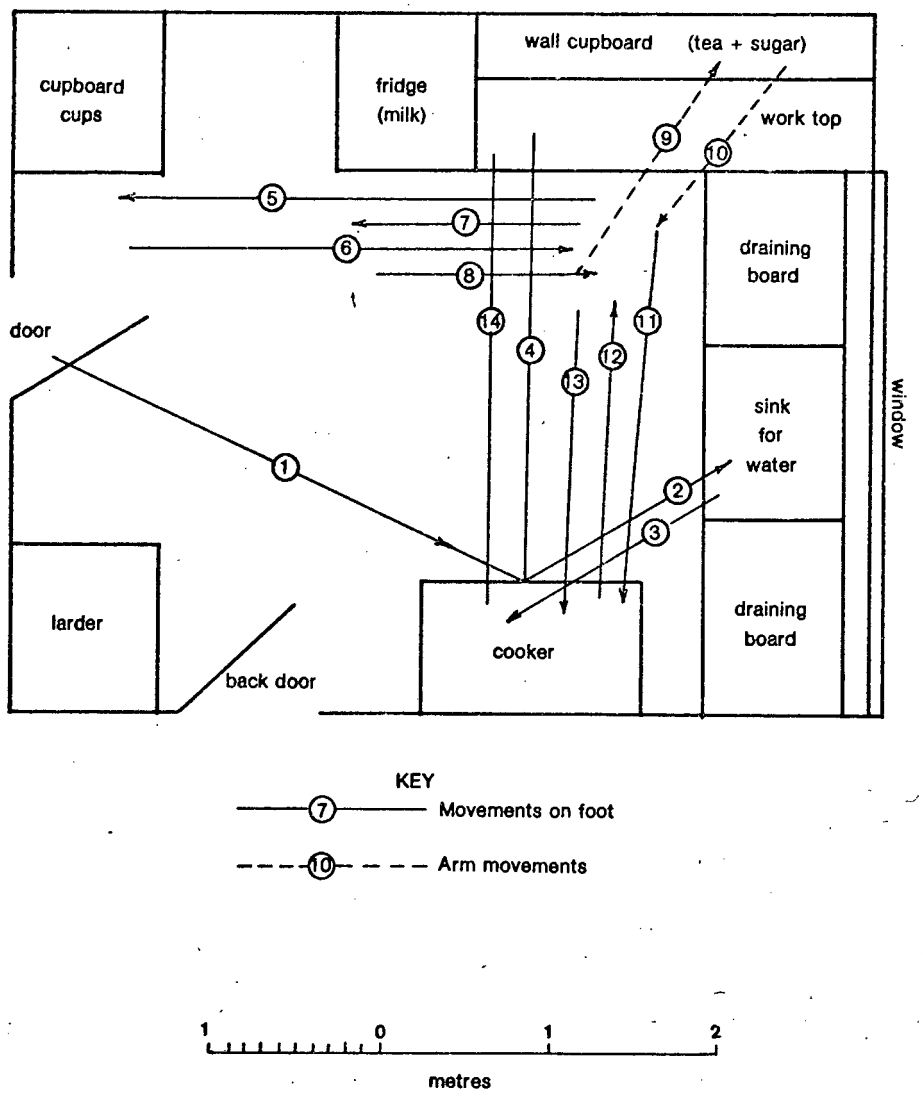


Figure A. 1.

Source: Kent, 1974

CALCULATING AN AMENITY INDEX FOR YOUR HOME

Is your home well placed in respect of amenities, or do you find it difficult to reach other places from it?

Is your home better placed than your friend's home in another part of the town?

Both of you may try to settle the argument by working out the amenity index for his own home.

The index can be worked out by counting the number of paces from home to each of the main amenities.

Here is an example

	Amenity	Number of paces from home
1.	Bus stop	250
2.	Railway station	Beyond walking distance
3.	School	915
4.	Grocery shop	821
5.	Butcher's shop	803
6.	Clothing store	1613
7.	Newsagent's shop	805
8.	Park or playing field	892
9.	Chemist's shop	1689
10.	Telephone box	27
	Add an estimate of each place which is beyond walking distance	
	Estimated distance to railway station	3000
	TOTAL	10815

Divide by 10, as this is the total number of amenities, giving 1081,5 as the amenity index for the house in the example. A low index means that the home is in a well-serviced suburb, a high index indicates a home remote from amenities, situated in the heart of 'desert of housing'.

Reference: Bull, G.B.G., 1969: A Town Study Companion, Hulton, London.

MOVEMENT IN SCHOOL

1. On a map of your school put all the movements you make on a Monday morning.

2. Work out the total distance you move within the school buildings during a morning.

3. Is there any way in which you could have cut down on the distance travelled?

4. Can you suggest a different plan for the school which would mean less movement. Remember that what suits you might not be best for other people, so bear everybody in mind.

In the previous exercises you have been studying part of the school's network of corridors, staircases and paths. At some points corridors meet each other, these are known as nodes. Where two corridors meet we have 3-nodes and where four meet 4-nodes.

5. How many 3- and 4-nodes are there on Fig. A.2?

Some parts of the network will be busier than others. This will depend on two factors: First, the number of the node: 4-nodes will probably be busier than 3-nodes. Second, the nature of land use, certain rooms are busier than others, they generate more traffic.

6. Try to predict which will be the busiest parts of the school.

7. Check your predictions by making a traffic count and drawing a flow-map as in Fig. 2. Each member of the class must take up a position at a suitable point (counting station). Beginning at exactly the same time (when the school bell goes at the end of a period), count accurately the number of people who pass you in the course of 5 minutes. Draw a flow-map as in Fig. A.2 and check the predictions you made concerning pedestrian flow.

8. From your flow-map identify the main points of congestion.

9. Make a plan for an emergency fire drill, indicating where the people in each classroom should go. Keep the following factors in mind:

   (i) Pupils should get out of the building as quickly as possible.

   (ii) Congestions should be avoided wherever possible as it slows down movement and can lead to panic and accidents.

10. Identify two other examples of networks and nodes which occur in your school area. Name some problems associated with these.

Reference: Kent, A. et al., 1974: The Local Framework (Oxford Geography Project), Oxford University Press, London.

FLOWS OF PEDESTRIANS IN A SCHOOL AT CHANGE OF PERIODS

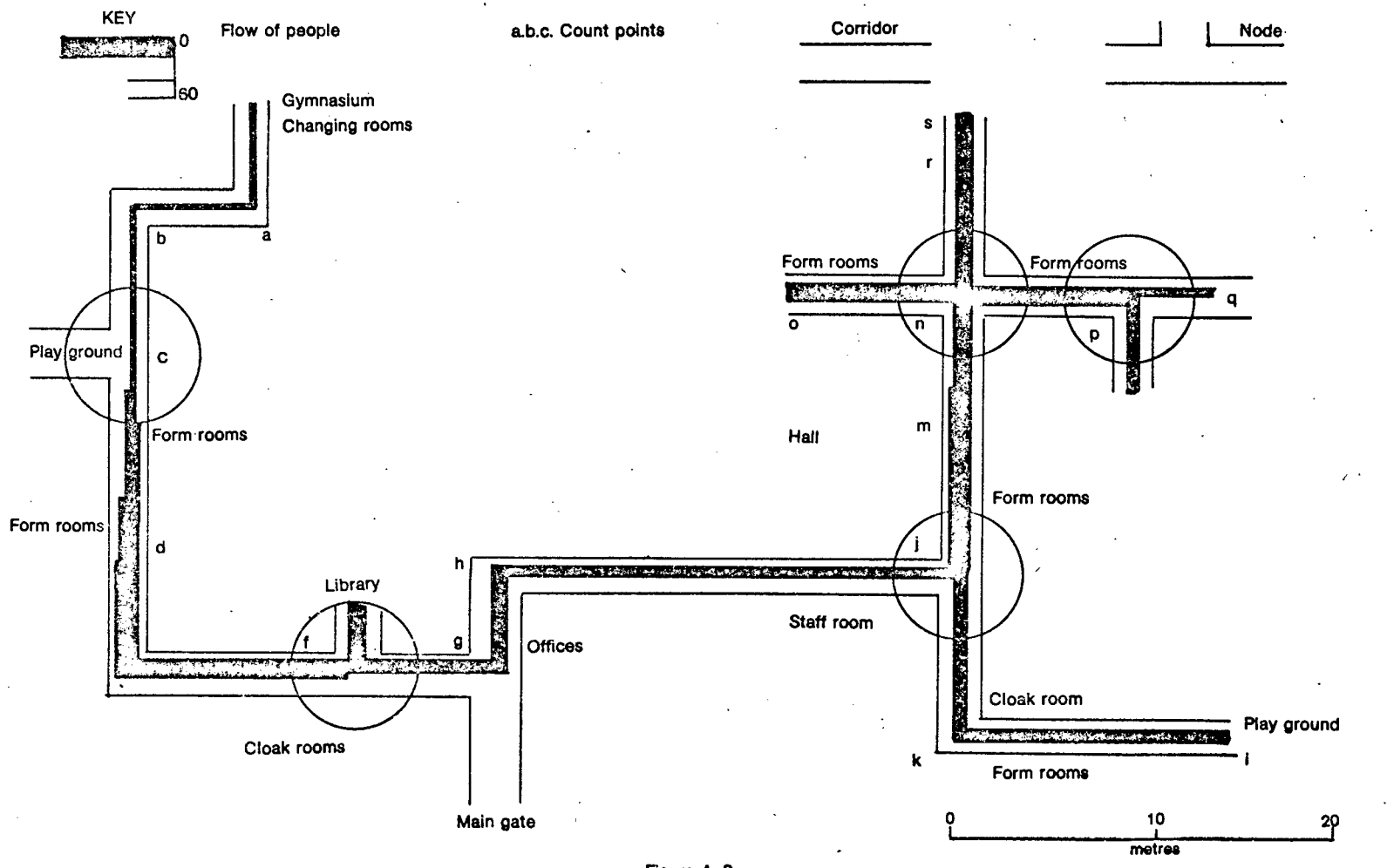


Figure A. 2

Source: Kent, 1974

FIELDWORK - THE EFFECT OF MICRO-CLIMATE ON LIFE AT HOME

Aims

The general aims of this study are:

1. To make pupils aware of microclimatic variations in their home locality.

2. To show how this effects plant and animal life as well as the behaviour of people.

Specific aims, expressed in behavioural terms are that pupils should be able to:

1. draw to scale, a simple plan such as a house and garden;

2. make observations about the sunny and the shady parts of the house and grounds;

3. understand why different substances are heated to different temperatures by the sun;

4. appreciate the importance of the angle of incidence and the direction of the sun to plant life, and animal and man's use of space;

5. realise the need for careful consideration of aspects of microclimate in planning houses and gardens;

6. have some awareness of the importance of microclimate in our daily lives.

Fieldwork

1. Draw a map to scale of your house and garden. Show only the downstairs rooms of the house, as well as doors and windows.

2. Using suitable shading indicate the following on your map:

(a) the rooms in the house which get the most sun, afternoon sun only, morning sun only, no sun at all, and any rooms which get sun during one season of the year only;

(b) those parts of the garden which get the most sun and those which get the least.

3. Using a thermometer measure the following:

(a) the temperatures of different surfaces such as concrete and grass when the sun is shining and half-an-hour after the sun has set;

(b) the temperature of the air in different parts of the garden 10 cms above the surface;

(c) the temperature of the different walls of the house.

Attempt to explain any differences you may note.

4. Indicate those parts of the garden which are most sheltered from the wind. What features provide the best windbreaks?

5. Are any trees in the neighbourhood deformed by the wind? If so, draw one and show the direction of the prevailing wind as indicated by the tree.

6. Identify and name three plants which grow only in shady areas, and three which grow in sunny situations.

7. Where in the garden does the dog (or cat) usually lie? Explain why.

8. Where in the garden do people usually sit? Explain why.

9. Do you consider that the person who designed your house paid sufficient attention to sunshine? Are the rooms which are used most during the day sunny rooms? Suggest what improvements (if any) could be made to the design of the house to take account of sunshine.

10. If you were to install a solar heater, where would you locate it?

FIELDWORK - A STUDY OF THE EFFECTS OF TRAMPLING AND MOWING ON VEGETATION AND SOILS

Aims

The aims of this study are:

1. To investigate the effects of trampling and mowing on soils and vegetation.

2. To teach pupils some elementary techniques of making and recording field observations.

Specific aims, expressed in behavioural terms, are that pupils should be able to:

1. use the technique of quadrat sampling to obtain information about vegetation and factors influencing it;

2. understand the significance of species diversity as an indicator of vegetation which has remained free from man made peturbations for a considerable period of time;

3. appreciate the importance of such peturbations as trampling and mowing in reducing species diversity;

4. understand the operation of natural selection in isolating species which are capable of adapting to certain conditions.

Fieldwork

Choose three quadrats which lie close to each other: The first in a much trampled part of a rugby field; the second just outside the touchline where the grass will be mowed but there is little trampling; the third close to a fence where neither mowing nor trampling have taken place. For each plot make and record the following observations.

1. Species diversity. Count the number of different species of plant in each quadrat.

2. Compaction of the soil. Pour 100 ml of water over the soil and record the time it takes to soak in.

3. Quality of the soil. Collect similar samples of soil by taking 3 identical tins, removing one end, and puncturing the other. Push this into the ground until the can is full of soil. Remove it and scrape the open end level with the edges of the tin.

Follow-up Work

Add enough water to the soil samples to turn them into a paste. Place them in separate 200 ml measuring cylinders and fill with water. Shake thoroughly and leave to stand. The soil will separate into layers with the humus floating to the top. Compare the three cylinders and record which soil sample had the least and which the most humus.

Tabulate the results as follows:

Observations	Quadrat 1	Quadrat 2	Quadrat 3
No. of species Relative amount of humus Time taken for water to soak in			

Attempt to correlate and explain the results of your findings. What happens to the soil, and to the vegetation, when much trampling and frequent mowing takes place?

Do your results bear out the contention that: "the more the humus, the richer the soil; the better the soil, the greater the variety of the flora"?

Why would the results of this experiment be of interest to farmers?

Attempt to identify which species of plant are best adapted to trampling. What biological principle is exemplified by the absence of other plant species from the trampled areas?

References: Mottershead, A., 1974: Practical Biogeography (Teaching Geography), the Geographical Association, Sheffield.

Middlemost, C.G., 1977: Organisation and Implementation of Science Excursion, Student Project, University of Cape Town.

ENVIRONMENTAL SURVEY OF SCHOOL LOCALITY

Standard Six Suburban Town Trail

To be completed in the area immediately to the south of Rondebosch Boys' High School.

Answer all the questions in the space provided. Map your route as you go.

1. Clent Lane

(a) Name five types of tree growing in the area (Exclude fruit trees). Classify them as exotics or indigenous, perennial or deciduous.

.....

.....

(b) How many types of fruit tree growing in this area can you identify? Name as many as you can. Attempt a simple classification of these trees.

.....

.....

(c) What does the type of tree growing in this area suggest about the climate?

.....

(d) Why are there so many fruit trees to be found here?

.....

(e) Which of the following house types are the staff quarters in Clent Lane: detached, semi-detached or terraced?

.....

(f) What is the approximate age of Clent?

.....

2. Leith Road

(a) What physical feature are you walking along as you proceed along Leith Road?

.....

(b) In what approximate direction are you walking?

.....

Stop at the corner of Leith and Orkney Roads and look westwards along Orkney Road.

(c) Estimate the approximate angle of slope and gradient of the steepest part of the slope in front of you.

.....

(d) What physical feature does this slope represent?

.....

(e) How have the houses been adapted to accommodate this slope? Do you consider that the architects have planned the houses in such a way that the best possible use has been made of the slopes?

.....

.....

.....

Stop at the corner of Leith and Argyle Roads and look eastwards over Keurboom Park.

(f) What evidence is there of government (including local government) planning and of regulations controlling the use of land in the area?

.....

.....

(g) Describe the colour and texture of the soil near the edge of the canal. Is the soil sandy or clayey? Does it contain stones?

.....

(h) Why has the Black River been canalized in this area?

.....

3. As you proceed along Aberdeen Road compare the properties to the east and west of you and answer the following questions.

(a) Which part of Sunnybrae estate has the oldest houses?

.....

(b) and which the smallest plots?

.....

(c) What does this suggest about the stages in the development of the area?

.....

.....

(d) List as many different types of material used in the construction of houses in this street as you can, using the following headings:

(i) Materials used in the walls

.....

.....

(ii) Roofing materials

.....

.....

(iii) Materials used to portion off plots

.....

.....

(e) Can you detect any relationship between the age of the houses and the type of materials used?

.....

(f) If a major road were to be built through this area, which buildings (if any) do you think merit preservation?

.....

.....

(g) Suggest why so many of the houses have high walls around them. Would this area be more attractive without them?

.....

.....

Proceeding along Camp Ground Road:

4. Is there any evidence of adjustments being made to increase pressure of population in this area?

.....

Corner of Keurboom and Camp Ground Roads:

5. What style of architecture, for which the Cape is famous, is represented by the house on the corner with a wooden fence?

.....

Entrance to Vredenburg Sports Grounds. Note the fine example of Victorian wrought iron gates.

The Frank Joubert Art Centre. This house was built in 1902 by a mining magnate. It was sold to the Provincial Administration and became a school, then a school hostel and finally an art school. Note the following features:

the general size and appearance of the building;
the marble used as facing material;
the stain glass in the front doors;
the pottery section, which was an old coach house;
the playing fields which were vineyards.

6. (a) Which of the following would you use to describe the building as it was originally constructed:

castle, manorhouse, terraced house, semi-detached house, double storey suburban residence.

.....

(b) Why do you think this house is not still being used as a residence?

.....

.....

(c) Do you think that this is a suitable venue for an art centre? Give reasons for your answer.

.....

.....

Stop at the bridge on Keurboom Road.

7. (a) What do you notice about the relationship between drainage and "green areas" in this locality? Can you give any reasons for this?

.....

.....

(b) Look under the bridge for evidence of services provided by the Cape Town Municipality. List as many different types of service as possible for which there is definite evidence, both below and above the bridge.

.....

.....

.....

Keurboom Park:

On a separate sheet of paper:

8. (a) Draw a plan of a stretch of the rivulet using form lines to show the slopes.

(b) Draw a sketch section showing a cross profile of a meander. Annotate this, naming as many features as possible.

(c) Name three different species of alien tree which are to be found in Keurboom Park.

.....

(d) Why are there so few indigenous trees in the park?

.....

.....

(e) For each of two alien trees, suggest why they were introduced.

.....

.....

School Grounds:

9. (a) What is the purpose of the tall trees lining the Black River where it flows through the school grounds?

.....

.....

(b) Identify the trees and say why they were chosen for the purpose which they serve.

.....

.....

(c) Suggest a suitable location for another line of trees to perform much the same purpose. Give reasons for your answer.

.....

.....

(d) Though the Cricket "A" has been levelled to a certain extent, much of this ground was probably quite flat. What physical feature would it have been?

.....

(e) On what physical feature does the main school building stand?

.....

(f) What reasons can you give for the poor drainage, during winter, of the Lower Desert?

.....

Follow-up questions:

1. On the map supplied:

   (a) Show the bluffs by means of hashures;

   (b) Write the words "former flood plain" in the appropriate area;

   (c) Shade in those areas zoned as "Green Areas". You may consult other maps in order to do this;

   (d) Mark by means of suitable shading areas of (i) older houses; (ii) newer housing;

   (e) Mark and name Rondebosch Boys' High School, and the Frank Joubert Art Centre;

   (f) Name the streets traversed;

   (g) Show, by means of a broken line, the route which you took;

   (h) Using suitable symbols, plot the position of a wind break.

2. Comment on the historical changes in the land use pattern in:

   (a) the area of the Rondebosch Boys' High School grounds;

   (b) Sunnybrae Estate;

   (c) the area surrounding the Frank Joubert Art Centre.

3. What reasons can you give for the prevalence of upper class residential housing in the Sunnybrae area?

4. Sketch examples from the area studied of:

   (a) An old manor house;

   (b) Modern semi-detached housing;

   (c) A modern detached dwelling;

(d) Victorian architecture. Label distinctive features;

(e) Cape Dutch architecture;

(f) A house showing adaptions to slope;

(g) The house in this area that appeals to you most.

5. Using survey instruments, check the accuracy of your guesses of the slope of the land.

6. Suggest where the following materials used in the construction of the Frank Joubert Art Centre came from: the teak, the marble, the bricks.

7. Comment on the role of alien vegetation in the part of Rondebosch we walked through. Do you think that more use should be made of indigenous plants? Give reasons for your answer.

8. Keurboom Park is very valuable land. Do you think that it should be sold for additional housing, and the money earned from the sale of the plots, used for charity?

9. Do you think that any improvements could be made to the park? If so, describe them.

FIELDWORK - A SURVEY OF THE SHOPPING COMPLEX ON THE MAIN ROAD, RONDEBOSCH

Aims

The general aims of this study are:

1. To study the character and functions of a local business complex, attempting to explain the mix of shops, banks and services.

2. To determine which are the most favourable locations in this area, and to relate these to the land use.

3. To determine the nature and importance of barriers to pedestrian movement.

Specific aims, expressed in behavioural terms, are that the pupil should be able to:

1. make a land use survey of an urban area, selecting and recording significant information;

2. draw up a meaningful classification of the land use of an urban area;

3. make a pedestrian count and record the information in such a way that the main flows of pedestrians are apparent;

4. understand the terms: convenience goods, durable (shoppers) goods, services;

5. understand the concepts: hierarchy of shopping centres, high order and low order goods, comparative shopping;

6. appreciate the significance to commercial concerns of: barriers to pedestrian movement, relative location, parking, generators of pedestrian traffic;

7. evaluate the advantages and disadvantages of introducing a retail outlet which will attract a very large clientele, into a small shopping complex.

Fieldwork

Pupils record the land use of the study area by plotting each unit on a traverse sheet. A line drawn down the centre represents the road traversed. Starting from the bottom of the sheet, plot the approximate position, and name of each unit of land use (road intersections should be shown). Where necessary the function can be added in brackets. Teachers will find that if the class work up one side of a street under close supervision, they can then be split into groups and asked to record the land use of small areas which are allocated to them. The approximate size of the land-use units is recorded by plotting on the traverse the number of paces, e.g. along a shop front.

Undertake a static pedestrian count by positioning pupils at strategic locations, e.g. street corners, and counting the number of pedestrians passing the enumerator during a given time interval, say 10 minutes. Children under school going age should be ignored. The count should be timed to avoid exceptional circumstances such as rush hour.

Follow-up

In the classroom a suitable classification of the land use surveyed should be decided upon. The discussion will encourage pupils to consider the varying functions of a shopping complex. The records of the land use of the area surveyed are pooled, and each pupil draws up a land-use survey of the whole area. Pedestrian flows are mapped using information from the pedestrian counts.

Discuss the results attempting to get pupils to understand the reasons for the mix of shops and services in a small business complex. Brief comparisons with the corner cafes on Camp Ground Rd., the Outlying Business District of Claremont, and the Central Business District of Cape Town should lead to an understanding of the functions of the local shopping area and the essential differences between it and the business complexes which are at different levels in the hierarchy.

The results of the various pedestrian counts should be discussed. Pupils can be led to see that where pedestrian counts are highest, the most sought-after business stands are most likely to be found. Pupils should attempt to select the most valuable sites for retail outlets. It will also be possible to show the importance of barriers to pedestrian movement (such as busy roads), and the influence that these have on the location, and prosperity, of businesses.

Pupils should work through the following exercises:

1. Draw a pie graph to show graphically the mix of uses in this area.

2. Into which of the following class of shopping centre would you place the area which you have just studied:

   Central Business District
   Regional Shopping Centre (or Outlying Business Centre)
   Suburban Shopping Centre (or Community Business Centre)
   Neighbourhood Shopping Centre
   Street corner (or Isolated Store Cluster)

3. Compare and contrast this shopping area with the one on the corner of Rouwkoop and Camp Ground Roads, and with the main Claremont commercial district. What similarities and differences do you note? Attempt to account for them.

4. There is no specialist jewellers shop in Rondebosch whereas there are several in Claremont. Why is this?

5. Explain why:

   (a) There is such a large number of clothing shops in the Rondebosch shopping area;

   (b) Dress shops are most numerous in the central block;

   (c) The dress shops are grouped so close together;

   (d) Four boutiques are to be found in this small shopping area.

5. Explain why the area immediately to the south of Belmont Road has a run down or blighted appearance, in marked contrast to the spruce appearance of the buildings north of Belmont Road.

6. In which part of the Rondebosch shopping area do you find walking most difficult? Why?

7. Which shop in Rondebosch is the main generator of pedestrian traffic?

8. Where in this shopping area would you expect to find the highest rentals paid per square metre of floorspace? Give reasons for your answer.

9. Which of the two banks - Standard and Barclays - do you consider has the best location? Give reasons for your answer.

10. Give two examples of retail outlets selling convenience goods, and durable (shoppers) goods? Give two examples of concerns providing services.

11. What does the urban renewal which has taken place recently in this area, suggest about the general economic health of Rondebosch.

12. Explain the nature and importance of the following in a commercial area:

    (a) Barriers to pedestrian movement;
    (b) Generators of pedestrian traffic.

13. Has the establishment of a Pick 'n Pay in the area changed its character? What effect has Pick 'n Pay had on its environs?

FIELDWORK - THE STUDY OF A SHORT STRETCH OF COASTLINE NEAR CAPE POINT

Aim

The general aim of this study is to make an on-the-spot examination of the geological processes and landforms associated with wave and current action along a short stretch of coast.

Specific objectives and subsidiary aims stated in behavioural terms are that the pupil should be able to:

1. recognise significant land use patterns encountered on the bus journey, e.g. ribbon development, urban sprawl, cluster housing, marina developments, recreational uses;

2. understand some of the social, economic and political factors which give rise to urban land use patterns;

3. appreciate the significance of such concepts as the quality of life, amenity, location;

4. recognise landforms such as marine cut platforms, raised beaches, natural arches, stacks, offshore bars. Describe the processes which formed these features;

5. recognise different wave forms, and the processes with which they are associated;

6. identify landforms which result from wave and current action;

7. make records of features identified in the field in a variety of ways - field sketching, levelling, photography, mapping;

8. recognise features which indicate former sea levels;

9. understand the concept of dynamic equilibrium as it applies to a bay beach;

10. understand something of the cyclic nature of coastlines;

11. explain the evolution of indented coastlines with headlands and embayments, and features associated with them, such as marine cliffs and bay beaches.

Preparatory work

1. Distinguish between the terms: coast, shore (or shore zone), shore line. Make sure that you can identify different types of waves: shoaling waves, plunging breakers, spilling breakers, swash, backwash (outwash). Can you identify the following features? nip, notch marine cliff, sea cave, natural (or rock) arch, stack. Draw a diagram to illustrate the following: abrasion platform, shoreface terrace, marine cut terrace (or wave cut terrace), marine built terrace. Describe the following processes: shore drifting (longshore drift), counter currents, longshore currents.

2. Enlarge the map of the southern tip of the Cape Peninsula by a factor of five. On your map show the location of beaches, rocky costs, cliffs, and other landforms of the area. Add significant information to this map which does not appear on published maps, this might include important but minor breaks-of-slope, other relief features.

3. Make a record of the weather for 3 days prior to the field trip paying particular attention to wind direction and speed. If possible cut out relevant synoptic charts from newspapers.

Follow-up Work

1. Arrange your field notes in a logical order.

2. Rewrite material which is barely legible and improve sketches, and sketch maps.

3. Compile a full scale project based on the major aim of the exercise as stated above. Give as much of the information

as possible in the form of field sketches, photographs, sketch maps, cross sections and other diagrams. Try to avoid long written explanations.

4. Each group should prepare a report on the work which they undertook for presentation to the class.

5. A number of questions were dealt with which do not relate to the main aim of this field excursion. These do not form part of the project.

On the bus journey to Cape Point:

Camp Ground Road: Note the style of architecture and thus determine the age of the majority of the houses facing onto Camp Ground Road. What evidence is there that ribbon development occurred along this road?

Landsdowne Road: Another form of ribbon development has taken place along Landsdown Road. Identify and name it.

Rosmead Avenue: What are the major forms of land use to the left and right of this road? This is a major routeway and it is often congested, do you consider that the avenue of trees should be felled in order to enable the road to be widened?

Prince George's Drive: Note the major forms of land use on either side of this road.

What is the approximate age of Plumstead? To what socio-economic group do the majority of its inhabitants belong? What form of transport do the majority of the working population of Plumstead use for their journey to work? What problems in central Cape Town are aggravated as a result? Contrast Plumstead and Rondebosch in terms of: age of the suburbs, size of houses and plots, social status of the inhabitants, amenities. Which suburb would you prefer to live in? Why?

As you cross the railway line south of Plumstead, note the new Parkwood Housing Estate to your left.

For people of which race and what socio-economic group has this suburban development been planned?

Note and comment on the nature and use of buffer zones between the housing areas of different race groups.

Cape Flats: Contrast the Southfield and Grassy Park suburban areas with Plumstead and Rondebosch referring to such factors as race and socio-economic status of inhabitants, size and condition of houses and plots, provision of services.

What is the function of Cafda? How is it staffed and financed?

On the left in the Lavender Hill area is newly constructed sub-economic housing, and on the right, further south, the elite Marina Da Gama.

Compare and contrast these two residential areas taking into account: the socio-economic status of the groups for which they were planned; cost and methods of financing housing and services; amenity; quality of life in the two environments. What are the advantages of living in a marina? What problems does this particular marina development face?

Note the "Vrygrond" Squatters Camp on the left.

What causes the squatter problem and what is being done about it?

In what parts of the world is the squatter problem most serious? Why?

Explain how the vleis have been formed. What role do the vleis in this area play at the present time? Could they be further developed? For what purposes? What problems are associated with such waterbodies in peri-urban areas?

Muizenberg: This was once one of South Africa's premier holiday resorts. Would you describe it as such today? Why has it deteriorated, and what is being done to revitalize the resort? What facilities does the Muizenberg area provide for the holiday maker?

Muizenberg Beach (First stop): Note the position of the beach relative to False Bay.

Obtain samples of sand and note the size and shape of the grains. Calculate the slope of the beach. Why are the sand grains so small? Why is Muizenberg beach so favourable for swimming?

Main Road - St. James and Kalk Bay: Explain the marked contrast between the relief of this part of the Cape Peninsula and the Cape Flats.

What landform does the road follow between Muizenberg and Kalk Bay? What process produced this landform? What does this indicate about former sea levels?

How has relief influenced the pattern of settlement in this area? What different forms of land use compete for available space? What problems result from this competition, and what plans are there to relieve them?

How has the architecture of buildings been adapted to the terrain in this area?

What evidence is there that this has been a popular residential area for a long time?

A marked social gradient (progression from one socio-economic group to another) can be identified along this narrow corridor. How can you recognise and account for this gradient?

What is the function of Kalk Bay harbour?

Fish Hoek Valley: This valley is probably a rift valley, at times together with the Cape Flats it has been under water, and was thus a straight between two rocky islands.

What evidence is there that you are aware of that this area was once inhabited by early man? What advantages would the shallows of this erstwhile straight have had for early man?

What factors influenced the location and growth of Fish Hoek?

Why has there been considerable development of housing on the slopes of Fish Hoek Mountain, whereas few houses have been built on the slopes on the opposite side of the valley.

What is the source of the sand forming the sand dunes? What problems are caused by windblown sand in this area?

Fish Hoek to Simonstown: What is the type of rock across which the causeway below the railway line has been built?

What type of rock is being quarried in the vicinity of Glencairn? What is the stone used for? Do you consider this quarry has had a serious detrimental impact on this part of the Cape Peninsula?

What do you notice about the alignment of the valleys and mountains of this part of the Cape Peninsula? Attempt to explain any trend lines which you may notice.

What do you notice about the general shape of the mountain tops in the Cape Peninsula? Can you give any reason for this?

Suggest how the mountains of the Cape Peninsula have been formed.

Simonstown: What is the function of the docks at Simonstown?

In the early days of European settlement at the Cape, Simonstown was used as a harbour for ships during the winter months.

What advantages did Simonstown enjoy over Cape Town as a winter port?

What disadvantages does Simonstown suffer from as a port?

What evidence is there (visible from the bus) that Simonstown is one of the oldest settlements in South Africa?

Simonstown to Smitswinkel Bay: What rock type forms the spectacular scenery below the road along this stretch of coast?

What rocks form the higher mountain slopes?

Attempt to identify the following features visible from the road:

(a) a dolerite dyke cutting granite on the shore at Froggy Pond;

(a) a 20 metre raised beach of rounded boulders exposed in a road cutting.

(c) a wave cut platform 7 metres above sea level at Miller's Point.

How can you distinguish between granite and Table Mountain sandstone from the bus?

Identify the following features; free face and talus slopes, litter blocks, landslides, colls, headlands, inlets, coves.

Parking Area above Smitswinkel Bay (Second stop): Compare the rocks on either side of Smitswinkel Bay and attempt to account for the differences you observe.

Note and explain the differences between the boulders on the beach of Smitswinkel Bay.

Explain how Smitswinkel Bay and Smitswinkel Valley and its extension, George's Valley have been formed.

Identify an unconformity, dollerite dyke, and a valley breached by the sea.

Cape of Good Hope Nature Reserve: This Reserve is the only place in this part of the country where a large area of fynbos vegetation is preserved in its natural state.

Do you think that the wildlife of the reserve should be increased in numbers and variety? What criteria should determine how much wildlife is maintained in the reserve and what types of

animals are kept here?

Do you think that the tourist facilities of the reserve are adequate? Would you like to see more picnicing spots, restaurants, viewing platforms, etc. built in the area? What other developments would you suggest for the reserve? Do you consider that there should not be any further development of the area? If so, why?

Do you think that parts of this area should be made available for township development? Give reasons for your answer.

What is the purpose of preserving wilderness areas?

Name and identify 3 classes of vegetation in the fynbos.

The following words are used to describe the fynbos, give the meaning of the terms: Cape Machia, xerophytic, scheliferous, fire climax.

Identify alien vegetation in the reserve. What problems is it creating? Why has it spread so rapidly? What would happen to this reserve if no attempt were made to control the aliens?

Why is rotational burning part of the management of this reserve?

What forms of soil erosion can you detect in the reserve? Why is this area prone to soil erosion?

Which do you think are the more important aspects of this reserve - the flora or the fauna?

<u>From the Viewpoint at the West End of the Beach</u>: Carefully observe the waves breaking at Diasstrand and at the Cape of Good Hope.

Sketch the pattern of the waves approaching the headland and the head of the bay. Can you detect any wave refraction?

Where are the wave lengths shortest - at the headland or at the head of the bay? ~~At~~ which points can these waves be said to be

destructive and where constructive? With the aid of a diagram explain how a single wave can be destructive at one point and constructive at another.

What features result from the destructive work of the waves, and what from constructive wave action? Plot these on a large scale map of the area, and draw annotated sketches of the features.

Is there any evidence of shore drifting along the sides of the bay? If so, explain why this has taken place. Examine pebbles and sand on the bay beach and attempt to discover from whence the material has drifted.

Is the pattern of waves within the bay regular? Can you detect different wave trains? Where do these originate? Can you detect any peaks and troughs? Why do these occur?

By careful timing, determine the periodicity of the waves.

Calculate the wind speed and direction noting this on your map.

Mark the direction of maximum fetch of the waves.

Indicate the position of rip currents on your map. Time the pulsations of the rip. Explain how these rip currents are formed. Rip currents are responsible for the majority of drownings on our coasts. What advice would you give to swimmers who might get caught in rip currents?

Draw a plan of the beach and associated features of Diasstrand. Show the following: a bay beach, sea cliffs, high water mark, berms, storm beaches, an offshore bar, a trough, stacks, a wave marine-cut terrace.

Draw a field sketch of Cape Point showing the features of geographical interest.

Account for the configuration of this particular stretch of coastline. Explain the presence of the spectacular headlands and the bay with its bay beach. Illustrate the probable evolution

of this part of the coastline with a series of diagrams. Take into account both the geology and the processes at work. Look along the coast in a north westerly direction and complete the following:

What evidence is there of former marine levels? At what height above sea level do these occur? Attempt to correlate this information with similar indications of past marine levels in areas some distance away from your study area. At what elevations above present sea level must earlier stillstands of the sea have been?

Draw a sketch section for an area chosen because it exhibits a marine terrace, abandoned sea cliffs as well as the present shore line. Label the section in order to emphasize the important features.

On the Beach: Draw field sketches of cliffs. Where possible, cliffs should be chosen which are formed in contrasting rock types and which differ in profile. Show clearly and label: bedding planes, joints, unconformities and other significant features. The following questions will help to draw attention to the more important features of cliffs:

How steep is the cliff and how high is it? Can you account for contrasting profiles of cliffs seen on the field trip?

Is there an overhang at the foot of the cliff? If so, how was this formed?

Is there evidence of collapse of the cliff? If so, what factors have encouraged this and what effect has this had on the speed of retreat of the cliff in question?

How has the dip of the strata affected the rate of coastal erosion?

Is there a wave cut terrace and an abrasion platform at the foot of the cliff? Explain how it is formed.

Each time groups visit this beach its shape and size are different. What effect do seasonal changes of weather have on beaches? Discuss the statement: "beaches are in a state of dynamic equilibrium."

Compare the steepness of the seaward face of this beach with the one you measured at Muizenberg. Attempt to account for any differences you may note.

How does steepness of slope of a coast affect the processes of erosion and deposition?

Geology Groups:

Collect different types of pebbles on the beach.

(a) Account for the shape of the pebbles. Give an index of roundness.

(b) Identify the type of rock and suggest the possible origin of each of these pebbles.

Test for size gradings of pebbles.

(a) Sample pebbles along three separate transects running up the beach: these should be located at both ends and near the middle of the beach. Take the pebbles from the water's edge to above the storm berm noting both their long and short diameters. Is there any indication of a change in pebble size down the beach? Record your results on the sheets provided for later statistical testing and plot the position of the samples on a map.

(b) Sample pebbles at 10 metre intervals along the high water mark in order to test for grading of material along the beach. Measurements, recording and testing to be carried out as indicated above. Attempt to explain your results after consultation with the wave study group.

What evidence is there of a grading of pebbles from the seashore to the foot of a cliff? Explain what you find.

Take a random sample of 10 pebbles each from a berm and from a talus slope. Perform an index of roundness test on these pebbles. What indication do these results give as to the origin of these pebbles?

Wave Study Groups

Calculate the wave length, periddicity, height and steepness of the waves near the centre of the bay and at either end.

Throw a float into the breakers and note the direction in which it moves. Draw a diagram to show the path followed by the float. Label the swash, backwash, and, where applicable, the drift movements.

Explain the differences in the behaviour of the float beyond the line of breakers and the float in the breakers. Draw a labelled diagram in order to show what happens when they approach a shelving coastline. Distinguish between waves of oscillation and waves of translation. What causes waves to break?

Observe where the waves are breaking. Are they spilling breakers or plunging breakers?

How many times do the waves break? Account for each break.

Where do the waves reach the shore first? Why is this?

Compare the waves breaking on a headland and on the beach as to (i) their height and (ii) their wave length. Explain what you find. How does this effect the constructive or destructive activity of the waves?

What do you notice about the activity of the wave at the point of breaking - is the wave eroding or depositing material?

Determine the difference in depths of the swash and the backwash choosing points along the beach where the slope varies. Explain any differences you may note.

Study the movement of beach material.

(i) Determine whether the swash and backwash are eroding or depositing.

(ii) Is the swash carrying material further up the beach than back wash is carrying it down? - or vice versa? Explain why.

Design an experiment to determine whether or not longshore drift (shore drifting) is taking place. What part does shore drifting play in the formation of this bay beach?

Biogeography Group

Zonation is an obvious feature of shore life. Some organisms live at the top of the shore; others are found only at the bottom. The aim of this survey is to find out which are involved in the zonation pattern on the exposed shore.

This is an exposed stretch of coastline; in almost all weathers this part of the shore is exposed to wave action of some sort, and, during storms, heavy spray splashes at least five metres above the high tide level. The wind whips the tops off the waves and spray and salt are carried much higher and further inland.

Choose a rocky stretch of coast where the general pattern of zonation is clearly shown - where plants and animals are distributed in well-defined bands across the surface of the rock. Sketch this section of coast showing these zones and their dominant flora and fauna.

It is difficult for seaweeds to grow far out of the water on this exposed rock surface. Suggest reasons for this.

Sea water is always tugging and surging at the base of the cliff where the large seaweeds grow. How are the seaweeds adapted to withstand the wave motion?

Limpets live only in crevices at the top of a rock, but out on the exposed rock surfaces lower down. Once they have settled

in a place, they do not move far from it. Why are they found in crevices when they live far up the rock face? There could be more than one reason.

Barnacles feed on plankton (microscopic plants and animals floating in the water). Which barnacles (upper or lower) will be able to feed for the longest periods of time?

Barnacles, limpets and mussels are sedentary (they stay in one place when they are adult). The first part of their lives is spent in water as plankton where they float in and out with the tide. Remembering the part which is played by plankton in the food chain, what predictions can you make about the numbers of young which must be produced in order that some may survive to settle on the 'right' part of the shore?

Choose two rock pools at different levels on the rock shore. Note the approximate heights of the pools, their mode of formation, character (depth, rockiness of the floor, etc.), and features of the water supply.

Study the life in the pools and answer these questions:

Mussels feed by drawing a current of water into their bodies. From it, they extract particles of food. Limpets browse off vegetation growing adjacent to their stations on the rock surface. You can see where they have grazed the 'field' of small plants near their homes. Why can mussels live closely crammed together in crevices? Why do limpets tend to be more spaced out?

Barnacles do not live inside pools. It seems that they cannot survive pool conditions. They are less common higher up the rock surface than they are just above the water surface. What might prevent them from living high up the rock face or in pools?

Sea anemones are soft bodied creatures which expand their tentacles in sea water. Small organisms brushing against a tentacle trigger off a reaction in the other tentacles; they curl in to engulf the food which is digested inside the body cavity of the animal. At this level on the shore (but not lower down), the sea anemones are found only within pools. Suggest reasons

for this.

Which pool has the more abundant and which the more varied animal life? Suggest reasons for this.

Inlet near Cape Maclear

What reasons can you give for the presence of this inlet?

List and sketch as many features in this area as you can identify which result from the destructive or the constructive work of the waves.

On the Return Journey

Note signs of river-capture along the Schuster's River.
Assess land-values and potential development at Scarborough.
Note and account for the shape of Camel Rock.
Note land use at Slangkop and Kommetjie. How and why did Kommetjie get its name?
What evidence is there to show that during historical times the beach at Noordhoek has been extended seawards?

Account for the present stage of development of the Island Glades Marina (announced at about the same time as the Marina Da Gama).

What action could and should be taken to prevent environmental despoilation of this nature?

Comment on the location of the Ocean View township which houses coloured workers, many of whom lived, and still work, in Simonstown.

Comment on the location of the Sun Valley township. How can you tell that this is a new development? For what type of resident was this township designed?

Though the present Ou Kaapse Weg was constructed recently, it

follows one of the earliest routeways leading to the southern parts of the Cape Peninsula. What natural feature does the road follow? What natural feature formed the main obstacle to early travellers?

Parts of the Tokai area and Constantia were once some of the best farm land in South Africa. What is the reason for the urban sprawl which has overtaken much of this area? Do you think that there is a need for planning and government control in the development of such an area? Discuss the problems of the rururban fringe as exemplified by this area.

Discuss the pros and cons of cluster housing in this area.

Why has Bishopscourt become the most sought-after residential area in the Southern Suburbs?

Suggestions for Further Study

1. Compare the results of this study of an exposed shore with one of your own choice. Are the results shown here typical of exposed shores in general? Can you account for any differences you observe?

2. Clear a small strip of rock and investigate the way in which it is recolonized. The cleared area of rock should not be too large. It is never desirable to disturb more than an absolute minimum of organisms.

3. Whelks and star fish are mobile carnivores. If you mark some whelk shells with enamel, you may be able to find out how far they move or are moved between successives tides.

4. Compare the populations of pools:
   (a) at different levels on the shore;
   (b) with different salinities (choose one from a place where freshwater runs across rocks);
   (c) of different depths;
   (d) in different climates.
   Note differences in types and numbers of species.

5. Study the colonization of a marked piece of bare rock placed in a low tidal pool. This is only possible on less exposed shores (unless you care to cement it into position). It takes a long time for colonization to take place.

6. Mark a proportion of the mobile individuals in a selected pool and follow up the changes in their numbers. It may be possible to follow the travels of individuals. Try to explain any changes you note. Do any marked animals disappear completely? What causes their disappearance?

   A similar marking experiment using stationary animals could be done to investigate the long-term changes in populations (e.g. to find out how many limpets survived a winter).

   Note: The marking enamel you use should not be placed where it harms the animal or makes it more conspicuous. It should be one which is sufficiently durable to last some time in sea water. You will need to experiment to find a suitable means of marking the animals you choose to survey.

7. You are a potential predator on the shore. Men do in fact eat several species of animal from the shore (e.g. edible periwinkle, edible crab). Observe what happens when you disturb shore animals. What do limpets do? How do periwinkles react? Do any animals not react at all? Do any aspects of behaviour you observe have any survival value? Would they prevent a bird from taking the animal? Would they prevent you from taking it?

8. Attempt a long-term study of a beach in order to record and explain seasonal changes in the shape of the beach. This may be done quite casually by simply visiting the beach at intervals and noting changes. For more accurate results map the beach, using a plane table, at intervals during the year. If the maps are drawn to the same scale on transparent overlays, changes in the horizontal or plan shape will become apparent. If sections are levelled at appropriate places along the beach, and the levelling is repeated along the same lines at intervals during the year, vertical changes

in the beach's shape will be shown. A record of the weather should be kept during the period of the experiment. Relate your findings to wave action noting the importance of storm waves. Show how cut and fill processes operate at different times, illustrating the concept of dynamic equilibrium.

9. If any problems have been thrown up relating to marine action either as a result of the fieldwork or lessons in the classroom, discuss this with your teacher and formulate hypotheses which attempt to offer a solution to the problems. Set up a series of experiments to test the validity of your hypotheses.

Examples of problems and hypotheses are:

(a) Problem: What is the origin of the sand from which beaches are formed?
Hypothesis: Most of the sand on a beach comes from the land not the sea.

(b) Problem: Is material moved from capes to bay heads?
Hypothesis: There will be a gradation in the size of material, the largest pebbles occurring on a headland, with sizes dropping off steadily towards the head of a bay.

References: Clark, E., 1973: Fieldwork in Biology: An Environmental Approach, MacMillan, Basingstoke.

Nightingale, C.S. 1976: "Marine Action and Resultant Landforms", S.A. Geographer, Vol. V No. 3.

FIELD STUDY - THE ECOLOGY OF A COASTAL DUNE SYSTEM

Aims

The general aims of this study are to:

1. introduce and apply a number of major concepts and principles of ecology;
2. give pupils the opportunity to use standard field study procedures in order to analyse a sample area within an ecosystem;
3. demonstrate how follow-up laboratory studies can be used together with fieldwork;
4. synthesize and evaluate the results of the study in terms of relevant ecological theory;
5. gain some understanding of the adverse impact of man on fragile ecosystems and its consequences;
6. to encourage the development of relevant attitudes and values concerning man's environment.

Specific aims stated in behavioural terms are that the pupil should be able to:

1. make appropriate observations and measurements of the structure and floristics of plant communities;
2. make a study of the ecology of a stretch of dune coastline with particular reference to zonation phenomena;
3. make studies of the root systems and root modulations of various plant species;
4. appreciate some of the problems related to alien infestation;
5. realise the important part played by vegetation in the formation of coastal dunes;
6. understand the importance of peturbations - both natural and man made on vegetation;

7. gather data on relevant ~~on relevant~~ parameters, such as temperature, pH and salt spray gradients;

8. make a laboratory analysis of soil samples (e.g. moisture content, humus content, carbonate levels);

9. make observations of the animal populations associated with the various plant communities;

10. draw up a food pyramid for a particular ecosystem.

Preparatory Work

1. Make sure that you are familiar with the following:

   (a) Terms associated with waves:
   wave length, height, period, steepness, fetch, spilling breaker, plunging breaker, destructive wave, constructive wave, swash, backwash, run-up, wave refraction, shoaling waves.

   (b) Terms used in connection with coastal areas:
   coast, shoreline, foreshore, offshore, eustatic changes in sea level, prograding shoreline, eroding shoreline.

   (c) Terms used in describing and accounting for the movement of material by waves:
   sediment or littoral drift, beach drift, longshore drift, longshore current, rip current, feeder rip, prograding, erosion, cut, fill.

   (d) Terms used in describing features associated with dune coasts:
   bar, trough, runnel, summer and winter berm, storm berm, beach ridge, foredune, dune ridge, swale, lagoon, salt marsh, mud flats, blowout, mobile dune sheet.

   (e) Terms used in connection with plant and animal communities:
   ecology, ecosystem, biota, biotic, abiotic, flora, fauna, community, habitat, ecological niche, food chain, food

web, trophic level, herbivor, carnivor, primary producers, primary consumers, secondary consumers, tertiary consumers, reducers, decomposers, filter feeder, parasite, fungus, bacteria, protozoa, succession, climax community, sere, seral community, pioneer, zonation, podzolisation, benthic fauna, biomass, gradients (e.g. environmental gradient, salt spray gradient), colonizing.

2. You will be required to perform the following tasks, make sure that you are familiar with the procedures: levelling, plain tabling, field sketching, collecting, preserving and labelling fauna and flora, quadrat sampling, expanding quadrat species count, executing a belt transect, soil testing.

Equipment Required

Levelling instruments including staves (home made), slide for staves, clipboards, topo and geological maps, tapes, slope pantometer, pocket calculator, compass, magnifying glasses, plastic bags for samples, jars for samples, formalin, sieves, spade, auger, buckets, plankton net, rulers graduated in mm, 20 x 1m sticks for quadrats, ball of string, quadrat frame with string grid, knitting needle, labels (some waterproof), whirling hygrometer, whirling thermometer, thermometers, stop watches, exposure metres, 10 identical tins (open at one end with holes at the other), frames with cheesecloth, tide tables, radio, tape recorder, cameras, binoculars, felt nibbed pens, thumb tacks.

Fieldwork

The Dunes - their geomophology

1. Make and record the measurements required in order to draw an accurate beach profile. Extend it to include all the coastal defences.

The angle of slope of beach sand can be determined by dribbling dry sand between your fingers until a small pile of sand has been formed.

2. Note the angle of repose of the sand on the various dunes you have crossed. Which dunes have slopes which approximate to the expected angle? Which are oversteepened? Which slopes are less steep than expected? What effect have (a) vegetation, and (b) wave action on the slopes of dunes?

Most shorelines can be said to be in a state of dynamic equilibrium. During winter the action of storm waves is largely destructive resulting in an eroding shoreline, whereas in summer waves are often constructive and a prograding shoreline results.

3. What effect do these seasonal changes have on:
   (a) the slopes of the foredune face?
   (b) the vegetation of the foredunes?

4. Attempt to determine whether, taken over a long period of time, the stretch of dune coast you are studying is:

   (a) a prograding shoreline - dunes get progressively older with increasing distance from the sea;

   (b) a static shoreline where the seaboard biotope is extremely stable;

   (c) an eroding coastline. This will be indicated by the large scale erosion of beach fronts, blowouts, mobile dune sheets engulfing hind dune communities, with in some instances, active transgressive dunes moving considerable distances inland.

Observe the effect of vegetation on dunes noting the role which plants play in both the initiating and the stabilizing of dunes. Dig down into a dune which has Murram grass or another pioneer species growing on it, following the root system of a single plant carefully, noting growth patterns.

5. What part does vegetation play in initiating and stabilizing dune systems?

The Zonation of Plant Communities

Proceed inland from the beach and complete either a series of $1m^2$ quadrat vegetation surveys or a belt transect. Choose the quadrats so as to include all the significant sites, e.g. beach, berms, seaward faces of dunes, lee slopes of dunes, dune crests, swale, etc. For each quadrat fill in the required information on a survey form.

Attempt to learn the names of the dominant plant in each of the plant communities. These can serve to designate habitat types (e.g. Acacia longifolia thicket).

6. Draw up and complete a table as follows:

Dune morphology	Structural form of vegetation	Typical indicator plant
Beach	-	None
Berm	-	None
Seaward face of foredune	Open grassland	murram grass
Crest of foredune		
-		
-		
-		

Trends in Environmental Parameters

Some environmental data has been collected during the process of quadrat sampling or while making the belt transect. Additional information may be obtained by taking the following measurements at approximately 2 a.m. and 2 p.m. at 50 metre intervals along a line extending inland from the coast:

(a) Temperature of the surface in the sun and in the shade of the free air 1 metre above the surface and 5 cms below the surface.

(b) Humidity (using a whirling hygrometer).

(c) Light intensity (by exposure metre).

(d) Salt laden winds. (The procedure for measuring this parameter is given in a separate note.)

(e) Soil chloride (silver nitrate solution), soil carbonate (by dilute hydrochloric acid), soil pH (by universal indicator and colour chart).

At intervals along the transect (chosen to coincide with most of the more important vegetation zones), dig soil profiles and conduct the following studies: root distribution and rhizosphere studies; water table observations; indications of previous fires. Record the results.

Tap labelled baby food cans (with holes punched in the base) into the face of the soil profile at different levels. Shave off the soil from the top and place and can-plus-soil in a plastic wrap and seal with a rubber band.

Collect 2 litre samples of sand for further experiment, taking them from sites along the line of the transect which represents different vegetation zones.

Study the pioneer communities and answer the following questions:

7. (a) How are the plants adapted to the very harsh environment in which they live?

(b) How far inland do the pioneers extend? Why are they superseded by other plants?

Since salt laden winds are harmful to all but the hardiest of terrestrial plants, observe and make notes on:

(a) the differences in the structure of the vegetation in areas (i) exposed to salt spray, (ii) the sheltered areas;

(b) deformation of plants exposed to salt laden winds.

8. What evidence is there of invasion of the area by alien vegetation?

9. Name the main species of alien vegetation found in the study area. Do particular species of aliens show preferences for particular habitats?

10. Obtain seed from an alien plant and examine it. Pull up an alien seedling by the roots and note the nitrogen fixing nodules.

11. Which of the aliens are most aggressive? Explain why they are so difficult to control.

12. Go into a clump of alien vegetation, and note what flora and fauna are there. Compare this to the same terrain outside the clump.

13. Note and record any natural peturbations which have affected the vegetation cover of the dunes.

14. Note and record damage done to dune vegetation by man. What are the results of such damage on the stretch of coast under study?

The Animal Populations

Attempt to determine whether or not the zonation of plant communities is reflected in a zonation of animal populations. Their distributions cannot be determined with the same accuracy as for plants.

15. (a) Make a list of the animals which are present in the region of the sand dunes. If possible obtain single samples, failing this list distinguishing features including such evidence of their presence as 'runs', droppings, etc. Collect droppings for later examination noting where they were found.

(b) What are the animals feeding on among the dunes?

(c) Can you discern any relationship between the different types of flora and fauna?

(d) What parts of the plants are being utilized, for what purposes, and by what types of animal life?

Follow-up Work

Using the information obtained in the field:

16. Draw a beach profile labelling significant features such as berms, foredunes, hind dunes, transgressive dunes, sandy hinterlands, swales.

17. Draw vegetation on the dune profiles using symbols to show the dominant species in the different zones.

18. Complete the transect diagram by plotting, in tabular form, relevant information at appropriate points below the profile. This should be shown in tabular form. Include details such as vegetation cover by species, soil litter (dry weight); environmental parameters such as soil moisture (%), soil pH, soil chloride, soil carbonate, a salt spray factor. Some of these results can also be shown on graphs in order to show trends and gradients.

19. Have you detected any zonation of animal life? Comment on the interrelationships between the fauna and flora of this ecosystem.

20. Examine the dung pellets under a microscope in order to determine what the animals fed on. Attempt to identify the species of animals concerned.

21. Attempt to draw a food pyramid for the ecosystem under study.

22. Perform soil sediment observations on the samples of soil taken from the various communities. Shake up samples of soil in a measuring cylinder and allow to settle; make comparisons of relative amounts of humus, free carbon (from previous fires), contrasting sand colour and sand grain size.

23. Use a simple volumetric analysis technique and calculations to test for chloride ions (silver nitrate titration) and carbonate levels (back titration technique).

24. Weigh the cans of soil from the soil profile, then oven dry them at 70°C to constant weight. Calculate the moisture levels of the samples.

25. Transfer sand to suitable containers. Plant 5 tomato seeds per tin and keep the soils sufficiently moist for the sand grains to cake together. Include a control pot of some inert material such as perlite or vermiculite in the experiment. Make a note of the differences in the performances of the plants in the separate pots noting mean height and indications in the foliage of mineral deficiencies (chlorosis, recrosis, etc.).

26. After completion of the above experiment add to the soil a solution of mineral nutrients such as nitrogen and/or phosphorus. Show how the results of this experiment illustrate Liebig's "Law of the Minimum".

27. Complete the salt traps experiment indicating the relative amounts of salt carried by the wind at different heights and to different distances inland. Comment on the effects of this on the species of plant and the symmetry of seaboard shrubs.

28. Attempt to synthesize the results of the studies and to evaluate the findings on the basis of ecological theory. Relate environmental parameters to the vegetation zones in the area under study.

29. Comment on the nature and role of pioneer plants. Illustrate from the area you have studied.

30. Give examples, from the area studied, of seral communities, climax communities; and of ecological succession bearing in mind its structural and functional attributes - increase in species diversity, increase in structural complexity, increase in organic matter, tendency toward metabolic stability.

31. Identify the dominant process resulting from wave action on the stretch of coast under study. To what extent have these effected dune formations and their associated vegetation:
    (a) in the short term (seasonal changes)?
    (b) in the long-term?

32. Describe how the dunes have been formed, paying particular attention to the activity of waves and wind, and the role of vegetation.

33. What effect has alien vegetation had on:
    (a) the dune system?
    (b) the indigenous vegetation?

34. Which aliens appear to be most aggressive? Why are they often able to out-compete indigenous plants?

35. What attempts are being made to control alien vegetation? With what success? What would happen if no control measures were adopted?

36. Do you consider that an active policy of controlling and, where possible, eliminating alien vegetation should be pursued? Motivate your answer.

37. What natural peturbations are likely to affect the vegetation cover of the dunes?

38. Comment on the part played by vegetation in protecting coastal areas from migrating sand dunes and drifting sand.

39. What evidence did you note of man's interference in the ecosystem under study? What were the results?

40. In what ways do people damage dune systems, with what results? You may refer to examples which are known to you from outside the study area.

[illegible] environment and into [illegible]. The

SAMPLING TECHNIQUES

Quadrat Surveys

To examine the composition of a plant community quadrat surveys can be used. A different sized quadrat is used for each of the four categories of plants.

> 0.5 x 0.5 m quadrat for the moss layer
> 1 m x 1 m quadrat for the herb layer
> 4 m x 4 m quadrat for the shrub layer
> (Mottershead, 1974, p.14).

The number of quadrats to be surveyed can be determined by statistical means but usually 100 is a convenient number, this number is the minimum needed to give worthwhile results and facilitates calculations which will be made later (Mottershead, 1974, p.14). Classes are divided into ten groups, each equipped with a tape measure, four sticks of required length (or quadrat frames), a recording sheet and a key for plant recognition. It will be found advisable to spend a little time before the exercise in teaching the class to identify the main species present in the area. The direction of the line of survey should be selected at random, in the case of a stretch of dune coast, however, it would run across the major plant zones, i.e. at right angles to the coast. The 10 lines run parallel to each other. The distance between the lines will vary with the size of the area to be covered though 50 m has been found convenient (Mottershead, 1974, p.14). Each group makes 10 observations at intervals of about 40 m, (the interval can be varied to suit the circumstances but should be kept constant). At each stop a stick is tossed over the left shoulder, and where it lands a quadrat is laid out. To avoid subjective selection let the stick which is thrown form the same relative side of the square each time. In some instances (e.g. where there is strong zonation and/or relief) sites for quadrats may be selected in order to bring out, e.g. the relationship between the crest of a foredune and vegetation. This is a system known as "stratified sampling".

Estimate the cover of different species enclosed by the quadrat using one of the methods suggested below, and record this. Bare

ground is treated as a separate category of vegetation. Where pupils are likely to find it difficult recognizing species of plants (as with most non-biology classes) certain of the more common or indicator species may be selected, pupils are taught to identify these, and other plants are classified as "others". Alternatively the major type of each species could be recorded.

Assessing Plant Abundance

Several methods of estimating the occurrence of plants within the sample plots are used.

(i) Classify the particular species under one of the headings: dominant, abundant, frequent, occasional, rare. This is highly subjective and requires considerable experience.

(ii) The Braun-Blanquet rating system which describes the cover (occurrence) and grouping (distribution) of individual species as follows:

Cover	Grouping
+ = sparse, cover small	Soc 1 = isolated individuals
1 = plentiful, but small cover	Soc 2 = grouped or tufted
2 = numerous, cover greater or 1/20	Soc 3 = patches or cushions
3 = any number, cover ¼ - ½	Soc 4 = colonies or carpets
4 = any number, cover ½ - ¾	Soc 5 = pure populations
5 = covering greater than ¾ of area	

Table 1 - Braun-Blanquet rating system.

Errors with this system are likely to occur mainly as a result of over-estimates of brightly flowered species and of large leafed plants because they attract attention (Hanwell & Newson, 1973, p.88). This technique is useful for field excusions where time is limited and where groups make independent observations and the results are then pooled. Some prefer the Darin scale for estimating ground coverage:

100% coverage	10	5 - 20%	- 5
+ 75%	9	scattered	- 4
50-75%	8	very scattered	- 3
33-50%	7	scarce	- 2
20-33%	6	isolated	- 1

The same scale should always be used so that results from different areas can be compared.

Expanded Quadrats

A method used to find which are the plants comprising a particular community, and which are rare or common. It is not suited to vegetation which is tall or layered.

When studying vegetation it is often difficult to decide on the size and number of quadrats to be employed, this problem can be met as follows:

Lay down a quadrat of, say, 1 m side in the area which is being investigated.
List all the species within it.
Lay down a second quadrat next to the first (as shown).
List any new species.
Lay down a third quadrat next to the others which is equal in size to the other two (1 m x 2 m). It will probably be found that very few or even no new species are recorded in this third quadrat.
Continue with this doubling until no new species appear, (see diagram) the area surveyed can then be taken as being large enough to include a representative sample of the local vegetation.

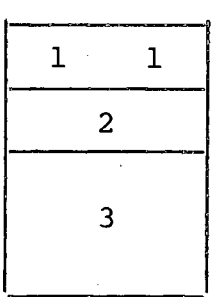


Diagram - Expanded Quadrats

The final task is to estimate how much of the whole area of the sample is covered by each species using one of the estimates of ground coverage given above.

Executing a Belt Transect

Using tape measures or string lay out two lines 1 metre apart. Divide this belt into 1 metre quadrats, and for each record the species of flora and fauna present, and the cover abundance using a system such as that drawn up by Braun-Blanquet. If the belt coincides with the line of a profile which is determined by levelling procedures, a transect diagram can be drawn which shows relief and vegetation on a single diagram. Other environmental parameters can be recorded along the line of the transect, e.g. pH of the soil, drainage characteristics; this information can be plotted onto the transect diagram in order to show relationships between vegetation and environmental parameters.

THE SALT TRAPS EXPERIMENT

Salt spray is an important parameter which must be taken into consideration when studying vegetation in coastal areas. It is inimical to the growth of many plants and has the effect of clipping others causing stunting and the asymetrical growth of many shrubs and trees.

In order to calculate the amount of salt spray carried by on-shore winds at different heights and varying distances from the shore line, proceed as follows: Build cheesecloth frames approximately 3 metres high. Erect these at strategic points, e.g. on a berm, the top of the foredune, in the lee of the fore-dune, along a line running inland from the shore. Leave these standing for 24 hrs., cut out decimetre squares of cheesecloth at different heights, soak in distilled water and titrate the resulting solutions with M/35.5 silver nitrate potassium chromate as an indicator. The results show relative amounts of salt which have collected in the squares, indicating the salt content of the air.

References: Clark, E., 1973: Fieldwork in Biology, MacMillan, Basingstoke, 222 pp.

McDonald, K., 1973: "Coastal Sand Dune Plant Ecology: Field phenomena and interpretation", The Australian Science Teachers Journal, Vol.19, No.1 pp. 33-42.

Hanwell, J.D. and M.D. Newson, 1973: Techniques in Physical Geography, MacMillan, Basingstoke.

Mottershead, R., 1974: Practical Biogeography, Teaching Geography No. 23, The Geographical Association.

ECOLOGICAL SURVEY SHEET

1. Quadrat No. ..... Location ..... Distance from shore .....
2. Observer ..... Date ..... Time .....
3. Vegetation Type: dune, fynbos, riparian, forest, other .....
4. Brief description of Vegetation - see key .....
   .....
   .....
5. Biotic Influences: path, road, firebreak, cultivated, grazed, cleared, burnt, building, animal droppings, browsed, other
   Details: .....
   .....
6. Topography: beach, base of foredune, seaward slope of foredune, leeward slope of foredune, crest of foredune, seaward slope of hind dune, crest of hind dune, lee slope of hind dune, swale, plain, pan, estuary, flood-plain, river-bed, dry river-bed, river-bank, estuary, dry-river bed, termitaria, talus slope, berm (sandy), berm (pebble)
   Other: .....
7. Geology: TMS, granite, Malmesbury, calcrete, silicrete
   Other: .....
8. Surface rock size: none 2,5cm 15cm 60cm, 2,2m bedrock
9. Rock Cover/Abundance: 0 1 2 3 4 5 6 7 8 9
10. Soil Sample: yes, no,
11. Litter Cover/Abundance: 0 1 2 3 4 5 6 7 8 9
12. Soil Colour: black, grey, white, yellow, brown, red, olive-brown, other .....
13. Site Drainage: dry temp. moist season, wet season. wet perm. moist perm. dry perm.
14. Slope: level (0-3°) gentle (3-8,5°) moderate (8,5-16,5°) steep (16,5-26,5°) v.steep (26,5-45°) over 45°
15. Aspect: N NE E SE S SW W NW
16. Altitude: .....
17. Number of Species in Quadrat .....
18. Dominant Species in Quadrat .....
    .....
19. Animals found in quadrat .....
20. Other evidence of animal life in quadrat .....
    .....

LAND-USE STUDIES IN THE CENTRAL AREA OF A CITY

The aims of this unit are:

1. to make an on-location study of the land-use pattern of a particular city centre (in this case Central Cape Town);

2. to make pupils aware of the fact that certain elements in this pattern are repeated in many other occidental cities;

3. to identify some of the forces which are at work creating the townscape and producing these oft repeated land-use patterns;

4. to introduce pupils to methods of obtaining and recording land-use data in the field;

5. to encourage pupils to consider future developments in the CBD, in terms both of desirable changes, and what should be preserved.

Other subsidiary aims are:

6. to review some important concepts relating to the urban landscape;

7. to demonstrate the use of models in analysing urban land-use.

As a result of these exercises pupils should:

1. be able to identify a number of the elements of the land-use of a particular city;

2. be familiar with some of the methods of delimiting land-use zones in the city, and be aware of some of the problems associated with drawing boundaries around these zones;

3. be able to identify some of the forces, the interplay of which creates land-use zones;

4. have compared the land-use of a particular city with a number of theoretical models;

5. be able to discuss the significance of the results of such comparisons;

6. have gained some expertize in locational analysis;

7. be aware of some changes of style in the architecture of notable buildings, and know the reasons for some of these changes;

8. have made an appraisal of some buildings in the city from the point of view of aesthetics;

9. have realized the need to preserve some elements of the townscape;

10. have isolated some of the factors that help to give a particular city (or street) its individual character.

In this study exercises which are to be completed by pupils are numbered consecutively 1 - 43.

DELIMITING REGIONS IN A CITY

1. From a location close to the King's Blockhouse on the slopes of Devil's Peak, draw a land-use map of the study area dividing it into the following regions: the Central Business District, other commercial areas, industrial areas, residential areas. Compare your results with other land-use maps of the area including both old land-use maps of Cape Town and those drawn by others in your class. Discuss the results.

2. Consider the boundaries which you have drawn around the industrial estate of Paarden Island and the Central Business District, have you found it easy to determine the boundaries of these regions? Discuss any problems that you have encountered.

Other methods of delimiting the CBD of a town are indicated below:

Using aerial photographs:

3. Attempt to delimit the boundaries of the CBD using both oblique and vertical air photographs. Discuss the problems you have encountered.

By means of fieldwork:

Many methods have been tried, the best known and most widely used was developed by Murphy and Vance (see Lowry, 1975, pp.41-47). This somewhat complex method was used by Davies (1965) and Dewar (1972) in order to delimit the CBD of Cape Town. It is important that objective methods of drawing the boundaries of such region as the CBD should be devised, so that comparative studies can be made. These studies often lead to new insights and make it possible to forecast likely developments in one city based on observations in another, this enables enlightened planning to be carried out.

4. Why is it important for urban planners to be able to distinguish between the different regions of a city?

Regions such as those you have drawn "arise from the interplay of forces in the town - physical, economic and social. A town is a physical object of buildings, streets and open spaces which together make up the townscape, but it is also an economic object because it provides work, and it is a social object because it provides homes and services." (Haddon, 1976, p.73).

5. Discuss this statement with reference to the land-use zones which you have demarcated. Does this statement apply to cities in general? If so, do they have similar land-use patterns?

Analysing the Land-Use Patterns of the CBD

Fieldwork:

Walk through the survey area and plot the height and function of each building in coded form on a 1:1000 map, giving first the height (in number of storeys), followed by a stroke and the code number as determined by referring to Table A.1 Only ground floor functions should be recorded.

Some Important Concepts:

Hierarchy:

6. Explain what is meant by the term "hierarchy of commercial areas". Citing examples from the Cape Peninsula known to you, draw up a hierarchy. Show the position of the commercial centres on a map of the Cape Peninsula. Briefly outline the significant differences between the different centres.

Range:

7. Give examples of long range goods and services which are sold in Central Cape Town but not in your local neighbourhood shopping area.

8. Why are both long and short range goods sold in the CBD area? Does this influence the character of the area?

9. Give examples from the area of small shops seeking locations close to large shops. Give a reason for their choice of location.

10. What factors help to increase the range of goods sold in the CBD?

Threshold:

11. On which sites in Adderley Street would you expect the highest rentals per square metre to be paid? Give reasons for your answer.

12. Choose and name the two buildings in Adderley Street whose tenants you consider pay the highest overheads. (For the purpose of this exercise all properties are considered to be rented from finance companies). Enumerate the chief items which go to make up the overhead costs in these buildings.

13. Explain why the demand threshold for firms operating in the central area is high. How is it that enterprises operating in this area are able to make a profit?

14. Rents in the central area of a city are normally higher than in the suburbs. Why, then, do firms still choose to locate in the CBD?

Status:

15. What evidence can you give to support the statement that St. George's Street is a shopping street of higher status than Long Street?

Both the Foreshore and the lower Adderley Street/St. George's Street areas have numerous highrise buildings.

16. Compare and contrast the nature and size of the retail outlets in the two areas. Account for any differences you may note.

17. What other types of land use have gravitated towards the foreshore area? Why?

Some Significant Patterns

Using the information which you have in coded form, show the following on tracing overlays:

(i) Buildings over 10 storeys high;

(ii) Vacant land, derelict buildings, and land where building is in progress;

(iii) The distribution of shops selling: women's clothes, high class jewellery, hardware, motor cars. Also show chain stores and ship-chandlers;

(iv) The distribution of industry.

Using models to isolate forces which mould the urban landscape:

18. Compare the land-use maps you have drawn with the urban regional models which you have studied.

(a) Which of these models most nearly approximates to the land-use of the built-up area occupying Table Valley?

(b) How does this model help you to understand how the land-use patterns have developed?

(c) What factors help to account for deviations from what might be expected in terms of the model?

The Profile of the CBD:

19. On a street map of the CBD plot those buildings which are over ten storeys high.

(a) Explain why there is a concentration of highrise buildings in this particular area. Does this apply to other cities?

(b) Are there any other areas in the Cape Peninsula where you would find a comparable concentration of highrise buildings? If so, what is the function of these buildings and why are they so tall?

(c) What technological developments have made the construction of highrise buildings possible?

(d) What regulations govern the construction of highrise buildings in Cape Town?

(e) What factors limit the growth of highrise buildings in Cape Town?

(f) What problems result from this concentration of high buildings?

20. Can you detect any concentration (peaking) of particularly high buildings in the CBD? If so, attempt to explain this.

21. Can you detect any height gradients in the central area? Explain why these occur.

22. What evidence is there from Cape Town's CBD to support the statement that the central area of a town is constantly changing? What reasons can you give for the continuous process of urban renewal in this area?

<u>The Architecture of the Highrise Buildings of the CBD</u>:

The General Post Office was built between the two world wars, the Trust Bank during the 60's and the Shell Building and Provincial Administration Building in the 70's. Compare and contrast the architecture of these buildings paying particular attention to the use of windows.

23. Why was glass at one time such a popular building material? Why is there less glass in the really modern towerblocks?

24. Select the highrise building in the central area which you find the most pleasing aesthetically and the building whose architecture you like least. What reasons can you give for your decision?

Locational Factors:

25. If you were to choose a location for each of the speciality shops listed below, where in Cape Town's central area would you locate them: (suppose that you had sufficient financial backing to choose a prime location and that the building on the stand you choose either is suitable for your purpose or is due for demolition). A women's dress shop (selling clothes of medium to high quality); a high class jewellers; a hardware shop; a motor car show room; a ship-chandler; a warehouse for a wholesaler dealing in soft goods?

26. Suggest reasons why food shops (grocers, etc.) are so few in number in the CBD whereas there are large numbers of restaurants.

27. Give examples from the areas you have studied in the field of: functional magnetism, functional prestige, functional convenience.

Clustering of Similar Types of Land-Use:

28. From your map of the land-use of central Cape Town you will note that some uses tend to group in particular areas. What reasons can you give for this phenomenon?

29. What factors have influenced the location of the following clusters: ladies' clothes, motor car showrooms, places of entertainment, wholesalers, ship-chandlers?

30. Using examples from Central Cape Town show how and why some activities tend to be carried out in close proximity to certain other activities.

31. Give a reasoned explanation of the character and location of manufacturing industries in the central areas of Cape Town.

32. Illustrate, from your study area, the effects of zoning in separating between incompatible activities.

Other Factors Influencing Land-Use Patterns:

33. In what ways has the tourist industry influenced the land use and character of Central Cape Town?

34. What is the role of administrative bodies such as the City Council, the Provincial Administration, and the Central Government in the development of a city such as Cape Town? Show how these bodies have influenced the pattern of land-use in:
    (i) the City Centre; and
    (ii) the Cape Peninsula as a whole.

35. The expansion of the CBD in certain directions has been halted. Identify and comment on the nature of the barriers. In which directions is the CBD expanding? Why?

36. District Six was once a colourful, though run down, area. What is taking place in this area? Why? Why were these developments opposed by the Cape Town City Council?

Transportation Networks:

37. What term best describes the street pattern of Central Cape Town? Give a reasoned explanation of the present street pattern, include a comment on the width of the roads.

38. On a map of Greater Cape Town show the major roads and railways leading to the city centre and harbour in 1880. How have these channels of communication influenced the morphology of Cape Town?

39. Show how in Greater Cape Town the motor vehicle has effected:

(i) an ever-increasing separation between place of residence and place of work;

(ii) increasing functional differentiation;

(iii) a decentralisation of functions.

Future Developments in the CBD:

40. Name and locate a building in the CBD which you think should be removed. Write a letter to the paper stating why you think it should go.

41. Name and locate three buildings in the CBD which you think should be preserved. (Do not include such obvious examples as the Houses of Parliament and old churches). Give your reasons for considering that these buildings merit preservation. What actions could you, as a citizen, take to help to ensure that these buildings will not be demolished?

42. Some streets have been made into pedestrian malls. How far has this affected the character of the areas involved? What other streets would you like to see closed to cars? Give reasons for your answer.

43. What do you think of the proposal to close the central area of Cape Town to all private motor vehicles.

References: Davies, D.H., 1965: Land Use in Central Cape Town, Longmans, Cape Town.
Dewar, N., 1972: Land Use Distribution in the Cape Town Frame: A Comparison with the American Norm, The S.A. Geographer, Vol. 4, No. 1

Table A.1: Classification of Functions

0 - CONVENIENCE STORES

(a) Everyday use:

001 General Stores

002 General Stores and P.O.

01 Grocer

021 Newsagent/confectioner/ Tobacconist

022 as 021, but with a sub-P.O.

03 Bar (not 54)

(b) Regular use:

04 Fresh fish

05 Greengrocer/Fruiterer

06 Baker (272 not dominant)

07 Butcher

08 Wine store/Off-Licence (not at 03)

09 Chemist

1 - SHOPPERS GOODS STORES

10 Clothes - General

101 Clothes - Ladies & children

102 Clothes - Men

11 Cosmetics/Wigs

12 Fancy Goods/Boutique - General

121 Seaside tourist gifts (cards, etc.)

122 Other tourist biased gifts & trinkets

13 Furrier

14 Jewellery/Watches

15 Millinery

16 Shoes - General

161 Shoes - Ladies and Children

162 Shoes - Men

171 Wood/Drapery/Perhaps some clothes

172 Cloth and Fabrics

18 Hardware/Domestic Appliances not 39

19 Radio/TV/Electrical goods

2 AND 3 - SPECIALIST STORES

20 Antiques

21 Art Dealer

22 Bicycles/Prams

23 Books

24 Cameras/Photographic materials

26 Florist

27 Foodstores - Specialist

271 Confectioner (only)

272 Delicatessen (06 not important)

273 Health Foods

274 Shellfish

275 Confectionery

276 Other (specify)

25 Chandlery/Boat supplies, etc.

28 Furniture/Furnishings/Carpets (not 394)

29 Leather Goods (not 16)

291 Leather Goods and some shoe repairs

30 Office Furniture

31 Optical Goods (not 75, 854)

32 Pets

33 Records/Musical Instruments, etc.

34 Secondhand/Junk/Surplus

35 Sports and Camping

2 AND 3 - SPECIALIST STORES (Contd.)

361 Coin Dealer
362 Stamp Dealer — Both 36
37 Stationery/Cards only
371 Tobacconist only
38 Toys/Baby Goods - General
381 Baby Goods only
382 Model Shop
391 Builders Merchant
392 Garden Supplies
393 Tools
394 Wallpaper/D.I.Y.

4 - AUTO SALES

40 Agricultural Machinery and Servicing
41 Car/Motor-bike Sales & Accessories (no petrol)
42 Car/Motor-bike Accessories only
43 Garage (Workshop and Petrol Sales)
44 Petrol Filling Station
45 to 49 spare

5 - FOOD SERVICES

50 Bed and Breakfast/Board and Lodgings only
51 Cafe (no meal distinction)
52 Cafe-Transport, with signif. off-road parking
53 Fried Fish & Chips
54 Hotel - licensed
55 Hotel - unlicensed
56 Ice-cream Parlour
57 Restaurant (provides meal distinction)
58 Tea Rooms (specialises in Teas & Morning Coffee)
59 Wimpy Bar

6 - LEGAL & FINANCIAL SERVICES

60 Bank - normal opening hours
61 Betting office
62 Building Society Office
63 Chartered Accountants
64 Estate Agent/Auctioneer
65 Insurance Office
66 Post Office (only)
67 Solicitor/Lawyer
68 Trustee Savings/Mutual Savings/Loans
69 Spare

7 - GENERAL SERVICES

701 Dry Cleaners
702 Laundrette
711 Electricity Showroom
712 Gas Showroom
72 Charitable Organisation
731 Hairdresser (Gentlemen)
732 Hairdresser (Ladies)
733 Beauty Salon
74 Newspaper Offices
75 Optician
76 Photographic Services (sales not significant)
77 Shoe Repairs
78 TV Rental (not sales)
79 Travel Agent

8 - EDUCATIONAL, RELIGIOUS AND MEDICAL FACILITIES, AND LOCAL GOVERNMENT

80 Primary Education
801 Nursery/Play School
802 Primary School

8 - EDUCATIONAL ETC. (Contd.)

81 Secondary Education
811 High & Secondary School
812 Other Secondary School
82 Higher Education
821 College of Education
822 Technical College
823 University
824 Other (specify)
83 Church, etc.
831 Church - Church of Prov. of SA
832 Church - Methodist
833 Church - R.C.
834 Church - Dutch Reformed
835 Synagogue
836 Other place of religious worship (not 84)
84 Cathedral
85 Surgery - General
851 Chiropodist
852 Dental
853 General Practitionery
854 Opthalmic
855 Psychiatric
856 Other (specify)
86 Hospital
861 Cottage Hospital
862 General Hospital
863 Specialist (specify type)
871 Town Hall (indicate if includes 88)
872 Other Local Government Office
88 Library
89 Funeral Director

9 - ENTERTAINMENT

90 Cinema
901 Cinema and tea-room
902 Cinema - specialist (specify)
91 Theatre
911 Specialist Theatre (specify)
92 Amusement arcade or Park
93 Billiard/Snooker Hall
94 Discotheque
95 Club - not included elsewhere (specify)
97 Skating Rink
98 Sports Ground
99 Swimming Pool

ALSO

A Allotments/Private Smallholding
B Builder's Yard/Contractor
F Factory
Of Offices (not included elsewhere)
N Nursery (plants)
P Car Park
Pm Car Park - multistorey
T Timber Merchant's Yard
V Warehouse

X - DEPARTMENT AND CHAIN STORES ETC

XO Clicks
X1 OK Bazaars
X2 Woolworths
X3 Other Department Stores (specify)
X4 Supermarket (e.g. Pick 'n Pay)

E - EXTRA CATEGORIES (not included above)

E1
E2
E3
(fill in as appropriate)

HYPOTHESIS TESTING IN CENTRAL CAPE TOWN

The aim of this unit is two fold:

(i) to study certain aspects of the business structure of Cape Town;

(ii) to conduct the research in such a manner as to exemplify the scientific method as it applies to geography, i.e. a model-hypothetical approach to fieldwork.

Additional, though subsidiary, aims are:

(iii) to involve students in the accumulation of data from a variety of different sources thus demonstrating the fact that much time consuming fieldwork can be avoided if the available data sources are used. In these exercises the fieldwork is simply used to plug the gaps, to obtain data not readily available from other sources.

(iv) to revise such concepts as bid rent, the operation of market forces, the zonation of urban land use, relative accessibility.

As a result of these exercises pupils should:

(i) be more aware of the scientific method and its applicability to geographical research;

(ii) be better able to isolate problems and formulate hypotheses for worthwhile study in Geography;

(iii) be aware of the existence and usefulness of published data on urban areas;

(iv) be able to locate such data;

(v) have gained some insights into how the operation of the market system has influenced land values and hence the morphology of central Cape Town;

(vi) be better able to predict probable patterns of land use in other Western cities.

These exercises should be complementary to work done in the classroom. If pupils have had previous experience in field research they can themselves be led to develop a series of hypotheses which can then be tested in the field.

A list of possible hypotheses which could be tested in central Cape Town is given below (based on Chapallez, 1970). In the discussion that follows only the first five will be tested.

Suggested Hypotheses which may be Tested in the Field

1. That the most accessible locations will be indicated by the pattern and intensity of flow of pedestrians within the Central Business District.

2. That because of more intense compeition in the most accessible area of town, land values will be higher in the central area.

3. That areas of highest land value will correspond to areas of maximum pedestrian density (both declining with increasing distance from the centre).

4. That because of the demand for sites in the most accessible areas, the supply of land the height of buildings will be greater to provide more floor-space.

5. That a zonal pattern of land-use within the centre will be discernible, and indicates ability to compete for the most accessible locations.

6. That certain types of shops selling "shoppers-goods" (e.g. clothes and shoes) tend to cluster so that customers may compare their goods.

7. That certain professional services (e.g. legal and financial) tend to cluster so that business contact may be facilitated.

8. That other shops (e.g. those selling durable goods such as radios, television sets and hardware) and services (e.g.

dry cleaners, cinemas) although not necessarily seeking to locate together, may, however, be expected to form a large part of the Central Business District complex.

9. That certain other types of shop, providing goods or services which are required on a day to day basis, will tend to seek locations which are highly accessible to residential areas. Grocers and the sub-post office are examples of such 'convenience' goods and services.

These hypotheses may be tested in all urban areas and may reveal interesting variations between towns of contrasting character.

Data Collecting

1. Obtain a valuation of the buildings plus land. Property values as such are not available in South Africa, though estate agents can give information for some sites. Rateable values, however, are obtainable for all sites. Though these are usually considerably below the market value for these properties, they are, in effect, the local authority's view of the value of the land and buildings in terms of the rent likely to be realised each year (Chapallaz. 1970, p.8). Before any meaningful trends in land valuation can be detected, the size of the plot must be allowed for. This is done by dividing the gross rateable value for each building by the length of its frontage. Frontage rather than area is taken, not only for ease of computation, but also because it is the length of the frontage rather than the area which weighs most heavily in the assessment (Eversen, 1973, p.58).

2. Calculate the pedestrian density for unit lengths (50 metres) of pavement. In order to do this a pedestrian count must be taken in the field. The moving pedestrian count is conducted by dividing the area into count sections (done beforehand on the base map). These are stretches of pavement which contain some homogeneity of character in land-use, and are not interrupted by side streets or car parks. The observer walks at a steady pace along the length of a count section noting the number of pedestrians he meets coming in

the opposite direction, those he overtakes, and any people who are window shopping (but not if they are inside a building). Only pedestrians of school going age or older should be counted. The counts should be timed so as to avoid those periods when non-shopping activity is significant (e.g. rush hour). Plot the numbers counted in the field onto previously duplicated maps and later transfer the information to a count recording sheet (see Fig. A.3). (Increase or decrease the observed Figure proportionately to allow a standard unit of 50 m).

A more accurate method of counting, the static pedestrian count, is outlined in Chappalez, 1970, p.6, but this requires a large number of personnel operating at the same time and is thus less suited to data collecting in a large area.

3. Data for hypotheses Nos. 4 - 9 can be taken from the information recorded for the previous unit.

Analysis and Representation of Results

Once the data has been collected it must be ordered and presented in such a way that it can be readily analysed and used to test the various hypotheses. This is done in three stages.

First: Show the pattern of pedestrian flow on a tracing overlay superimposed on the 1:1000 map of the CBD. This will sho[w] both the peaking of flows and the different nodes or foci[i] of p[e]destrian movement.

Second: Plot the rateable values per front foot on a bas[e] map and shade each building or lot using the following colou[r] scale:

Rateable value per metre frontage	Colouring
R 1	Dark Green
R 5	Light Green
R 10	Light Yellow
R 20	Dark Yellow
R 50	Orange
R100	Red
R200	Maroon or Purple

This map will show clearly any peaking of rateable values and may be compared subjectively with the pedestrian flow map in order to make a preliminary assessment of the correlation between the two.

Third: The information concerning building heights and land use can be plotted in much the same way as indicated under 2. Land use is plotted by transferring information from the 1:1000 field sheet to a map and colouring plots according to the 11 broad categories given in Table A.1. Once again the information on the maps can be correlated on a subjective basis.

Fourth: A more satisfactory way of presenting this information for the purpose of correlation is outlined by Chappallaz (1970). Information is shown as an urban transect diagram which facilitates comparison between the various sets of data collected in the town (e.g. rateable values, pedestrian density, number of storeys). These comparisons, however, remain subjective.

Testing the Hypotheses

Hypotheses 1 and 2 can be tested objectively only with some difficulty, so pupils will have to base their conclusions on information derived from visual comparisons of the maps or of the more precise comparisons made possible by the urban transect. The relationship between both rateable value and pedestrian density and distance from the centre of a town can be highlighted if the results are plotted on graphs. Land values (expressed as rateable values) are plotted as the dependent variable on the Y-axis, against distance from the centre as the independent variable on the X-axis. Similarly, pedestrian density can be plotted against distance from the centre.

Hypotheses 3 and 4 lend themselves to quite elementary statistical analysis which removes the subjective element. The extent to which rateable value per front foot correlates with pedestrian density can be determined statistically using some form of rank correlation such as Spearman's or regression analysis. These will also give the degree of significance that may be attached to the results.

Hypothesis 5, dealing with the zonation of land use, is more difficult to test. One method of indicating whether there is any degree of zoning of the land use is to place concentric circles, centred on the CBD, with radii of (say) 100m, 200m, 300m and so on on a trace over the land-use map. In this way a number of annular zones are produced. The proportions of the land-uses are then worked out for each zone and the results plotted on a graph as in Fig. A.4. This diagram should indicate the presence or absence of zoning. Strong zoning may indicate that some uses are better able to compete for the most accessible locations, though the possibility that other factors may help to account for the pattern discerned should be considered.

Conclusion: Whether or not all the hypotheses are found to be valid for the business centres considered, fieldwork conducted along such lines provides a useful way of considering the locational theory behind urban land-use. Using fieldwork as a means of testing hypotheses gives it a new relevance and sense of purpose.

References: Chappalaz, D.P. et al., 1970: Hypothesis Testing in Field Studies, Geographical Association, Sheffield.

Eversen, J., 1973: "Fieldwork in School Geography" R. Walford (ed.) New Directions in Geography Teaching Longman, London.

Fitzgerald, B.P., 1973: "A Model Hypothetical Approach to Fieldwork", R.Walford (ed.) New Directions in Geography Teaching, Longman, London.

Fig. A.3: Moving Pedestrian Count Recording Sheet

Location-Count Section	Length (Metres)	Time	Number of Pedestrians	Pedestrian Density (per 50m)
Averages:				

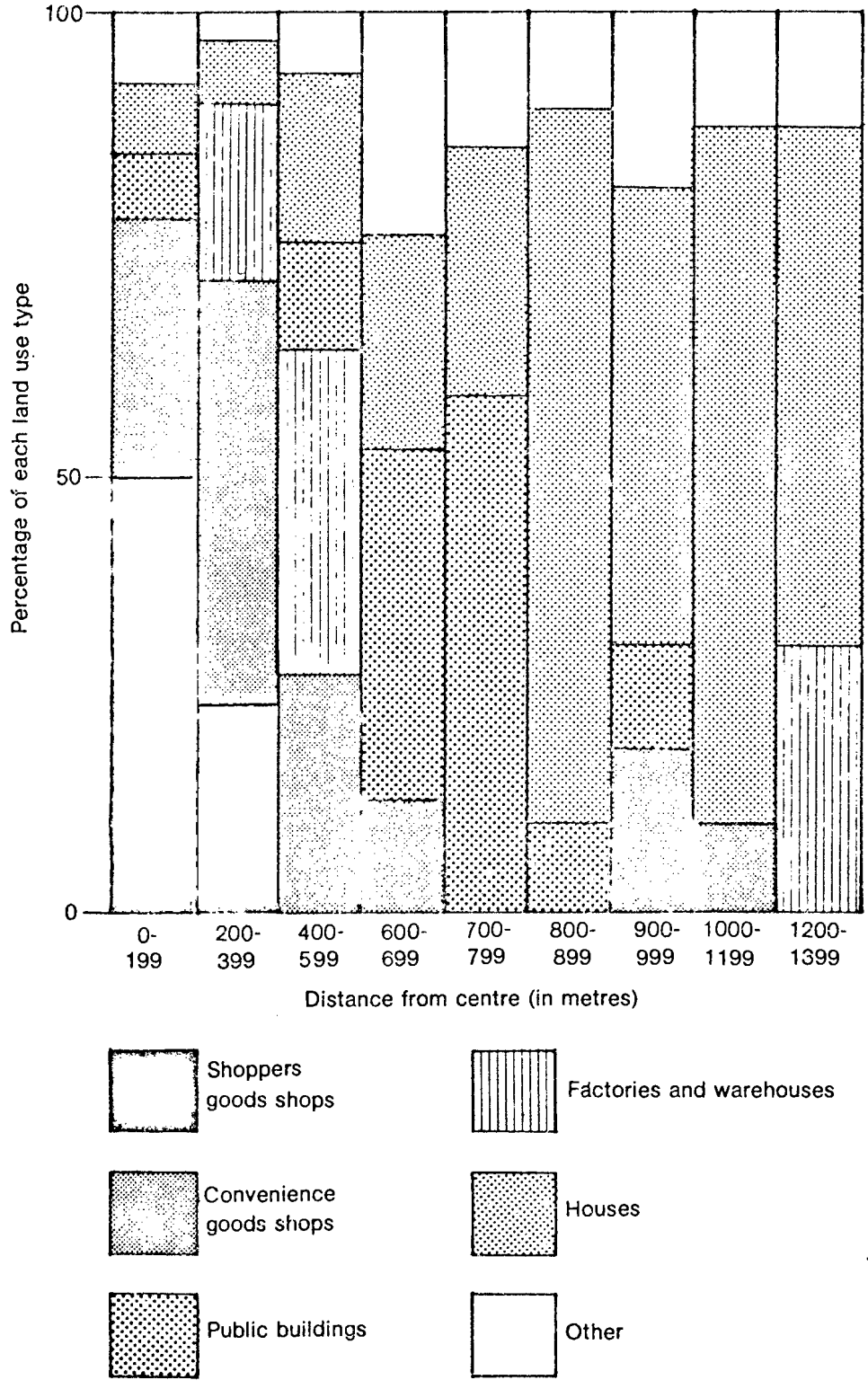


Fig. A.4. Proportionate changes in land use with distance from city centre

Source: Fitzgerald, 1973

APPENDIX B

The syllabus given in this appendix was submitted to the Cape Education Department for the Standard 8 year (age approximately 15 years) in an experimental Geography course, at Rondebosch Boys' High School. The Core Syllabus has been adapted in order to further the aims of the environmental education as outlined in Chapter 2.

PROPOSED GEOGRAPHY SYLLABUS - STANDARD VIII

The aims of this course are that pupils should:

(a) become more aware of the interrelationship between man and his total environment, and understand both the nature and implications of human impact

(b) develop a concern for the quality of life

(c) become committed to the principle of environmental conservation.

Short term objectives towards which teaching should be directed are stated before each of the syllabus sections. The aims would be better advanced by placing the student in a situation of personal involvement, contributing to his own studies as far as possible through extensive activities in the field rather than by too much authoritative teaching, hence fieldwork and library research will be carried out as time and facilities allow. Wherever possible the discovery learning approach will be used, with pupils acquiring skills, analysing data and other source material to develop generalisations and to develop concepts which reinforce or change values and attitudes. Decision making and hypothesis testing helps pupils to come to grips with problems in geography.

Syllabus

Section 1 - The Life Support System

1.1 Course Objectives

1.1.1 To understand that earth is the only planet in the solar system which can support life as we know it.

1.1.2 To know that energy occurs in many forms.

1.1.3 To understand that as human societies become industrialised, they remove increasing quantities of irreplaceable material from the environment.

1.2 Topic

1.2.1 The unique conditions on earth which are favourable for life as we know it.

1.2.2 The capture of radiant energy. Photo-synthesis. Technological capture.

1.2.3 Other forms of energy - kinetic, potential, heat, chemical, electrical, water power, wind power, nuclear power (non-quantitive).

1.2.4 (a) Accumulated energy resources - the dynamic structure of the earth - the nature of the earth's crust - nature of igneous, sedimentary, metamorphic rocks.

(b) Non-renewable energy reserves - examples of types, sources and their life expectancy.

(c) Materials needed to support an industrialised society, their relative availability and the use being made of them.

Section 2 - Ecosystems

2.1 Course Objectives

2.1.1 To understand that life cannot exist without a physical support system.

2.1.2 To understand that populations of different species live together as communities interacting with each other and with their environment.

2.1.3 To understand that the growth of a population is limited by environmental factors.

2.2 Topic

2.2.1 The interaction of the atmospheric components and surface components.

(a) Formation of soil-parent material; weathering, transportation, deposition; composition and characteristics of soils. Soil as a habitat.

(b) The concepts of ecosystems, pyramid of numbers, food webs.

(c) Cycling of oxygen, nitrogen, water and carbon dioxide.

2.2.2 Inter-dependence. A detailed study of one local habitat to show the way a habitat consists of living plants and animals in a physical environment. The feeding inter-relationship of the whole community.

Section 3 - Population Growth and Expectation

3.1 Course Objectives

3.1.1 To understand that the demands being made on the environment are related to increasing population and use of resources.

3.1.2 To appreciate the necessity of increasing and extending agriculture, which in turn is increasingly disturbing the natural and semi-natural ecosystems.

3.1.3 To attempt a critical appraisal of the effects of local extraction industries.

3.1.4 To understand some of the problems caused by urban living.

3.2 Topic

3.2.1 Population and world food supplies

Distribution of human population relative to available food supplies. The need to support non-food productive urban communities. Grassland and primary production. Animals as a source of food. Methods of increasing food supply; alternative sources of protein, increasing yields, high yielding varieties, pest control, extending areas under cultivation; limitations and ecological implications of these methods. Limitation of human population. Population control -voluntary and involuntary.

3.2.2 Conflicting demands for Land Use

(a) General population movement.

(b) A study of the local area and the Cape Peninsula in particular to investigate the way in which land is expected to be available for house building, food production, manufacturing industries, extraction industries, roads, recreation areas, conservation areas.

3.2.3 Farming Practice

Agriculture, horticultural and forestry practices as

artificial methods of maintaining unicultures.

3.2.4 Extraction Industries - non-renewable resources, taking as examples gold and oil.

3.2.5 Manufacturing Industries.

Exploitation of natural resources - limited supply. Projections for their eventual exhaustion. Pollutants as a by-product of manufacturing processes.

3.2.6 Problems of Intensive Settlement

Air Pollution.

Pressure for space,

Urban renewal. Conservation of historic buildings.

Awareness of the social implications of urban changes.

3.2.7 Conflicting Demands on the Countryside.

Knowledge of the work of such bodies as conservation bodies, the Department of Forestry, etc.

Rationalisation of conflicting demands for recreational facilities.

Section 4 - Japan

4.1 Course Objectives

4.1.1 To examine man's use of the varied environments and resources of a particular country.

4.1.2 To attempt a critical appraisal of the benefits and problems of living in this the most advanced Eastern nation.

4.1.3 To examine the spacial arrangement of this particular man/environment system.

4.2 Topic

Japan - The economic miracle
- The growth of the great cities
- The problems of urban areas
- The changing character and distribution of industr
- Power and raw materials for industry
- Communications between cities and industries
- Food supplies for the cities
- Playgrounds for the cities
- Pollution, environmental despoilation and environmental legislation.

Section 5 - Complementary Work

5.1 Field work

5.1.2 Preparation for Fieldwork: Field sketching, levelling.

5.1.2 The geology of the northern Cape Peninsula, illustrating: igneous, metamorphic, sedimentary rocks, contact zones, nonconformities, faulting, etc.

5.1.3 A study of the vegetation of St. James Mountain illustrating ecological concepts - adaptions of flora and fauna to climate and microclimates; diversity; effects of fire, etc.

5.1.4 Environmental conflicts and planning; a field study.

The student will select a topic in conjunction with his teacher which will be concerned with the interaction of man and the natural or built environment.

The emphasis should be on the inter-relationship of processes and activities outlined in the syllabus and the internal details only insofar as they affect these inter-relationships.

The student will be expected to find evidence for himself and to come to a judgment on the environmental pressures involved in the situation being studied.

5.2 Tasks. Two tasks to be completed from the subjects listed below.

5.2.1 Population pressure
5.2.2 The vicious circle of poverty
5.2.3 The Green Revolution
5.2.4 Rural poverty to urban squalor

} In India or Egypt.

ASSESSMENT:

On the paper	50% of total marks.
Fieldwork	Assessment of projects based on fieldwork through stated criteria 30%
Tasks	10%
Year's tests and exams.	10%

APPENDIX C

EXAMINATION QUESTIONS ON GEOGRAPHICAL FIELDWORK

General

1. (a) Draw a simple sketch map to show the chief geographical features (both natural and man-made) of an area of not more than 20 square miles, of which you have first-hand knowledge.

   (b) Select three of these features and write a short geographical account of each. (D., 1959).

2. Write a geographical account of any small area which you have studied in detail in the field. (L., 1952).

3. Select a small area (for example, a parish or a small town) which you have studied in the field. Locate the area and, with the aid of a sketch map, give an explanatory account of its land use. (O. and C., 1959).

4. Choose a viewpoint known to you from which at least a few square miles of country may be seen. Explain clearly where your viewpoint is and how it may be reached. Write a geographical note on the country you can see from it. You should illustrate your answer by a sketch map of the area seen, or by a simple panorama of the view. (S.U., 1959)

5. (Relating to a small area - not more than 100 square miles - studied at first hand):

   (a) State the forms of land use into which your field study area is best divided and show their distribution on a sketch map.

   (b) Account for the distribution of two of the forms of land use you have illustrated. (A.E.B., 1960).

6. Describe what you have learnt about two of the following during any geographical field work you have undertaken, illustrating your answer by examples you have studied:

(a) the relationship of relief to geology;
(b) erosional and/or depositional features;
(c) rural land use;
(d) shopping centres and markets;
(e) settlement and communications. (S.U., 1973).

7. Relate the pattern of settlement and communications within a small area personally known to you, to the relief and water supply. (A.E.B., 1971).

8. (a) (i) With the aid of an annotated diagram, describe EITHER an instrument you could use for recording temperatures OR one for recording precipitation at a school weather station.

(ii) Explain briefly how you might make a permanent record of the readings you obtained from the instrument you have described.

(b) (i) What maps would you use in making a land utilisation survey in your field study area?

(ii) Suggest ways in which you might make a permanent record of the details of your land use survey.

Physical

9. Explain the interrelationships between soil, slope and vegetation. Illustrate your answer by reference to small areas you have studied in the field. (M.L.L.S.B. Special Paper, 1972).

10. Describe, using sketch maps and diagrams, two contrasting landforms within any local area you have studied in the field, and attempt to explain the origin and development of the contrasts. (W., A Level, 1972).

11. EITHER: (a) If you have carried out practical fieldwork in physical geography on ONE of the following features: a river, a beach, a dry valley, a tor, an area of exposed limestone:

(i) describe the aims of your investigation;
(ii) state what observations and/or measurements you made and how you recorded them;
(iii) summarise the conclusions reached;
(iv) briefly state whether your conclusions accorded with the textbook.

OR: (b) Illustrate the influence of geology (structure and lithology) on EITHER coastal OR semi-arid landforms. M.L.L.S.B., A Level., 1973).

12. For an area well known to you, show to what extent its physical features are related to the rock types and structures of the area. (A.E.B., M. Level, 1972).

13. For a portion of a river or stream which you have studied in the field, describe and account for:

(a) its course and long profile,

(b) the form of the valley through which it flows.

14. Discuss the various ways in which terraces or benches may be formed in the sides of river valleys. Reference should be made to specific examples. (A.E.B., A Level, 1973).

Farming

15. By reference to an appropriate area you have studied in the field, give a reasoned account of the features of EITHER an industrial landscape OR an agricultural landscape. (M.L.L.S.B., Special Paper, 1969.)

16. (a) For any small area where you have undertaken fieldwork or made a case study, show how the pattern of agriculture is affected by:

(i) physical factors (relief, drainage, climate, soils);

(ii) human factors (settlement, markets, communications, labour, technology, etc.).

(b) With reference to at least TWO contrasting examples, consider the effects of large urban areas on the pattern of land use in adjacent rural areas (S.U., A. Level, 1973).

Settlement or Industrial

17. From the following select one you have studied as a 'field study': a lakeside settlement, a country market-town, a bridge-point settlement, a developed riverside frontage, a manufacturing site.
(a) describe the area;
(b) illustrate your answer with sketch maps and diagrams you used during your detailed study. (D., 1960).

18. Describe how you would investigate, by field observation and the use of source materials, the reasons for the initial siting of one specific small nucleated rural settlement and the way in which it has subsequently developed. (M.L.L.S.B., Special Paper, 1973).

19. Discuss the objectives and techniques of field work in urban areas. (M.L.L.S.B., A Level, 1973).

20. Attempt, and justify, the division into regions of an urban area you have studied. (W.I., A. Level 1971).

21. (a) How is the increasing number of motor vehicles affecting the distribution of populations within towns; the use and conservation of buildings and areas of historical significance; shopping arrangements?

(b) With reference to a specific town you have studied, explain the measures that are being taken to deal with these problems. (Carsons, 1971, A Level).

22. For any named new town or planned settlement which you have studied, describe how planning principles have been applied to its layout and to its location. (S.C. O Level, 1975).

Environmental, Conservation and Planning

What in your opinion should be the major priorities for the better environmental management of a specified area you have studied?
Why would you put them before other possible changes? (S.C. O Level, 1975).

The following abbreviations have been used:

A.E.B. Associated Examining Board
C. Cambridge University
D. Durham University
L. London University
M.L.L.S.B. Manchester, Liverpool, Lancaster, Bradford (Northern Universities)
O. Oxford University
O. & C. Oxford and Cambridge
S.C. School's Council 14-18 Project.
S.U. Southern Universities Joint Board
W.J. Welsh Joint Education Committee.

Some Points Emerging from a Study of These Examination Questions

To meet the demands of examiners, pupils will have to have completed in the field;

1. Detailed holistic studies of particular local areas. These should not be more than 250 km^2 and not less than 10 km^2 in area. The following should be studied in these areas:

   (a) Landforms in the area, relationship between relief and geology.

   (b) Land use in the area and factors influencing it.

   Pupils should be able to

   (a) Distinguish the chief geographical features (both natural and man made) of the area, account for their presence and comment on their significance.

   (b) Draw a land use map of the area, accounting for the aerial distributions shown.

   (c) Relate patterns of settlement and communications within the area to other geographical factors.

   Note: Choose an area of between 10 km^2 and 250 km^2 with a variety of land forms and land use:

   Using maps and aerial photographs examine the geology, relief, drainage and land use of the area.

   Conduct a search of available literature for information regarding geology, historical development, and historical landmarks, changing land use and factors influencing it.

   Draw a rough land use map from available maps and air photos - select and locate those areas that merit closer examination in the field. These should include -

   (a) All the important geographical features both natural and manmade;

(b) Interaction zones, e.g. boundaries of industry/residential areas, edges of business districts;

(c) Areas of recent development and change.

Update, and add details to land use maps in the field. Ensure that pupils can answer questions detailed above.

2. Other area studies to include as many of the following as possible:

Studies of small settlements - include site, historical development, present land use, water supply, etc.
Land use of an urban area.
Studies of industrial and agricultural landscapes.
Studies of the rururban fringe of a large settlement.

3. Topic studies.

Studies of physical processes and resulting features, e.g. relation of relief to geology; erosional and depositional features; rivers, their valleys and associated features; beaches; tors, exposures of limestone.

Studies of cultural features, e.g. communications, shopping centres, developed river frontages, manufacturing sites.

Man's impact on the environment, conservation, planning.

APPENDIX D

ASSESSMENT OF SITES FOR OUTDOOR EDUCATION

Instructions for the Completion of Assessment Forms for Outdoor Education

1. Code Number: Please leave this space blank.

2. Name and Location of Site:

   Name: e.g. Diastrand (at Cape Point), Epping Industrial Area.

   Location: Refer to the map supplied.
   Give a four figure reference if the site covers more than a single square, choosing the square which is closest to the centre of the site.
   Where the site is small, e.g. a rock pool, give a six figure reference.

3. Brief Description:
   This may include a feature, e.g. bay beach, industrial estate, natural forest, or the site might be chosen because it illustrates a process, e.g. plant succession, physical blight, longshore drift.

4. Size of Site:
   Very approximate dimensions of feature, e.g. 2 km x 15 km, 5 morgen, 5 m^2.

5. Owner/Managing Authority:
   e.g. Fish Hoek Municipality, S.A. Museum, Divisional Council.

6. Permission for Access:
   If the site is open to the public at all times and there is no restriction on access, simply state 'not needed'. Otherwise, give name, address and telephone number of person to whom enquiries should be directed.

7. Access Code:
   Details concerning access to the sites should be very carefully checked and members of the group, in consultation with the site owner/manager/tenant/warden, should assess its relative sensitivity to overuse. This information can then be clearly entered in the Guide in the form of coding symbols. A possible scheme of classification is as follows:

Category A : Sites freely available for use by school parties and members of the public (e.g. town parks, shopping precincts). As this category would include certain areas designated as 'beauty spots', it may be necessary to stress in the space given for comments that certain sites, although freely accessible, should be used with the utmost care.

Category B : Sites available and suitable for use by all pupils for general environmental studies, subject to permission being obtained (e.g. private sites, the castle, and houses open at certain times). Give times when open to the public where applicable in the space given for comments.

Category C : Controlled sites for which permission for access would be granted to senior pupils experienced in field study techniques (e.g. specialised farms, stretches of forest and wilderness reserved and under warden control, certain archaeological and geological sites, certain historic buildings and other urban sites).

Category D : Sites which can only be used for specialist research and which are carefully managed so that their qualities are conserved. Access to these sites would be strictly limited.

Category X : Sites to which access is severely limited or forbidden altogether, either for reasons of extreme vulnerability or for some other reason.

Entries relating to Category C, D and particularly Category X sites should include a strongly worded warning which stresses the undesirability of using these sites for ordinary fieldwork, and the need to consult expert advice from wardens/managers before <u>any</u> work, including preliminary investigation, is carried out. This warning should be given in the space left for comments.

Also for sites in private ownership which come within Category X for reasons of severely limited access the words "private ownership" should be added to the warning. In

some cases the owner may request a 'negative' entry which states clearly that the site is not available for field work, this should be included.

Certain sites in Category X may be physically easily accessible although access for field work is severely limited or forbidden. Entries relating to this type of site must be carefully worded to dissuade field workers from straying onto the site.

8. Number of Students who can be Accommodated:
Numbers visiting a site may have to be restricted because of convenience, e.g. a sewerage farm, or because it is a sensitive area, e.g. where there are rare plants. Numbers indicated should be an approximation of maximum number who should visit a site at any one time.
Please use the following code:
A less than 10; B 10-30; C 30-60; D over 60.
If in doubt leave this blank.

9. Recommended Age Range: Please use the following code:
I - Infant (under 7); P - Primary (7-11); J - Junior Secondary (12-14); S - Senior Secondary (15-18);
U - University; Z - all ages.
If in doubt please leave this blank.

10. Safety Code: Please use the following code:
A - Generally safe for all parties in most weather conditions.
B - Site generally safe except for specified hazards (e.g. dangerous tides, cliffs)
C - Site unsuitable for very young or physically handicapped visitors.
D - Site unsuitable for junior or inexperienced field workers and leaders for reasons of safety.
X - Extremely hazardous sites only to be used by responsible experienced leaders and parties following consultation with local experts.

11. Facilities for Users:
Please tick those which apply.

12. Suitability Rating: (Please indicate).

A - Excellent site, high educational value.

B - Good site, not perfect but adequate.

C - Fair, could be used but such factors as size, accessibility, safety make it less suitable.

13. Additional Information:

Any additional information which might be useful to field-workers using the site, e.g.

No visits allowed to Die Monde estuary during summer months (breeding season of Black Oyster Catcher).

Castle - guided tours commencing at

- other sites of interest in the vicinity - C.B.D., many historic buildings, Houses of Parliament.

14. Assessors Particulars:

NAME: ..... TELEPHONE NO.: .....

ADDRESS: .....

DATE: ..... OCCUPATION: .....

N.B.: If you are not able to complete each part of the form please do not hesitate to return it to me. The information you are able to give will be gratefully received. If you have any queries please phone:

Mr. C.S. Nightingale, 65-2406 after 5.30 p.m.

or contact me at Mason House, Oakhurst Avenue, Rondebosch, or

Mr. W. Diepeveen, 69-3965, Teachers Centre, 3 Station Road, Mowbray, during working hours.

ASSESSMENT OF SITE FOR OUTDOOR EDUCATION

Assessment Form

1. Code Number:
2. Name and Location of Site:

3. Brief Description:

4. Size of Site:
5. Owner/Managing Authority:
6. Permission for Access:
7. Access Code: Category A, B, C, D, or X.
8. Number of Students who can be Accommodated:
   A (less than 10), B (10-30), C (30-60), D (more than 60).

9. Recommended Age Range:
   I (under 7), P (7-11), J (12-14), S (15-18),
   U (University), Z (all ages).

10. Safety Code Category: A,B,C,D or X.
11. Facilities for Users: (Please tick): parking for buses, parking for cars, toilets, refreshments, none of these. Others (please specify):

12. Suitability:
    A - excellent site, high education value.
    B - good site, not perfect but adequate.
    C - fair, could be used but such factors as size, accessibility, safety make it less suitable.
13. Additional Information:

14. Assessors Particulars: NAME: .....
    ADDRESS: .....
    OCCUPATION ..... TELEPHONE NO.: .....
    DATE: .....

When complete, please return to:
Mr. C.S. Nightingale, Mason House, Oakhurst Ave., Rondebosch, 7700
or Mr. W. Diepenveen, Teachers Centre, 3 Station Road, Mowbray,