BIBLIOGRAPHIC DATA SHEET	1. CONTROL NUMBER	2. SUBJECT CLASSIFICATION (695)
	PN-AAH-754	DA00-0000-G182

3. TITLE AND SUBTITLE (240)

Draft environmental profile of Swaziland

4. PERSONAL AUTHORS (100)

5. CORPORATE AUTHORS (101)

Library of Congress. Science and Technology Div.

6. DOCUMENT DATE (110)	7. NUMBER OF PAGES (120)	8. ARC NUMBER (170)
1980	105p.	WZ330.9683.L697

9. REFERENCE ORGANIZATION (130)

LC

10. SUPPLEMENTARY NOTES (500)

(Sponsored by AID through the U.S. National Committee for Man and the Biosphere)

11. ABSTRACT (950)

12. DESCRIPTORS (920)

Swaziland
Natural resources
Economic conditions
Healthsservices
Water resources
Soil management
Forest management
Wildlife
Fisheries
Environmental management

13. PROJECT NUMBER (150)	
14. CONTRACT NO.(140.) SA/TOA-01-77	15. CONTRACT TYPE (140)

16. TYPE OF DOCUMENT (160)

AID 590-7 (10-79)

DRAFT ENVIRONMENTAL PROFILE
OF
SWAZILAND

PREPARED BY THE SCIENCE AND TECHNOLOGY
DIVISION, LIBRARY OF CONGRESS
WASHINGTON, D.C.

AID/DS/ST CONTRACT NO. SA/TAO 1-77
WITH U.S. MAN AND THE BIOSPHERE SECRETARIAT
DEPARTMENT OF STATE
WASHINGTON, D.C.

JANUARY 1980

DRAFT ENVIRONMENTAL PROFILE OF SWAZILAND

Table of Contents

Table of Contents, cont'd.

Table of Contents, cont'd.

List of Tables

List of Figures

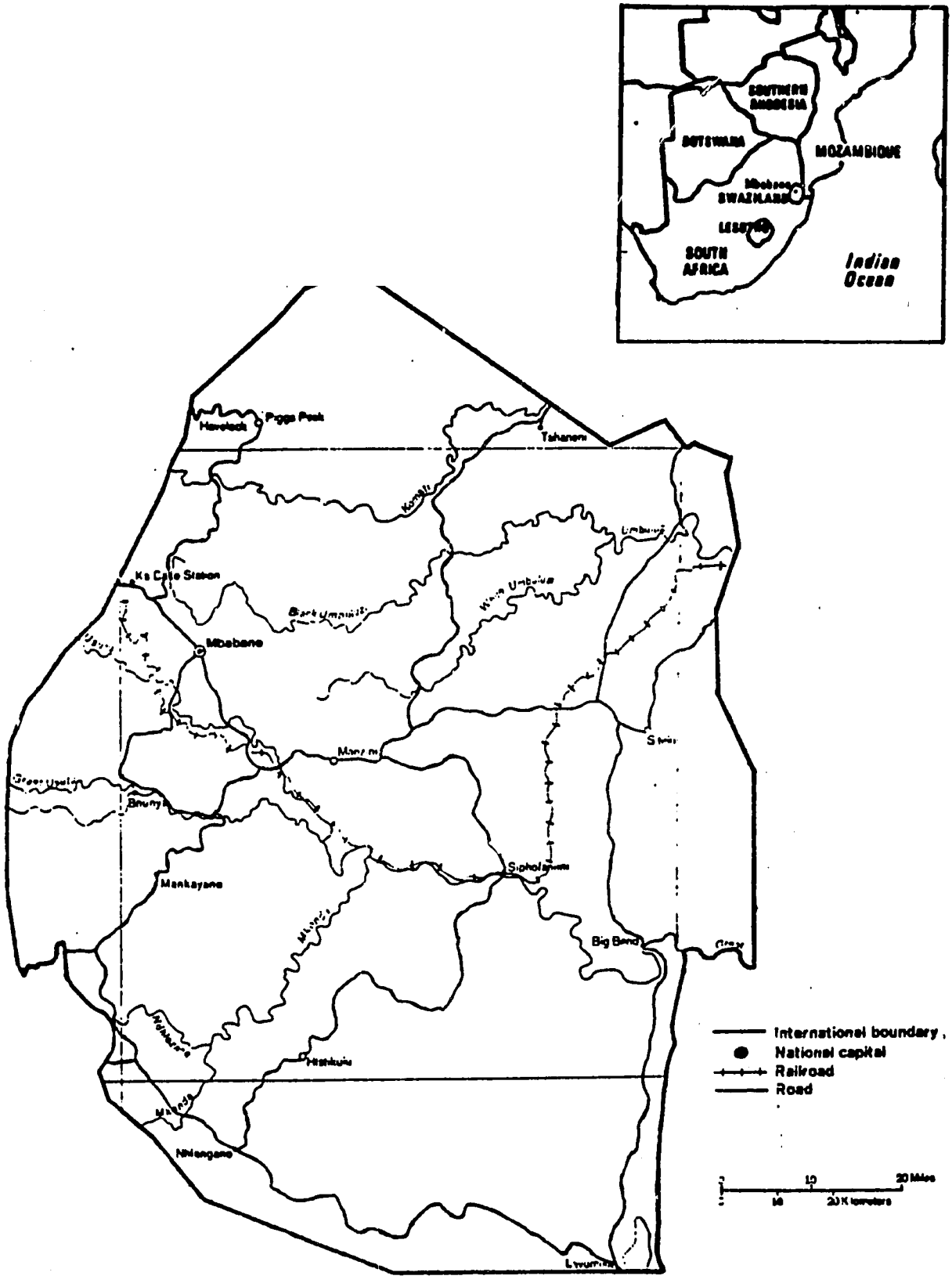


Figure 1. General map of Swaziland.

INTRODUCTION AND SUMMARY

The Natural Environment

The Kingdom of Swaziland is a small landlocked country located in the southeast of Africa. It is bordered on the south, west and north by the Republic of South Africa and to the east by the People's Republic of Mozambique. With a total area of only 17,374 sq km (6,704 sq mi), it is the second smallest country in Africa. Despite its small size, Swaziland is a country of great natural diversity. The country can be divided into four main ecological regions, extending longitudinally from north to south in roughly parallel belts. From west to east they are the Highveld, the Middleveld, the Lowveld and the Lubombo escarpment and plateau.

The Highveld, a continuation of the Drakensberg range, is a granite massif with quartzite ridges that are broken up into rugged terrain by numerous valleys and gorges of perennial streams. The Middleveld is a region of hilly country and well-watered valleys, ranging from mountainous in the west to gently undulating savanna in the east. In contrast to the Highveld and Middleveld, the Lubombo is a gently undulating plain that stretches to the cliffs of the Lubombo escarpment, which is made up of the Lebombo mountains.

Again, despite its small size, Swaziland has significant variations in its climate; which ranges from the subtropical and near-humid conditions of the Lubombo to the humid, near-temperate climate of the Highveld. Swaziland has two distinct seasons - summer (October to March) and winter (April to September). Most of the annual rainfall occurs during the summer half of the year, while the winter is primarily a dry period. The rains are seriously deficient in Swaziland on an average of one year in ten.

The four main ecological regions intergrade, and the divisions between them should be regarded as approximate midpoints of zones of separation rather than exact boundaries. This is particularly true in terms of the country's flora. Three main veldtypes (vegetation) occur in Swaziland - forest, savanna and grassveld. The most extensive forested areas are in the Highveld, though the indigenous forest has been largely replaced by plantations of exotic species, primarily pines and eucalypts. Swaziland is well endowed with surface rivers, which provide the main source of water for the great majority of the population. Swaziland has relatively abundant mineral resources, with mineral production concentrated in iron ore, asbestos and coal. Swaziland has an impressive variety of wildlife. However, the wildlife population has been greatly reduced and is now very scarce outside of protected areas.

The Human Environment

In 1978, Swaziland had an estimated total population of 554,322 and an average annual growth rate of between 3.0% and 3.2%. Africans comprise 97% of the population, the vast majority of whom are Swazis. Over 99% of the total land area is rural, and is divided into two distinct systems of land tenure interwoven throughout the country - Swazi Nation land and freehold title land. Swazi Nation land, which comprises 57% of total land area, is held by the King in trust for the Swazi people and supports about 70% of the population. About 22% of

the population lives on freehold title land, comprising 42% of total land area, the majority of which is owned by Europeans. The remaining 8% of the population lives in urban areas which make up less than 1% of the land area. On Swazi Nation land, rural settlement has followed a dispersed pattern due to the fact that 85% of the land is used for communal livestock grazing. The rural Swazi do not live in nucleated villages, but in settlements revolving around small family homesteads. Tradition and the pattern of rural settlement have thus far served to retard rural/urban migration, though the rate of internal migration is increasing.

The economy of Swaziland is agriculturally-based, export-oriented, and reasonably well diversified compared to other African economies. The economy is characterized by its sharply dualistic structure; being composed of a modern, capital intensive, largely foreign owned and managed sector alongside a traditional sector producing mainly agricultural products for subsistence. An estimated 50% of the population depends on traditional subsistence agriculture. Maize is the major crop, though an increasing amount of land is being used for cash crop production. The modern economy consists of a capital intensive agricultural sector, a growing manufacturing sector based primarily on the processing of agricultural commodities, and the mining sector.

Major Environmental Problems

The major environmental problems facing Swaziland today are: (i) soil erosion and degradation; (ii) waterborne diseases; (iii) the lack of an established system of protected areas; (iv) shelter and environmental health problems associated with urbanization; and (v) the high rate of population growth.

(i) The deterioration of arable and, in particular, communal grazing land in the traditional sector is the most significant environmental problem facing Swaziland today. The problem stems from the increasing pressures being exerted on Swazi Nation land by a growing population and livestock herd. Overstocking on grazing lands has led to the denudation of pasture and subsequent widespread soil erosion, bush encroachment (particularly by thorny scrub in the Lowveld), drying up of springs, dam siltation, and low animal productivity.

(ii) The incidence of waterborne disease in Swaziland, particularly bilharzia, is a serious environmental health problem. The bulk of the population relies on surface water supplies where disease vectors thrive. Current estimates indicate that approximately 30% of the population is infected with bilharzia. The problem is most severe in the Middleveld and Lowveld, where conditions become ideal for the spread of bilharzia and other waterborne diseases due to lower stream velocities, higher water temperatures, and greater population densities.

(iii) There is an increasingly urgent need in Swaziland for a comprehensive system of protected areas due to the spreading activities of man and subsequent modification of the natural environment. The establishment of a protected area system is needed in order to conserve for present and future use the diversity and integrity of biotic communities of plants and animals within natural ecosystems, and to provide areas for ecological and environmental research, particularly baseline studies.

(iv) Though Swaziland is still a predominantly rural society, the country is moving rapidly through an early stage of urbanization, most notably in the Mbabane-Manzini corridor. This has led to attendant shelter and environmental health problems. Squatter settlements have developed on the urban fringe, accounting for as much as 50% of annual shelter production in Mbabane and Manzini. A large percentage of these are without access to potable water and adequate sanitation facilities.

(v) Interconnected with all of the above problems is Swaziland's high rate of population growth - between 3.0% and 3.2%. Under the existing system of land tenure, this rate of growth is putting great pressure on the land and resources of the country. The Government recognizes the problem and, with outside support and technical assistance, is carrying out a maternal and child health/ family planning program.

Institutional Responses

Swaziland has taken significant steps, both organizational and legislative, toward addressing its environmental problems. A Natural Resources Board has been established to oversee the use of resources on freehold title land. The Rural Development Area Program underway on Swazi Nation land has several environmental components. Perhaps the most significant response to date was the passage of the Swaziland National Trust Commission Act and the subsequent establishment of a National Trust Commission, which is responsible for the development of a national park system. However, efforts to address existing and future environmental problems will be hampered by the lack of a central organization with a legislative mandate for overall environmental and natural resource management in Swaziland.

1.0 THE POPULATION

The Kingdom of Swaziland is a small landlocked country bordered on the south, west and north by the Republic of South Africa and to the east by the People's Republic of Mozambique. With a total area of only 17,374 square km (6,704 sq. miles), it is the second smallest country in Africa, and is about the size of the state of New Jersey. Projections based on the 1976 census estimated the total population (both resident and absentee workers in South Africa) to be 554,322 in 1978.

1.1 General population statistics 1/

Total population:	554,322
Total resident population:	518,264 (93%)
Total absentee population:	36,058 (7%)
Resident African population:	500,729 (97%)
Resident European population:	11,227 (2%)
Other resident population:	6,308 (1%)
Average annual growth rate, 1966-76:	3.1%
Population density per sq km:	
Swaziland	30
Swazi Nation Land	40
Freehold title land	15
Urban	396
Birth rate, 1970-75:	49 per 1,000
	47 per 1,000 2/
Death rate, 1970-75:	22 per 1,000
	19 per 1,000 2/
Years to double population:	25 2/
Population in the year 2000:	900,000 2/
Population under 15:	48% 2/
Population over 64:	3% 2/

1/ Unless otherwise noted, statistics are mid-1978 projections from Stallings, 1979 (31g).

2/ Population Reference Bureau, 1979 (26).

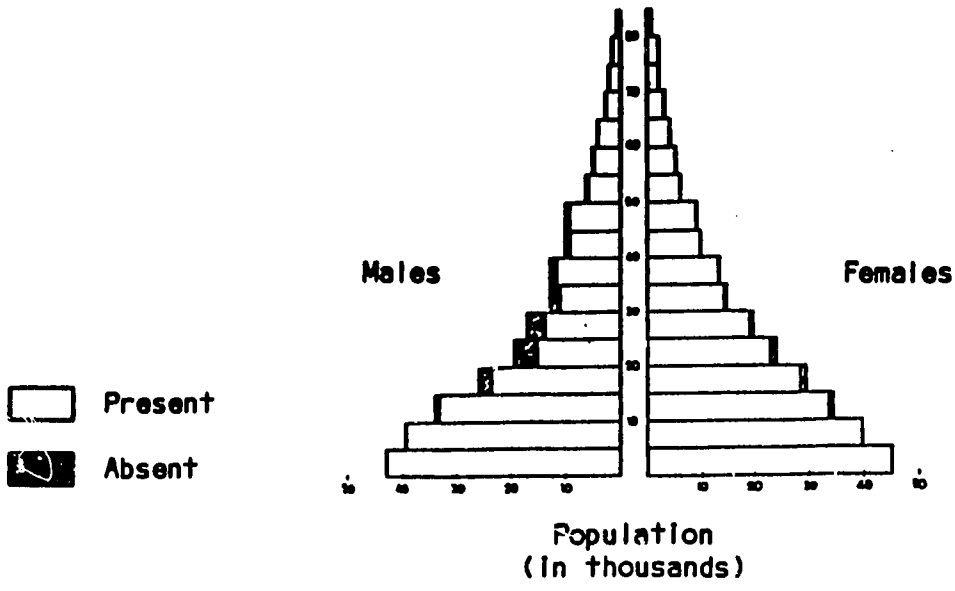


Figure 2. Age/sex pyramid, 1976.

Source: Rivkin Associates, 1978 (31f).

1.2 Spatial distribution

Despite its small size, Swaziland divides naturally into four geographical regions: Highveld, Middleveld, Lowveld and Lubombo (see Fig. 8, p. 28). Administratively, the country is divided into four districts: Shiselweni in the south, Hhohho in the north, Manzini to the west, and Lubombo to the east (see Fig. 24, p. 66). Over 99% of the total land area is rural, and is divided into two distinct systems of land tenure interwoven throughout the country - Swazi Nation land and freehold title land (see Sec. 2.2.1 for a more complete description of the land tenure system). Swazi Nation Land, which comprises 57% of total land area, is held by the King in trust for the Swazi people and supports about 70% of the resident population. About 22% of the resident population lives on freehold title land, comprising 42% of total land area, the majority of which is owned by Europeans. The remaining 8% of the population lives in urban areas which make up less than 1% of the land area. 1/

This complex pattern of land ownership is partly responsible for considerable variations in the distribution and density of the population. With Europeans comprising just 2.3% of the population, the density of Swazi Nation land is considerably greater than the European-held areas (40 vs 15 persons per square km). On Swazi Nation land, rural settlement has followed a dispersed pattern due to the fact that 85% of the land is used for communal livestock grazing. The rural Swazi do not live in nucleated villages, but in settlements revolving around small family homesteads, of which there are over 40,000 averaging less than 3 ha in size. The most densely populated region is the Middleveld. Tables 1 and 2 below outline the distribution of the population.

1/ Stallings, 1979 (31g).

Table 1. Geographical Distribution of the Resident Population, 1976, 1978 and Projected, 1988 and 1998 1/

	1976	1966-76 Annual Growth Rate	1978	1988	1998
Core Region Total	171,910		186,920	277,530	434,060
Mbabane - Town	23,100	5.3%	25,600		
Mbabane - Expanded area	26,660	7.0%	29,750	56,520	115,120
Ezulwini	3,960	7.3%	4,560	9,220	18,660
Lobamba	2,650	6.7%	3,020	5,780	11,050
Manzini - Town	10,020	9.1%	11,100		
Manzini - Expanded Area	28,860	6.0%	32,590	58,290	104,390
Bhunya-Mhlambanyati	5,330	6.1%	6,000	10,850	19,610
Malkerns	2,200	22.0%	3,300	5,380	8,760
Nhlangano	600	1.6%	700	840	1,000
Siteki	1,330	5.8%	1,710	3,000	5,280
Rural Manzini District	101,040	2.3%	105,120	125,650	150,190
Northern Hhohho District	100,220		104,910	125,900	
Motshane	1,240	2.9%	1,310	1,740	2,320
Pigg's Peak - Town	2,190	4.5%	2,390		
Pigg's Peak - Expanded Area	5,210	1.4%	5,360	6,930	10,130
Havelock	4,840	1.6%	4,990	5,850	6,850
Rural Hhohho District (excluding Mbabane Exp. Area, Ezulwini and Lobamba)	88,930	2.4%	92,850	111,380	133,610
Shiselweni District	117,170		121,730	147,360	177,580
Hlatikulu	1,180	1.9%	1,220	1,470	1,780
Nhlangano	2,100	2.8%	2,230	4,390	6,500
Lavumisa	765	-	820	1,100	1,480
Rural Shiselweni District	113,125	2.0%	117,460	140,400	167,820
Lubombo District	104,330		109,650	140,320	182,440
Stegi - Town	1,360	-0.7%	1,360		
Stegi - Expanded Area	3,460	9.0%	4,110	7,360	13,180
Big Bend - Town	2,080	-3.0%	2,080		
Big Bend - Expanded Area	6,630	3.7%	7,130	10,250	14,740
Mhlume - Town	3,920	6.0%	4,400		
Mhlume - Expanded Area	14,840	3.4%	15,870	22,170	30,970
Tshaneni	2,810	10.0%	3,160	5,660	10,140
Rural Lubombo District	76,590	1.8%	79,380	94,880	113,410
Swaziland Total	494,530		522,810	691,110	946,990

Table 2. Distribution of the 1966-76 Population Growth

District	1966-76 Population Increase	
Core region	54,000	45%
Urban	33,400	
Rural	20,600	
Northern Hhohho	22,100	18%
Shiselweni	21,400	18%
Lubombo	22,500	19%
Total	120,000	100%

1/ Frau Rivkin Associates, 1978 (31f). In deriving the above tables the authors used a much broader definition of "urban area" than was used in the 1976 census; hence the difference between the urban/rural population figures above and the figures given earlier in this section which are based on the census. For the tables above, any settlement with a minimal core of infrastructure was considered likely to experience significant growth in the future and was excluded from the rural figures. Under this definition, 16% of the total population was urban in 1976.

Tradition and the pattern of rural settlement of Swazi Nation land have thus far served to retard rural/urban migration. However, the rate of internal migration from rural to urban areas is increasing. Between 1966 and 1976, the urban population grew twice as fast as the rural. This growth was centered in the emerging core region in the west-central part of the country, comprising Manzini District, the Mbabane area, and Hhohho settlements between Mbabane and Manzini. The Mbabane-Manzini corridor is the only significant urban/peri-urban concentration in Swaziland. The rapid growth of this region has been stimulated largely by expanding wage sector employment opportunities. 1/ In addition to internal migration, there is a significant degree of external migration due to the attraction of wage employment in South Africa. A 1978 rural household survey undertaken in the Northern Rural Development Area indicated that 31% of the households were missing adult males normally resident there. Of an estimated 25,000 men working in South Africa in 1976-77, about 17,000 were employed in the mining sector. 2/

1.3 Ethnicity and religion

With the exception of a small minority of Europeans, the population of Swaziland is very homogeneous. Africans comprise 97% of the population, the vast majority of whom are Swazis. The Swazis are composed of over 70 clans, of which 70% are Nguni and 30% Sotho. The Dlamini, the dominant clan, forms the nucleus of the nation and constitutes the royal family. Its customs, laws of property and person, and dialect, known as Siswati, prevail. Other Africans, mainly Shangaan from Mozambique, number about 25,000. A majority of Swazis are Christian. About 43% hold strongly to their traditional animist religious beliefs.

1.4 Education

Adult literacy rate: 30% 3/

Percent enrolled in school (1975): 4/

Males		Females	
6-11	12-17	6-11	12-17
75%	59%	75%	55%

No. of school-age children (5-19) per teacher (1975): 60 4/

The education system in Swaziland is based on the British model, and the curriculum is academically oriented. Primary students begin their education in Siswati in Grades I and II, and English is introduced in Standard I. Enrollments in both primary and secondary schools have increased substantially in recent years.

1/ Rivkin Associates, 1978 (31f).
2/ SADAP, 1979 (31).
3/ Pielemeier, 1975 (25).
4/ Population Reference Bureau, 1979 (26).

The largest concentration of enrollment is found at the lower primary level, yet one-third of the children enrolled leave school without achieving literacy in Siswati. A further problem is that a significant proportion of school teachers are expatriates. 1/ The result is a severe lack of trained manpower, which poses a major constraint to Swaziland's development.

The Government is taking a number of steps to improve the educational system. The main educational objective of the Government at present is to provide adequate schools and teachers and to make the curriculum more relevant. A school garden scheme now operates in 200 primary schools with the purpose of increasing the rural bias in the education of younger children. In recent years adult education in the rural areas has received greater attention. A literacy program is being implemented through a National Adult Literacy Campaign organized by a National Literacy Board. In addition, Community Learning Centers are being established in or near some of the Rural Development Areas to provide training and advice in such fields as agriculture, home economics, and health. Finally, a number of technical and vocational training programs have been established. In the Draft Third National Development Plan, 13% of planned capital expenditure is devoted to the education sector.

1.5 Health

Life expectancy at birth (1977): 44 2/

Crude birth rate per 1,000 (1975): 49

Crude death rate per 1,000 (1975): 22

Infant mortality rate per 1,000 live births (1973): 168

Population per physician: 7,600

Population per nursing person: 1,020

Population per hospital bed: 435

Percentage of urban population served by community water supply: 83

Percentage of rural population with reasonable access to water: 29

Per capita calorie supply as percentage of daily requirement: 91 3/

The only available statistics on levels of health in the country are medical statistics from hospitals and clinics, which do not necessarily reflect true disease patterns. According to the Ministry of Health, morbidity and mortality rates "reflect disease patterns largely due (directly or indirectly) to low incomes, inadequate or inappropriate diet, lack of access to clean water, and

---

1/ Pielemeier, 1975 (25).
2/ Unless otherwise noted, figures are from Family Health Care, 1979 (31a).
3/ Population Reference Bureau, 1979 (26).

in many cases, a lack of awareness of the causes of ill health" (Family Health Care, 1978). Table 3 below gives the most recent information on main disease categories at government and missions' general hospitals for first attendances only. In 1975, 38.5% of all first attendances could be attributed to two main diagnostic categories - diseases of the digestive system and respiratory diseases. The major health problems of Swaziland are primarily due to the interaction of the following major factors:

Population growth - Swaziland's rapid population growth has several negative consequences for health common to most developing countries. Rapid growth has led to a high dependency ratio, a declining land/farmer ratio, and increasing demand for services as well as pressure on existing services.

Water, sanitation and communicable disease - Swaziland's major health problems, all preventable in nature, stem from water and sanitation-related diseases. Water-related diseases are transmitted or spread because of poor water control (polluted water or water that provides a breeding ground for vectors of disease) and unsanitary habits and conditions related to lack of water supply. Statistical data available for Swaziland estimates that 184,000 persons (37% of the 1977 population) received minimal piped water service - 59,000 persons in urban and 125,000 in rural areas. Approximately 300,000 persons (60% of the 1977 population) did not have any access to piped water supplies and depended on water collected directly from rivers, streams, ponds and (to a lesser degree) unprotected wells or springs. 1/ Groundwater provides only a limited source of water as the sub-surface soil structure is not conducive to productive boreholes. 2/ The Second National Development Plan states that in rural areas there is a "total inadequacy or more usually total absence of good potable

Table 3. Main Disease Categories at Government and Missions' General Hospitals

	No. of first attendances		Percent of total	
Disease category	1974	1975	1974	1975
Digestive system	31,384	24,415	22.9	18.7
Respiratory system	29,012	25,789	21.2	19.8
Genito-Urinary system	10,927	11,266	8.0	8.6
Injuries	10,740	12,378	7.8	9.5
Infective and parasitic diseases	10,301	11,472	7.5	8.8
Skin diseases	7,214	7,309	5.3	5.6
Others	37,443	37,860	27.3	29.0
Total	136,985	130,489	100.0	100.0

Source: Family Health Care, 1979 (31a).

1/ Bruce and Unrau, 1977 (6).
2/ Roder, 1977 (29).

water supplies and safe methods of human waste disposal." Protection of water supplies and provision of sewage disposal systems in rural areas is complicated by the dispersed pattern of settlement of the population. In urban areas the problem of water supply is especially severe in the spreading squatter settlements. Lack of sanitary facilities is an acute problem in rural areas and in the squatter settlements surrounding urban areas. UN figures from 1976 show that 25% of the rural population had "adequate disposal", 6% of the urban population was connected to public sewerage systems, and 65% of urban households had a pit privy or septic tank. 1/

Among water-borne diseases, bilharzia is one of the most urgent, affecting approximately 60 to 90 percent of the population in the Middleveld and Lowveld, and significant numbers in the Highveld as well. The incidence of bilharzia is spreading with the development of irrigation, in spite of the fact that 24,000 out of a total of more than 70,000 irrigated areas are under snail control. Typhoid is still endemic, tapeworm (which infects cattle) is prevalent throughout the country and gastro-enteritis (an important cause of infant mortality) is a very serious problem, particularly among infants ranging in age from four weeks to two years. These diseases occur in all parts of the country where purified water or protected supplies are not available. It is believed that climatic conditions cause incidences to be lower in the Highveld than in the subtropical Lowveld. Malaria, which had previously been controlled, is on the increase. 2/

USAID identified the following major obstacles to the control of water-borne diseases:

- the population's lack of access to safe water sources, especially in the Middleveld and Lowveld;
- popular ignorance of and disinclination to employ sanitation and hygiene measures;
- shortages of both technically qualified personnel and resources necessary to mount a comprehensive control program;
- development activities involving irrigation, and other impoundment schemes that contribute to disease (particularly schistosomiasis), especially if appropriate safeguards are not included.

Nutrition - The Swazi diet is based on cereal made of cornmeal or sorghum eaten with a relish or sauce, and meat when available. Maize is consumed in many forms. The main nutritional disease problems in Swaziland are multiple deficiency conditions, kwashiorkor and pellagra (caused by a niacin deficiency due to the low niacin content in maize). WHO reports conducted during 1976 and 1978 list the following major agricultural problems related to nutrition:

- soil erosion;
- maize production fluctuates according to rainfall and is declining due to competition with cash crops;
- small-scale farming, mostly on a subsistence basis and with low productivity;
- high rate of population growth;

1/ Family Health Care, 1979 (31a).
2/ Bruce and Unrau, 1979 (6).

- overgrazing;
- inadequate utilization of 40% of freehold farms (non-Swazi), covering 36% of area under individual tenure.

Cultural factors related to nutritional problems such as food taboos exist but are lessening.

Health care services - Given the present disease pattern, environmental sanitation and health education services will play an important role in reducing the incidence of waterborne and sanitation-related diseases. However, facilities to meet these needs are very inadequate. 1/ There continues to be a serious maldistribution of health services, both curative and and preventive, between urban and rural areas. The Mbabane-Manzini corridor, comprising roughly 16% of the population, has 60% of hospital beds, 62% of doctors, and 55% of nurses. 2/ Similarly, public health and environmental sanitation services are available to urban residents but are practically non-existent in rural areas. All of these problems are compounded by the lack of trained Swazi health personnel. In recognition of these problems, it is the stated policy of the Government "to reorientate their priorities for development in the health field away from conventional institutional facilities centered in urban areas and towards different kinds of programs which are cheaper and more closely geared to the preventive aspects of health, so that a wider impact may be achieved on the health problems of the rural population at large" (Second National Development Plan). In its budget projections for the Third National Development Plan, the Ministry of Health has placed greater emphasis on the provision of health services to rural areas and on preventive health care. Under the Second National Development Plan, planned investments for the 1973/74 - 1975/76 health budget were as follows:

	% of Total
Hospitals	55.4
Public health centers (urban)	6.1
Rural clinics	15.3
Rural sanitation and water supplies	8.2
Public health training centers	4.2
Central medical store	.6
Housing	10.0
Total	100.0

1.5.1 Public Health Services

The Ministry of Health is primarily responsible for the organization and provision of health services, which are divided into six major groups: 3/

- Government personal health services (preventive and curative);
- Government non-personal health services;
- Voluntary non-profitmaking (including religious groups) personal health services;

1/ Bruce and Unrau, 1977 (6).
2/ Pielemeier, 1975 (25).
3/ Family Health Care, 1979 (31a).

- Industrial personal health services;
- Private allopathic practitioner personal health services;
- Traditional practitioner personal health services.

The Public Health Section (PHS) of the Ministry is responsible for dealing with community health issues. Specific aims of the PHS are the provision of potable water supplies, refuse disposal and sewage facilities, pest control, improved standards of nutrition and improved housing (see Sec. 5.3.1 for further information on the organizational aspects of the Ministry).

The main centers for preventive services are the five urban public health centers located in Mbabane, Manzini, Siteki, Hlatikulu and Mankayane hospitals. These centers concentrate on preventive aspects of health care and service, including: health education, medical examinations, prophylactic injections, medications, maternal and child health services, and nutrition guidance. The activities of these centers are intended to spread to subcenters and rural clinics. The Government operates 32 rural health clinics. While mainly curative services have been provided by the nursing personnel in these clinics in the past, attempts are being made to integrate preventive services. Government rural health activities are backed up by a corps of village health workers, who form the backbone of the Government's program to extend services in rural areas. Their tasks include collection of certain basic statistical data, supervision of home treatment, motivation in completion of vaccination schedules, basic health/environmental sanitation/nutrition education, and first aid for emergency cases. A National Rural Environmental Health Program has been instituted to educate and assist rural communities to improve water and sanitation facilities. Health inspectors and health assistants are employed by the Town Councils of Mbabane and Manzini. Health assistants encourage and instruct in protection of springs, construction of wells and latrines, and general hygiene. By 1980, it is expected that 100 health assistants will have been trained. In addition to the 32 government clinics, there are 60 mission-run clinics and 16 private clinics. 1/

Traditional healers, such as the Inyanga and the Sangoma, are still popular in Swaziland (especially for childcare and psychogenic illnesses), and are consulted by well over 80 percent of the population. However, the acceptance and popularity of modern health services indicates that the traditional belief in the supernatural causes of illness has either lessened or at least been combined with the recognition of natural causes and the effectiveness of modern medical practices. There are three basic types of traditional healers - those who practice divining or diagnosis, those who treat, and those who do both. The Minister of Health, at the direction of the King, recently announced the development of a National Organization of Traditional Healers in an attempt to integrate traditional and modern medicine.

The Ministry of Health's Third Five-Year National Development Plan (1978/79 - 1982/83) sets the following objectives:

(1) To increase the proportion of resources devoted to preventive services, to allow special emphasis on the protection of certain vulnerable groups, and to reduce the incidence of waterborne diseases and diseases of insan-

1/ Family Health Care, 1978 (31a).

itation.

(2) To maintain the present national level of curative health services, as indicated by the bed-to-population ratio, and to improve their standards and to redress the distributional balance by attempting to achieve a more equitable distribution of health services by population area (the Government has set a target of increasing clinic coverage so that 75% of the population are living within 8 km of basic health facilities by 1983).

(3) To increase activities in the field of health education with particular emphasis on nutrition, and to strengthen the activities of the Nutrition Council so as to redress the incidence of malnutrition.

(4) To create a situation in which a substantial moderation in the rate of population growth can be achieved, and where family spacing for the benefit of the family is practiced.

1.6 Birth control and population policy

In both the Second and Third National Development Plans the Government recognizes the need for family planning services. The Ministry of Health, with the support and technical assistance of WHO, UNICEF and the United Nations Fund for Population Activities, is carrying out a maternal and child health/family planning program which seeks to integrate family planning (referred to as "child spacing") into maternal and child health services. There are five major public health centers that provide maternal and child health care and family planning services. The activities of these centers spread to subcenters and rural clinics, which act as subsidiary centers on an integrated basis, whether they be government/mission, private or industrial.

2.0 THE ECONOMY

2.1 General economic statistics

GDP at factor cost, 1977/78 (estimate): $256.7 million 1/

GDP per capita at factor cost, 1977/78 (estimate): $495 1/

Annual rate of growth in GDP since 1960: 7.6% 1/

1976/77 (provisional): 2.6%

Value added by sector, 1976/77:	US$ millions	%
Agriculture	68.7	29.9
Industry	57.4	25.0
Services	103.6	45.1
Unallocated	-	-
Total/Average	229.7	100.0

Labor force participation, 1976: Total - 41%

Urban - 50%
Rural - 39%

External debt as of December 31, 1978 (US$ millions):

Public debt, incl. guaranteed private:	103.3
Non-guaranteed private debt:	-
Total outstanding and disbursed:	-

Currency equivalents: The national currency is the lilangeni (plural emalangeni). It is at par and freely convertible with the South African rand, which remains legal tender in Swaziland.

US$ 1.00 = 0.87 E
E 1.00 = US$ 1.15

Member: Rand Monetary Area
South Africa Customs Union
Lome Convention

Fiscal year: April 1 - March 31

1/ Stallings et al, 1978 (31g).

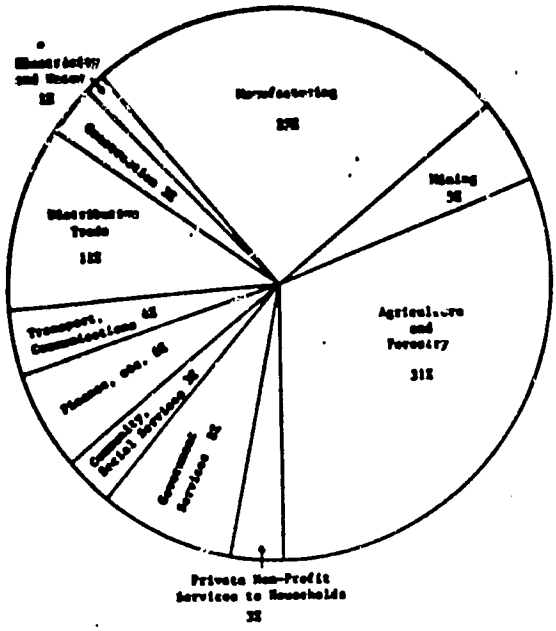


Figure 3. GDP by economic sector, 1973/74

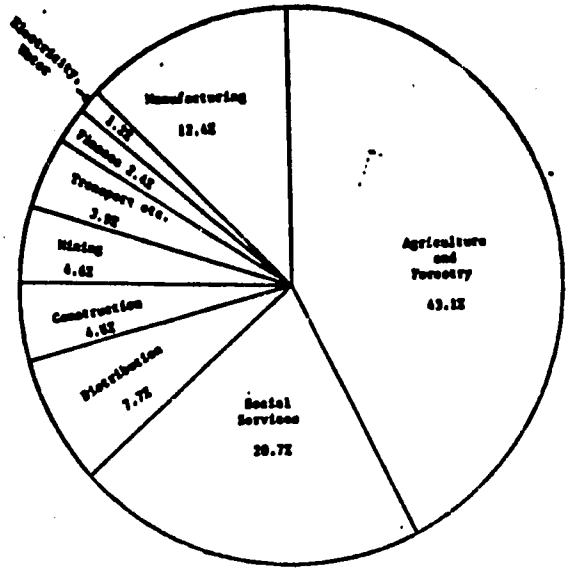


Figure 4. Formal employment by economic sector, 1976

Source: Central Statistical Office, 1976 (7).

Table 4. Volume of Major Domestic Exports, 1971-75 1/

Commodity	Unit ('000)	1971	1972	1973	1974	1975
Foodstuffs and Tobacco						
Live animals	head	6	7	6	10	7
Meat and meat products	kg	3,272	3,388	5,460	3,131	1,515
Butterfat	kg	51	39	22	7	2
Paddy rice	m. ton	6	5	3	3	3
Citrus fruit	m. ton	53	52	56	46	43
Sugar	m. ton	150	172	166	184	161
Molasses	m. ton	45	49	46	55	56
Tobacco, unmanufactured	kg	188	145	159	253	159
Chocolates and sweets	m. ton	1	1	1	0.5	0.4
Raw Materials						
Hides and skins	pieces	31	29	30	49	10
Blood, bone and carcase meal, horns and hooves	kg	366	463	920	505	563
Seed cotton	m. ton	4	4	5	4	6
Cotton lint	m. ton	2	3	3	0.9	4
Cotton seed	m. ton	4	6	5	2	-
Minerals						
Chrysotile asbestos	m. ton	35	29	40	32	41
Iron ore	m. ton	2,886	2,304	1,993	2,481	1,960
Coal	m. ton	85	63	80	62	67

1/ Wood and wood products excluded.
Source: Annual Statistical Bulletin, 1976 (7).

2.2 Spatial development

2.2.1 Land tenure system 1/

Two distinct systems of land tenure are recognized in Swaziland under Swazi law:

(I) Swazi Nation land;

(II) Freehold Title land.

These two land tenure systems grew out of the colonial era in Swaziland. This distinction has a significant impact on current development programs, both because of the economic gap that has emerged between the two, and because Government and law differ substantially for the two types of land. Figure 7 (p. 24) shows the distribution of the two main systems, which are scattered alternately throughout the country in all four ecological zones.

(I) Swazi Nation land is owned communally by the Swazi people, but is vested in the King who holds it in trust for the nation. Under the guidance of the Swazi National Council, the King allocates holdings to individuals through the traditional chiefs. Holdings are allocated for farming plots and homesites; all other land is held communally and may be used equally by all members of the community. The right to use land and other resources on Swazi Nation land is restricted to members of the Swazi Nation. Individuals must offer allegiance to the area Chief and be accepted as his subject. Thus, any Swazi settled on Swazi Nation land is subject to traditional authority; this is not the case for Swazis who live on freehold title land or in urban areas.

While the land is under crops, the farmer has exclusive rights to its use. However, all allocated land remains the property of the Nation, the user has no right to sell the land, and "ownership rights" may be diminished through failure to use the land and are dependent on continued membership in the community. This lack of security of tenure is believed to have acted as a constraint to investment in land development. All individual land holders on Swazi Nation land have the right to use communal resources, such as pasture land, woodland and water, anywhere in the country. In practice, though, individuals restrict their activity to areas accessible to the homestead.

(II) The origin of freehold title land dates back to the turn of the century when Swazi rulers granted vast land concessions to foreigners. A commission appointed by the British Government in 1907 recommended that these concessions be given the same status as a 99 1/3 year lease under the Roman-Dutch law of the Territory, and that holders of concessions be permitted to convert these to freehold title on application. Subsequently, most land concessions were converted to freehold title. In 1973 the Swazi National Council ruled that all land still held under original concession title or lease could no longer be converted to freehold title and, once the 99 1/3 year lease expired, ownership of this land would return to the Swazi Nation.

1/ World Bank, 1977 (38).

The rights of a freeholder are based on European land law. A non-citizen owning land in Swaziland is free to will land to descendants, and citizens are permitted to buy and sell freehold title land without restriction.

(iii) Other land classifications (effectively hangovers from the colonial era) include urban land within gazetted townships which is effectively freehold title land; Tibiyo Fund land, which belongs to the Swazi Nation but is often managed on a commercial basis under the authority of the King and the Swazi National Council; and Crown land and Lifa land, purchased with proceeds from a levy of 10% on Swazi cattle by the King. Table 5 outlines the division of the land among the different land tenure categories.

2.2.2 Land Use

Swazi Nation land comprises about 57% of total land area, while 42% is freehold title land. 1/ In addition to the differences discussed above, the pattern of settlement, organization of agricultural production, and location of industrial activity differ sharply between the two tenure systems. Figure 5 illustrates the pattern of land use for Swazi Nation and freehold title land, as well as for the country as a whole. The Government does not have any explicit spatial development policy. Within the framework of the five-year development plans, no regional growth targets or population and economic objectives are formulated at the level of individual regions or urban areas. 2/

Table 5. Land Tenure Categories

Tenure Category	Area (ha)	%
Swazi Nation Land	984,500	57
Tibiyo Fund, King's land and other gov't. controlled land	184,500	11
Land held or grazed by Swazi farmers	800,000	46
Freehold Title Land	751,900	43
Urban land	9,300	1
Freehold title farms and estates	742,600	42

Source: World Bank, 1977 (38).

1/ This excludes the less than 1% of urban land - Annual Statistical Bulletin, 1976 (6).

2/ Rivkin Associates, 1978 (31f).

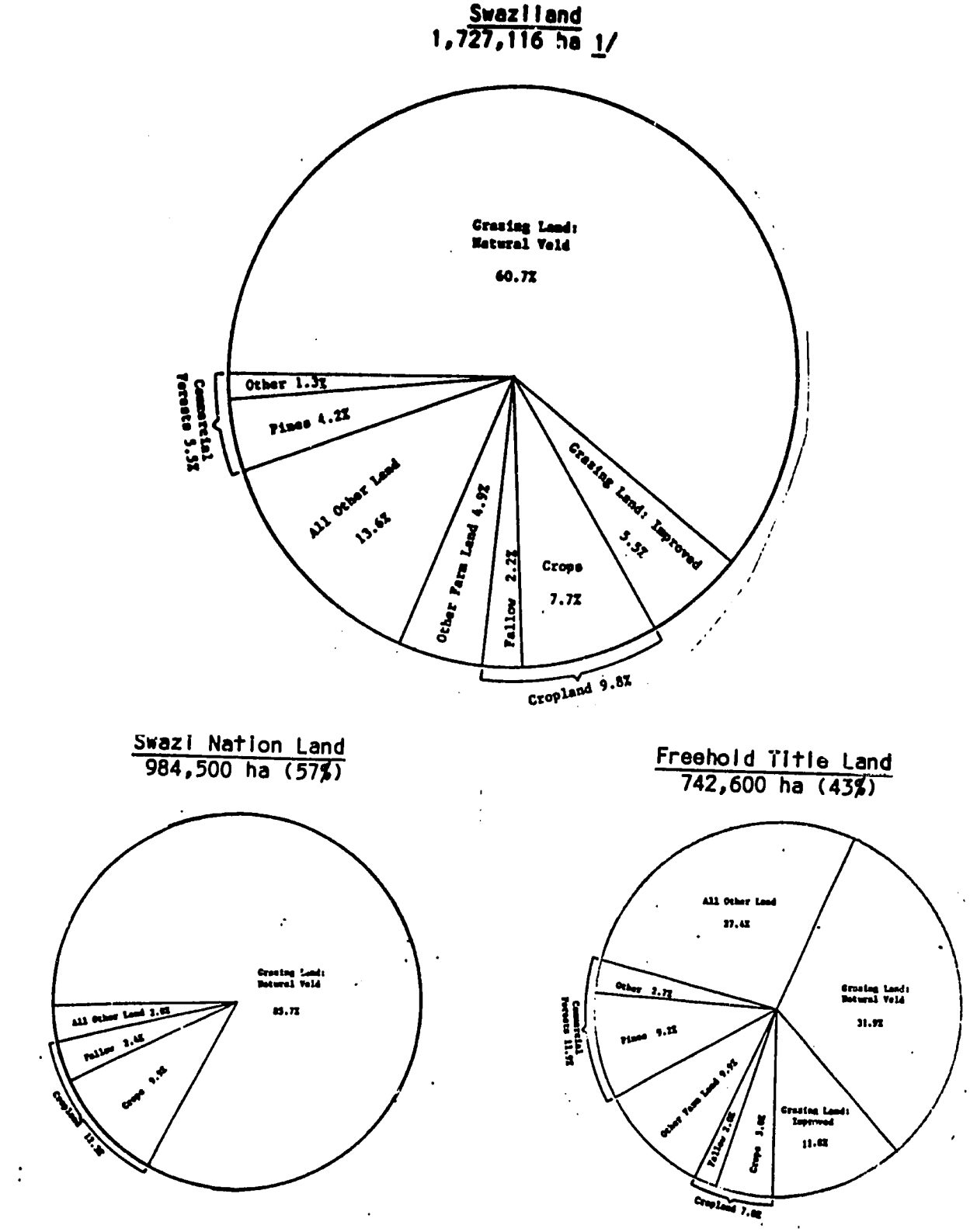


Figure 5. Land use pattern, 1974/75.

1/ Excludes urban areas of approximately 9,300 ha - Central Statistical Office, 1976 (7).

(i) Settlement pattern - See Section 1.2

(ii) Agriculture - Agricultural production patterns differ significantly among both the four ecological regions (see Table 6) and the two primary systems of land tenure. Agriculture (including forestry) on freehold title land is operated on a capital intensive basis by large companies or expatriate farmers, producing mostly irrigated crops for export (see Table 7 for planted area and yield of crops grown on freehold title land). The average size of freehold title farms is estimated to be 800 ha, and over 60% of freehold title cropland is irrigated. 1/ However, although freehold title land produces the bulk of GDP, it is estimated that 30-40% of the land is unutilized or underutilized.

Table 6. Land Use and Crop Pattern by Ecological Region

Region	Area (sq km)	Land Use and Crop Pattern
Highveld	5,029.5	Highly mineralized; afforested; winter grazing of sheep; maize, potatoes.
Middleveld	4,597.5	Some forest, grassland; mixed farming, maize, beans, sorghum, tobacco, cotton; pineapple, citrus, and rice on freehold title farms.
Lowveld	6,416.2	Dense thorn thickets to parkland savannah ranches; maize, beans, sorghum, cotton, groundnuts; citrus, rice, cotton and sugar cane on freehold title farms.
Lubombo	1,321.2	Deep, cultivable soils at places; maize, beans, and cattle ranches; sugar on freehold title and Tibiyo farms.

Source: World Bank, 1977 (38).

About 100,000 cattle, generally exotic or upgraded animals, are run on modern-style ranches on a strictly commercial basis, 50% of which are in the Lowveld. Generally, there is a sufficient amount of pasture land available, stock rates have been kept below recommended optimal levels, and over-grazing is rare. However, on many freehold title farms with absentee owners, Swazi Nation cattle graze freely and pasture deterioration is a problem. Significant amounts of pasture land have been improved (increasing carrying capacities and raising the nutritive quality of grasses) through bush clearing, pasture control and management, and pasture improvement. 2/

On Swazi Nation land, farming is mainly for subsistence; though there is an emerging tendency to grow more cash crops such as cotton, tobacco, rice, and

1/ Stallings et al, 1979 (31g).
2/ World Bank, 1977 (38).

Table 7. Planted Area and Yield of Crops in Swaziland, 1974/75

Crop	Total		Individual Tenure Land		Swazi Nation Land	
	Area (ha)	Yield (m. tons)	Area (ha)	Yield (m. tons)	Area (ha)	Yield (m. tons)
Maize	65,947	93,911	4,948	5,950	60,999	87,961
Sugar Cane	19,060	1,781,012	18,929	1,767,042	131	13,970
Cotton	17,583	16,723	6,247	6,820	11,336	9,903
Groundnuts	5,808	2,503	--	--	5,808	2,503
All Dry Beans	3,572	2,598	210	189	3,362	2,409
Sorghums	3,449	2,320	2	4	3,447	2,316
All Potatoes	1,787	10,737	294	2,218	1,493	8,519
Rice	1,613	4,418	1,613	4,418	--	--
Pineapples	1,205	17,394	1,205	17,394	--	--
Grapefruit	1,193	24,832	1,193	24,832	--	--
Oranges	1,063	29,063	1,063	29,063	--	--
Wheat	446	442	446	442	--	--
Pecan Nuts	383	7	383	7	--	--
Tobacco	334	306	74	52	260	254
Avocados	221	117	221	117	--	--
Bananas	150	945	150	945	--	--
Mangoes	114	729	114	729	--	--
Naartjies	82	58	82	58	--	--
Granadella	56	33	56	33	--	--
Tomatoes	40	225	40	225	--	--
Misc. Vegetables	21	534	21	534	--	--
Lemons	11	30	11	30	--	--
Total Area Planted	124,138		37,302		86,836	--

Source: Central Statistical Office, 1976 (7).

vegetables (see Table 7 for planted area and yield of crops grown on Swazi Nation land). Agriculture is practiced according to traditional methods and techniques, thus there is little irrigation or crop rotation. The traditional system of land tenure, by which land has been given to farmers to farm but is not owned by them, has led to harmful and practices:

- a lack of incentive to invest in land development;
- an increasing sub-division of land, which restricts the use of modern inputs;
- The limited land available results in farmers cultivating poor soils on sloped land, leading to soil erosion.

Livestock plays a vital role in traditional Swazi society. Cattle serve as a source of prestige and wealth, with the number of cattle owned seen as being more important than their quality. Cattle sales are the principal source of cash income for subsistence farmers. In addition, work oxen are used for plow-

ing and transport, and cattle are a source of meat and milk. Due to the importance of livestock and the excellent quality of veterinary services in Swaziland, cattle numbers have increased steadily over the past 20 years. This constant expansion of grazing over a gradually decreasing area of land (because of expanding food crop production) has led to a serious overstocking of pastures.

Density has reached an estimated 1.8 ha per animal unit (A.U.) compared with a carrying capacity of between 2.5 and 3.0 ha per A.U. Overstocking has led to problems of overgrazing, soil erosion, and declining quality of cattle (see Section 4.1 for discussion of overgrazing and soil erosion). The problem of overstocking is exacerbated by the traditional husbandry techniques practiced on Swazi Nation land. As mentioned earlier, pasture land is owned communally and there is no systematic management in herding and grazing.

Table 8. Livestock Numbers in Swaziland, 1966 and 1976 1/

Livestock	1966	1976
Cattle	491,000	634,000
Goats	220,000	237,000
Sheep	36,000	30,000
Horses, Mules, and Donkeys	18,000	15,000
Poultry	245,000	521,000
Pigs	8,000	18,000

1/ Of an estimated 622,000 cattle in 1975, 520,000 were on Swazi Nation land and 100,000 on freehold title land - World Bank, 1977 (6).
Source: Stallings et al, 1979 (31g).

(iii) Industry - No single development center dominates the economy. Economic activity is well distributed across the country due to the emphasis on extractive and agriculturally-based industries. During the last decade economic growth in the modern sector has taken place largely in four established core regions (see Figure 6):

(1) Mbabane-Manzini - manufacturing, construction, tourism, urban expansion, and commercial forestry to the south;
(2) Piggs Peak-Havelock - asbestos, timber, and citrus;
(3) Mhlume - sugar and citrus;
(4) Big Bend - sugar and citrus.

A fifth core region is emerging around Nhlangano in the south with the development of lumbering, tobacco, industrial projects, and tourism.

2.2.3 Transportation network 1/

Though the road network in the modern sector is better than in many developing countries, the rural poor lack an adequate feeder road infrastructure to permit

1/ Pacific Consultants, 1979 (31c).

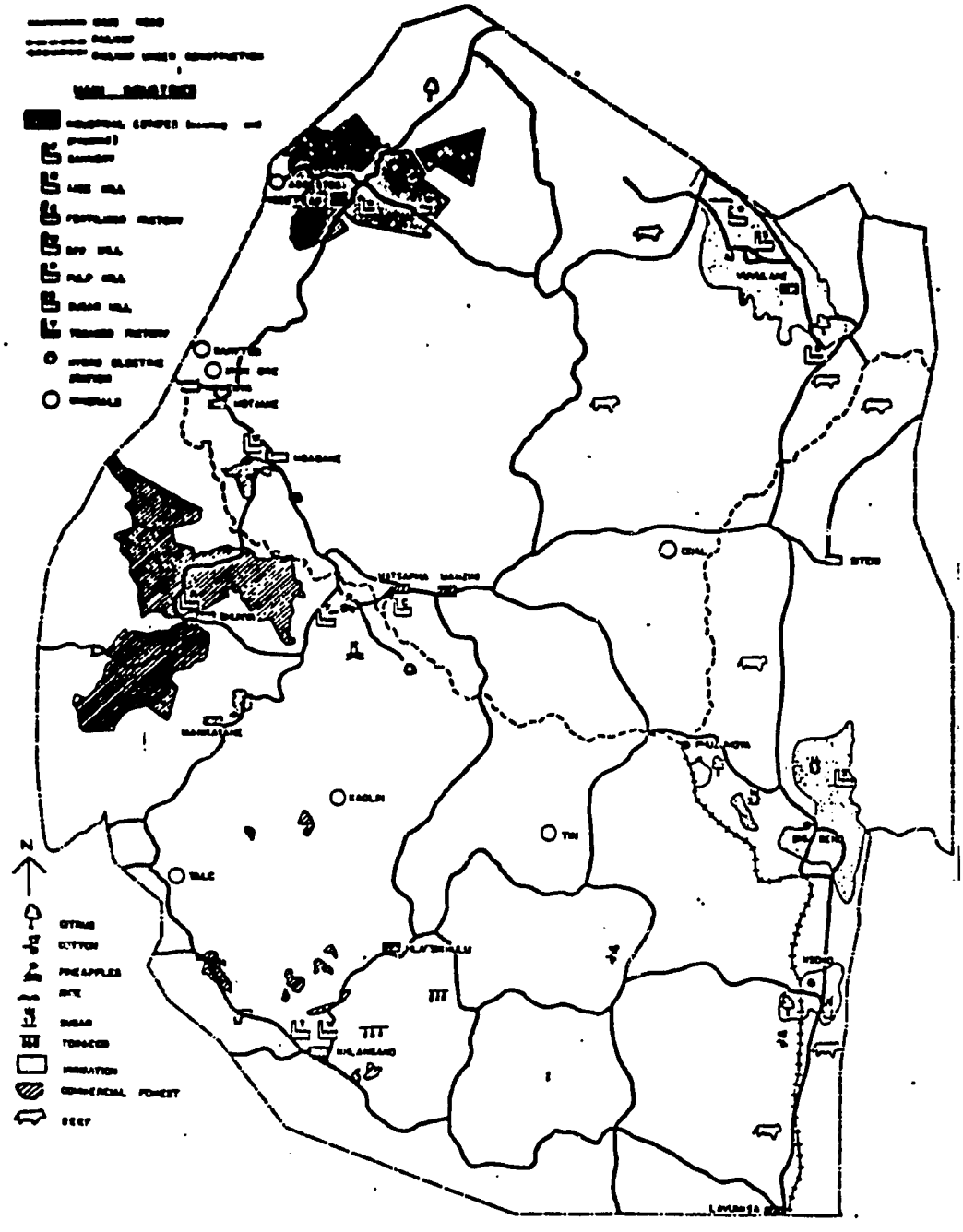


Figure 6. Location of economic activity.
Source: Rivkin Associates, 1978 (31f).

the ready availability of farm inputs and services and access to markets for farm output. The total length of the road system (as of 1978) is 2,653 km, of which 1,428 (54%) are classified as main roads and 1,225 km (46%) are classified as district roads (see Fig. 6). Of the total, however, only about 280 km (10%) are paved. Two-thirds of the country is within 8 km of an all-weather road

(many "all-weather roads" are impassable during periods of heavy rain).

The railway network consists of two lines. The original 224 km line, which links Ka Dake in western Swaziland to the Mozambique railway line at the eastern border (74 miles from Maputo), was constructed to move high-grade iron ore. A new 94 km line was recently completed providing a southern link between Phuzumoya on the existing line and Golela, the rail terminus of the South African railway on the border (see Fig. 6).

According to the Third Plan, the Government intends to use transport infrastructure as a means to facilitate industrial development and exploitation of mineral resources; to promote agricultural development through both the increase and diversification of production; and to make possible the improvement of health, education, and socio-political cohesion among the people of the country. Past road projects have sought to both expand the system and to link the major development areas. The present program is extending the paved road system into the periphery. Transport goals during the next five years are:

(1) To achieve a stage in road development whereby 28% of the entire network of roads will be tarred;

(2) To ensure efficient and reliable road freight and passenger transportation;

(3) To ensure that the Swaziland Railway will become operationally independent and to accomplish an economically feasible extension of the railway network in the country;

(4) To ensure the development of civil aviation to the point where the operational and safety standards are reached and maintained;

(5) To expand and improve the efficiency of the posts and telecommunications networks in the country.

2.3 Economic growth and structure 1/

Since independence, Swaziland has achieved an impressive rate of growth. Over the past several years GDP is estimated to have grown at an average annual rate of 7% in real terms. However, in the last two years a slowdown appears to have occurred as investment flows have slackened and export earnings have fallen with declining prices of the country's two major exports, sugar and wood pulp. Since independence, agriculture and forestry have emerged as the largest contributors to GDP, rising from 19% in 1968/69 to 31% in 1976/77; while mining and quarrying fell from 21% to 5%. Tourism is now emerging as one of the counry's top four revenue earners. Because of its limited domestic market, most of Swaziland's modern sector production is exported. The value of these exports amounted to 61% of GDP in 1977. 2/ Though Swaziland is an exporter of commercial crops, it must import to feed the population.

1/ World Bank, 1977 (38) and SADAP, 1979 (31).
2/ Stallings et al, 1979 (31g).

Swaziland had an estimated per capita income in 1976/77 of U.S. $450, among the highest in sub-Saharan Africa. However, though data is poor, it is clear that income is distributed very unevenly, reflecting the dual nature of the economy. Table 9 reveals that the two-thirds of the labor force comprising the traditional sector earn only 14% of total income.

Table 9. Income Distribution, 1971/72

	African Population 1/ (%)	Labor Force (%)	Income
Swazi Nation Farms	62.1	65.7	14.1
Individual Tenure Farms and Forestry	16.8	15.2	22.0
Other Employment	21.1	19.1	63.9
	100.0	100.0	100.0

1/ Excludes absentees.
Source: SADAP, 1979 (31).

The economy of Swaziland is agriculturally-based, export-oriented, and reasonably well diversified compared to other African economies. The development of the economy has been characterized by three major factors. First, is the sharply dualistic structure of the economy; composed of a modern, capital intensive, largely foreign owned and managed sector alongside a traditional sector producing mainly agricultural products for subsistence. The second factor is the open nature of the economy, providing an attractive environment for foreign investment. Foreign investment is responsible for developing all of the productive sectors of the economy, including agriculture. Finally, Swaziland's economy is characterized by its dependence on the larger economy of South Africa and, to a lesser extent, the People's Republic of Mozambique.

2.3.1 Economic dependence

Swaziland's economy is heavily tied to, and thus dependent on, that of the Republic of South Africa (and to a somewhat lesser extent of Mozambique). With South Africa and Lesotho, Swaziland is a member of the Rand Monetary Area, and prior to 1974 Swaziland used the rand as its national currency. In 1974 Swaziland issued its own currency, the Lilangeni. The Lilangeni is wholly backed by the rand and is readily convertible. Both currencies circulate in the economy and Swaziland continues to be a member of the monetary area. Swaziland also belongs to the South Africa Customs Union along with South Africa, Botswana, and Lesotho. Movement of goods and funds among all of these countries is virtually free and over half of Swaziland's foreign exchange earnings are derived from participation in the Union. South Africa has been the traditional source for vital manufactured goods (providing over 90% of consumer goods) and operates the major transport links on which these goods are shipped. South Africa also provides about 24% of Swaziland's water supply and electrical energy, 27% of private foreign investment, and employment for a significant number of unskilled Swazi laborers. Swaziland is equally dependent on Mozambique's port of

Maputo as an outlet for its exports, though this dependency will lessen upon completion of the new railway being constructed between Phuzumoya and Golela in South Africa. Mozambique also provides a significant market for maize and other Swazi agricultural commodities.

2.3.1 Dual economic structure

(i) Traditional sector - An estimated 50% of the population depends on traditional subsistence agriculture. The traditional sector consists of over 40,000 small-scale farms widely distributed on Swazi Nation land and averaging less than three hectares in size. Women are the principal farmers by tradition, with the men predominantly concerned with livestock. Maize is the major crop, though an increasing amount of land is being used for cash crop production. The traditional farmers have not shared significantly in the country's economic growth. The traditional sector has remained virtually stagnant with production increasing at only 3% a year over the past decade, barely keeping pace with population growth. It is estimated that only 22% of the traditional farmers enter the market economy (representing less than 10% of total production), and cattle still make a comparatively little though growing contribution to growth in GDP. 2/

(ii) Modern sector - The modern economy comprises the capital intensive, largely foreign owned and managed agricultural sector (including forestry), a growing manufacturing sector based primarily on the processing of agricultural commodities, and the mining sector. The modern economy accounts for over 80% of GDP and wage employment and, in contrast to the traditional economy, is expanding rapidly. The major development in the modern sector is the growth in the value of agricultural exports and the expansion of the manufacturing sector. The modern agricultural sector consists of 790 foreign owned farms and estates that average about 800 ha in size. Output per unit is high and growing at a rate of about 5% per year. 3/ The development of modern agriculture has been accompanied by the establishment of related processing industries of sugar, woodpulp, and fruit canning. Manufacturing has been increasing rapidly in importance over the past decade, and is now the second most important productive activity in the economy. Nearly half of all manufacturing enterprises still in operation in 1977 were established between 1973-77. About 33% of all enterprises are foreign-owned, 28% are joint ventures, and 39% are owned locally. 4/ Though the contribution of mining to GDP has been declining (due to the depletion of commercially exploitable iron ore deposits), prospects for the future development of other mineral resources are good (see Sec. 3.5 on mineral resources).

2.4 Development prospects

Swaziland is well endowed with natural resources and has a vast development potential in relation to its small size. However, in its review of the Swazi

---

1/ SADAP, 1979 (31).
2/ World Bank, 1977 (38).
3/ Stallings et al, 1979 (31g).
4/ Pacific Consultants, 1979 (31c).

economy, the SADAP emphasized the following major constraints that, unless reversed, could limit Swaziland's success towards realizng this potential:

(1) Inadequate human resources development - The lack of adequately trained manpower at all levels has been identified as the single most important constraint to the development and diversification of Swaziland's economy. The problem is characterized by: the large proportion of expatriates holding key technical, managerial and professional positions throughout the country; the shortage of skilled craftsmen; and the generally low productivity of Swazi labor both in the factory and on the farm.

(2) Weak national development planning - National development planning is hindered by the absence of a macro-economic, cross-sectoral perspective and the lack of data and analytical capability.

(3) Dependence on South Africa - Dependence can distort the ordering of development priorities and hinder efforts toward self-reliance.

(4) Land tenure system - discussed above.

(5) Population growth - Swaziland's high rate of population growth will put increasing pressure on urban areas, the land tenure system and the natural resource base, particularly the land.

(6) Overgrazing - With the highest livestocking rate in Africa, Swaziland's soil and water resources are deteriorating.

2.4.1 Rural Development Area Program

In 1970, Swaziland initiated the Rural Development Area Program (RDAP), which has become the primary instrument for developing Swazi Nation land. RDAP is an integrated program for rural development involving crop and livestock extension, soil conservation measures such as terracing, health services, construction of water systems, school construction, road improvements, tractor hire services, and construction of dipping tanks for livestock. The primary goal of the RDAP is to promote agricultural development and to improve living standards of Swazi farmers. To achieve this, the RDAP is helping Swazi farmers make the transition from subsistence to commercial agriculture, while preserving and enhancing the long term productivity of land resources and taking into consideration effects on traditional Swazi culture. Thus, the program is designed to improve agricultural methods and the general welfare of the rural population rather than transform the agricultural system through reform of the land tenure system. The Ministry of Agriculture and the traditional government jointly manage the program, with major support from the Ministries of Education, Health, and Local Government. The program is based on the development of Rural Development Areas (RDA's), each intended to serve about 15,000 people and covering 24-28,000 ha of arable and range land. Seventeen RDA's are in various stages of being proposed, planned, or under active development (see Figure 7). These areas comprise about 60% of Swazi Nation land. Eventually, the Government plans to expand the RDAP to cover all Swazi Nation land, and all agricultural extension services will be provided through the program.

1/ SADAP, 1979 (31).

Present RDA (ODM) 1/

1 Northern
2 Central
3 Mahlangatsha
4 Southern

Future RDA (ODM)

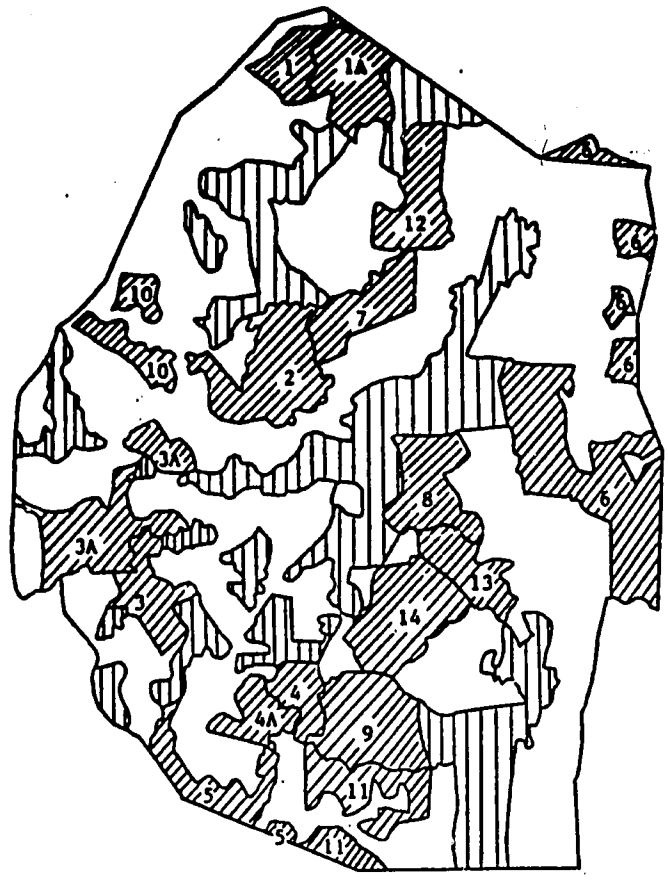
1A Maylwane-Herefords
3A Mponono
4A Madulini-Mahlalini

Intensive RDA (IBRD) 2/

5 Mahamba-Zombodze
6 Lubombo-Mpolonjeni

Non-Intensive RDA (IBRD)

7 Bhekinkosi-Miliba
8 Masala-Vikizijula
9 Sandleni-Luqolweni
10 Siphocosini-Motshane
11 Mahanga-Hluti
12 Nkambeni-Madlangempisi
13 Siphofaneni-Maphobeni
14 Sithobela-Madubeni



Rural Development Areas

Swazi Nation Land not covered by RDA Program

Freehold Title Land

Figure 7. Rural Development Areas

To date, the definition and selection of RDA's has been the responsibility of the Land Planning Section of the Ministry of Agriculture. Areas selected have been those with heavy concentrations of population, good development potential, and uniform ecological conditions. The program is divided into three phases:

(1) The Planning Phase - An RDA is selected, base data for the area is collected, and a detailed development scheme is designed. Local communities, as a whole and through the traditional chiefs, are involved in preparing the initial RDA plan; separating suitable arable land from grazing land, and and identifying locations of future development projects. Once a consensus has been reached on the preliminary plan, it is passed on to the Land Planning Section for more detailed development.

1/ ODM - Overseas Development Ministry of the United Kingdom.
2/ IBRD - International Bank for Reconstruction and Development.

(II) The Minimum-Input Phase - In this initial development phase a minimal package of inputs and services are introduced to initiate the process of increasing crop and livestock production and improving marketing operations. This would include improved seeds, fertilizer, and equipment; improved husbandry standards; construction of access roads; a project center; demonstration plots; and provision of extension personnel and staffs for cooperatives.

(III) The Maximum-Input Phase - This long term phase includes the introduction of improved technology, intensive cropping, soil conservation, improved rural infrastructure, and social services. Implementation of this phase is based on detailed land use plans developed during the preceeding phase.

2.5 The Third National Development Plan 1978-83

Under the Plan, Swaziland has three overall development objectives: economic growth; self-reliance; and social justice and stability:

(I) Economic growth - To achieve economic growth, the aim is to increase growth of domestric product by 7% per annum. This is to be achieved through investment to expand modern sector agriculture, commercialize traditional agriculture, and expand the manufacturing and processing industries.

(II) Self-reliance - To achieve a greater measure of self-reliance, the strategy is to gain greater control of productive activities, to strengthen the Government's administrative capacity, to develop local sources of goods and services, and to diversify external economic relations.

(III) Social justice and stability - This objective will be promoted by spreading economic opportunities and social services more widely and, through greater utilization of traditional institutions, by increasing the participation of rural people in decision-making on matters affecting their well-being. 1/

Table 10. Capital Expenditure (millions of Emalangeni, constant 1977/78 prices)

	1978/79	1979/80	1980/81	1981/82	1982/83	Total
General administration	16.4	3.7	4.2	4.3	4.1	32.7
Law and order	4.3	5.6	4.6	3.7	4.0	22.2
Community services	18.5	15.0	10.5	8.5	7.6	60.1
Education	10.3	12.2	10.9	10.7	9.8	53.9
Health	2.9	1.7	1.6	1.2	1.3	8.7
Agriculture	10.6	15.8	8.7	9.4	9.9	54.4
Industry and mines	24.7	24.7	18.9	13.9	8.7	90.9
Transport and Communications	34.0	13.4	9.7	12.3	15.8	85.2
Other	0.8	3.2	0.3	0.1	0.2	4.6
Total	122.5	95.3	69.4	64.1	61.4	412.7

1/ SADAP, 1979 (31).

3.0 THE PHYSICAL ENVIRONMENT AND RESOURCE BASE

Despite its small size, Swaziland is a country of great natural diversity. The country can be divided into four major ecological regions, extending longitudinally from north to south in roughly parallel belts. From west to east they are the Highveld, the Middleveld, the Lowveld, and the Lubombo escarpment and plateau (see Fig. 8). 1/ The varied ecological conditions of these four regions range from lowlying semi-tropical savanna to temperate highlands.

3.1 Topography

The topography of these four regions is markedly influenced by structure and geology (see Figs. 9 and 10). Both the rock formations and their distribution help to determine the relief of the country. Four main groups of rocks have contributed to the structure of the country:

(i) ancient metamorphosed sedimentary rocks of the Swaziland-Pongola systems (pre-Cambrian);
(ii) ancient intrusive grey granite (intruded into pre-Cambrian);
(iii) sedimentary rocks of the Karoo system (Jurassic);
(iv) recent rhyolithic lavas (late Jurassic).

Highveld - The Highveld, which covers an area of 3,218 sq km (2,000 sq mi), is a continuation of the Drakensberg range of South Africa. Locally known as "Inkangala" (meaning "a cold treeless place"), it is a granite massif with quartzite ridges that are broken up into rugged terrain by numerous valleys and gorges of perennial streams. The average elevation is between 1,066 m and 1,372 m (or 3,500 and 4,500 ft). Average gradients exceed 18% and there are many slopes of 50% or steeper.

The mountains of the Highveld are made up of ancient metamorphosed rocks which are divided into the Swaziland system in the north and the Pongola system in the south. The Swaziland system stretches southwest from Komatipoort in the Transvaal to the Barberton flats, where it is divided into northern and eastern ranges. The northern arm of the system stretches west to the edge of the Drakensberg escarpment, and the eastern arm southwest to Oshoek and Hlom Hlom, where it forms the Barberton mountain land (see Fig. 10). The eastern extremity of the latter lies within Swaziland, and forms the most marked relief of the Highveld. The ranges extend from northeast to southwest and are separated from each other by deep valleys. The dominant ranges are the Makonjwa and Ingwenya, a narrow chain of parallel ridges which form the Swaziland boundary. These ranges are not defined by any sharp boundaries but merge into one another. Other small hilly areas with distinctive topographical features are the Kobolondo hills north of Piggs Peak and the Havelock hills. The Ingwenya ridge rises to a small undulating plateau (Forbes Reef) at 1,822 m (5,979 ft). To the Komati gorge the peaks of the Makonjwa range gradually increase in height, rising to the highest mountain in Swaziland, Emlembe, at 1,850 m (6,070 ft). South of the plateau at Forbes Reef is the Pongola system. Here the relief ba-

2/ Veld has several connotations in Southern Africa, but normally refers to terrain or topography and associated vegetation.

comes more complex. The ranges of hills trend in a direction from northwest to southeast. The most prominent of these hills are the Mbolengeni, the Mahamba, and the mountains containing Mahungutsho Kop (hill). The Mahamba mountains rise to a height of about 1,463 m (4,800 ft). The ridges are composed of quartzites while the valleys are composed of shales. Throughout the remainder of the Highveld and across the whole of the Middleveld, the relief of the country is dependent upon the underlying granite.

Middleveld - The Middleveld covers an area of 3,058 sq km (1,900 sq mi) and has an average altitude of 610 to 762 m (2,000 to 2,500 ft). It is a region of hilly country and well-watered valleys, ranging from mountainous in the west to gently undulating savanna in the east. The region has a median slope of 12%. Its foundation is mainly dolomite (limestone rich in magnesium carbonate) and gneiss (coarse-grained rocks containing ponds of minerals). Dolerite (coarse basalts) and quartzite also occur.

North of the watershed between the Komati and Mbuluzi rivers the most prominent ranges, such as the Ponjani, Slingana, Inyoni, Malegate, and Thomson's ridge, extend from north to south. To the south such ridges as the Mucucene, the Mdimba, and the Lotolja hills trend in a northwest to southeast direction. Occasionally a prominent ridge, such as the Impale and Imputi, is aligned from west to east. East of Mbabane the transition from the Highveld to the Middleveld is very marked. The valleys widen, the boulder-strewn kopjes become less frequent, and the terrain is more undulating and presents a complicated system of wide, rolling valleys and open plateaus. North of the Mbuluzi river and south of the Great Usutu the Middleveld is less well-defined.

Lowveld - The Lowveld, or Bushveld (locally known as "Lihlanze", meaning "a warm place with trees"), covers 3,540 sq km (2,200 sq mi). The Lowveld presents a distinct contrast to the Highveld and Middleveld. It is a gently undulating plain that stretches to the cliffs of the Lebombo escarpment. The highest part of the Lowveld is the watershed between the Usutu and Mbuluzi rivers, at a height of about 305 m (1,000 ft). The Lowveld has the most gentle relief of the four regions with a median slope of 3%. The complex geology of the region ranges from the acidic rocks of the west to the basalt and dolerite of the east (which weathers relatively easily).

Lubombo - The Lubombo, covering an area of 965 sq km (600 sq mi), is an escarpment along the eastern fringe of the Lowveld made up of the Lebombo Mountains. These mountains are the remains of a plateau formed by the denudation of a long dyke of igneous rocks. It is a very uniform ridge, rising from an average height of 610 m (2,000 ft) to the two highest points of Isateki hill (762m or 2,500 ft) and Mananga Beacon (823 m or 2,700 ft), which is on the border with South Africa. The scarp is intersected by the gorges of the Ingwavuma, Usutu, and Black Umbeluzi rivers. The watershed is on the western edge of the plateau and thus drains almost entirely to the east. The plateau's foundations are composed of acidic and intermediate volcanic lavas such as rhyolite (lava-formed granite).

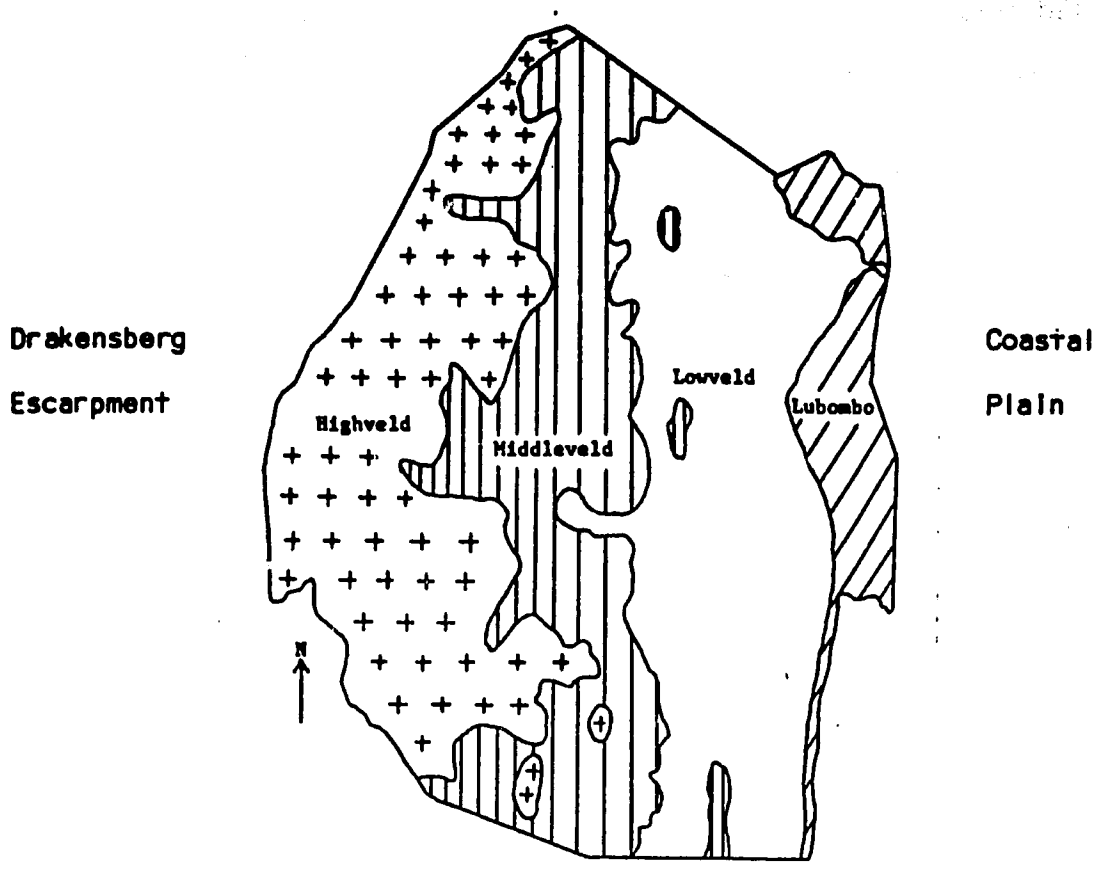


Figure 8. Major Ecological Regions

Region	Area (sq km)	Average Altitude (m)	Climate	Predominate Vegetation
Highveld	5,029.5	1,300	Humid, near-temperate	Sour grassland with some natural and man-made forests.
Middleveld	4,597.5	700	Near-humid, sub-tropical	Tall grass and mixed bush.
Lowveld	6,416.2	200	Semi-arid, hot	Broad-leaved savanna in west, thorn park-land and scrub in east.
Lubombo	1,321.2	600	Near-humid, sub-tropical	Mixed bush.

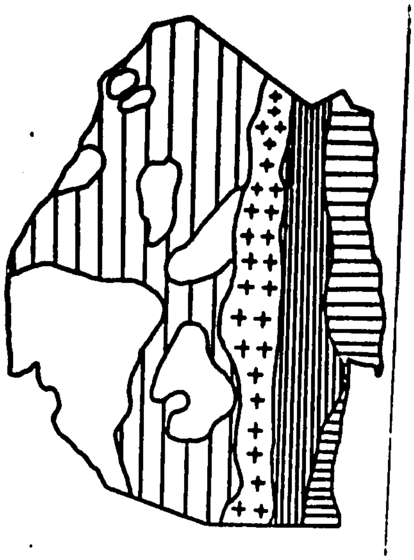


Figure 9. Geology of Swaziland

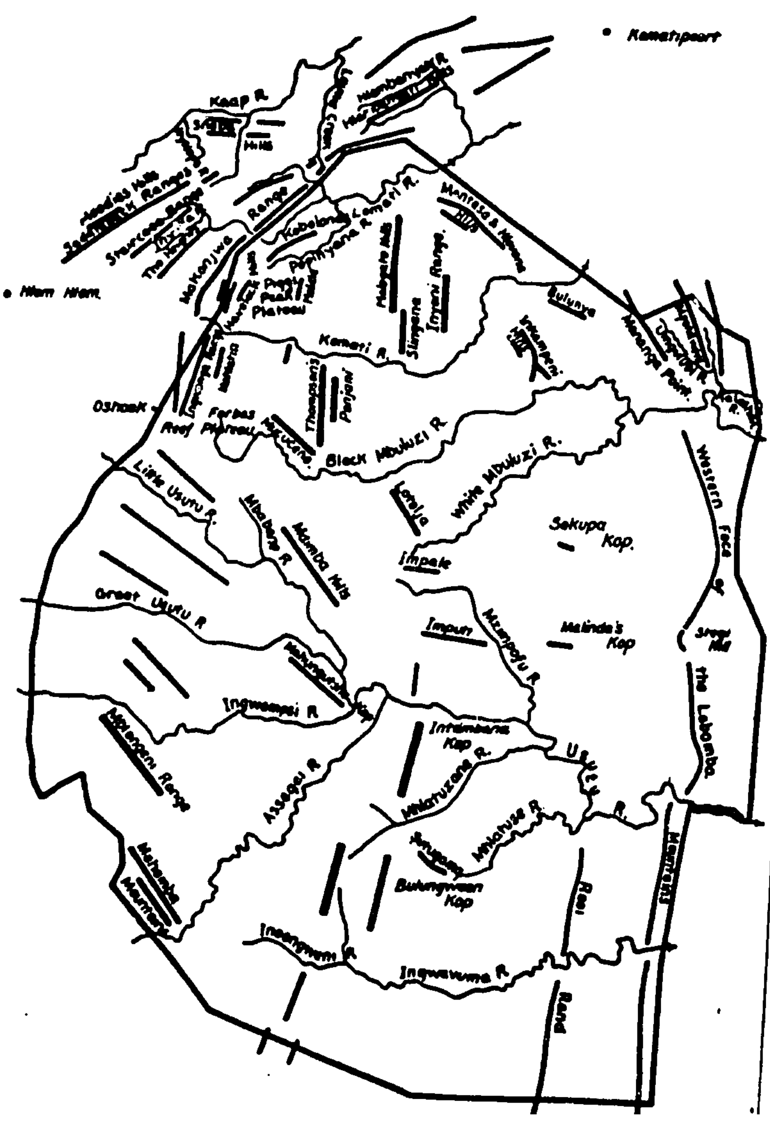


Figure 10. Mountain ranges

3.2 Biogeography

The four main ecological regions described in the previous section intergrade. The divisions between regions should be regarded "as approximate midpoints of zones of separation rather than exact boundaries." 1/ This is particularly true in terms of the country's flora. Several factors limit the growth and variety of vegetation in the four regions. Such limiting factors include soil type and depth, moisture balance, climate, fire, exposure, human impact, etc. Probably the single most limiting factor of the Highveld is temperature (frosting); of the Lowveld, drought; and of the Lubombo, drought as well as extensive subsurface layers of rock. Limitations in the Middleveld provide fewer constraints, as demonstrated by the near total environmental modification of the region through the agricultural and pastoral activities of man. 2/ Despite these regional limitations, Swaziland has a rich variety of flora. More than 2,600 species of ferns and flowering plants alone have been recorded.

3.2.1 Description of veldtypes 3/

Within the four regions, three major divisions in grass quality occur; sweetveld, sourveld, and mixedveld. The terms "sweet", "sour" , and "mixed" relate to the degree of palatability of the grass when mature and dry. In Swaziland, the two major determinants of sweetveld, sourveld, and mixedveld are basically soil (edaphic) and rainfall. The inherent fertility of the soil is regulated by rainfall, which determines the degree of nutrient loss by leaching. Depending on the particular soil type and its capacity to retain its nutrients against leaching, sweetveld, sourveld, and mixedveld result as a general rule from the following approximate annual rainfall variants:

Sweetveld -	71 cm (28 inches) or less.
Sourveld -	71-97 cm (28-38 inches).
Mixedveld -	97 cm (38 inches) or more.

Three main veldtypes occur in the four regions - forest, savanna, and grassveld. They are defined as follows:

Forest (lihlatsi) - This veldtype comprises a closed to semi-closed canopy climax tree layer with a degree of density which precludes grass as a significant component, whether by light or nutrient competition. Different types of forest can be classified as follows:

"Wet" forest - This relates to evergreen forests, and would include all montane forests as well as some mountain forests. Montane forests are located in the mist belt and are therefore mist influenced. Mountain forests occur below the mist belt but may nevertheless be "wet" and evergreen.

"Moist" forest - This relates to semi-deciduous ravine forest. "Moist" forests would include the semi-deciduous ravine and mountain forests of the Lubombo, composed of evergreen and deciduous species.

1/ Compton, 1966 ( ).
2/ Riley, 1979 ( ).
3/ Ibid.

"Dry" forest - This relates either to the dry drainage forests of the bushveld, or the dry Androstachys johnsonii (bukunku) and associated forests of the Lubombo. The dry drainage forests of the bushveld may be either fully deciduous or semi-deciduous (where they are mixed with evergreen components.

Savanna - In Africa, the term savanna is widely used to describe any expanse of veld which has both a tree and grass component. Where the grass component gives way on a successional and cyclic basis to bush or thicket without regressing beyond its capacity to revert to grass, and the climax upper canopy remains unaltered, the term savanna still applies. The savanna would then merely be qualified by terms such as "thicket-invaded" or "encroached" or "modified". Where the tree component gives way to grassveld, the term savanna no longer applies. Often, however, there is not a clear transition from savanna to grassveld and it is difficult to define a margin between the two.

Grassveld - This term is used to identify grass-covered veld when there is virtually no tree component. Broadly viewed, grassveld may include islands of other veldtypes such as thicket or boulderbased bushclumps, as in the Highveld.

The three main veldtypes can be further divided into six subtypes defined as being botanically distinct - valley bushveld, vleiveld, bushclumps, thicket, broadleafveld, and thornveld. They are defined as:

Valley bushveld - A subtype of savanna, sour.

Vleiveld (sitete or sihlambo) - A subtype of savanna and grassveld that is composed of moisture-dependent vegetation found in areas with a high watertable. There is usually an absence of woody species. Where woody species do occur, they are typically species of the genera Ludwigia, Passerina, and Erica, which colonize the verges or elevations within the viei. Swazis differentiate between a permanently wet viei (sitete) and a periodically dry viei (sihlambo).

Bushclumps (tincumatsi) - A subtype of savanna and grassveld that are composed of communities of plants that are boulder or termitaria-based. The termitaria, which are rich in minerals brought to the surface by the termites, support sweet grasses on the verges. These grasses are normally heavily utilized by grazing animals, thus protecteing the bushclumps from fires that burn in the surrounding grassveld. In boulder communities, the boulder piles lessen the impact of fire and thus facilitate arboreal growth even of fire-sensitive species.

Thicket (livungu) - A subtype of savanna and grassveld related to a canopy of dense scrub covering the veld, which is usually successional and often impenetrable. The Swazi understanding of a thicket relates only to a small tree or shrub species and does not include saplings of large tree species, e,g, a closely packed sprouting of Spirostachys africana would be called a small forest (lihlashana) and not a thicket.

Broadleafveld (macembeni) - A subtype of savanna that consists of predominantly thornless tree species, typically broadleaf Acacia species.

Thornveld (emanyeveni) - A subtype of savanna that relates to communities characterized by thornbearing woody plants, especially of the genera Acacia and Dichrostachys.

All these veldtypes and their subtypes may be more precisely defined by descriptive adjectives or prefixes relating to significant characteristics of the veldtype and its locality. For instance, a forest may be a "pristine", "climax", or "pioneer" forest, or a "dry", "wet", or "moist" forest. Often the dominant plant species is used to identify a veldtype, such as "dry Acacia savanna" in the Lowveld.

3.2.2 Biogeography by region

Highveld - The dominant vegetation of the Highveld is grassland, gradually becoming shorter with increasing altitude. The montane grassland is composed of a large number of species of grass, primarily of the tussock or bunch type. The grasses are mostly wiry and narrow-leaved, and because of the low nutrient content of the the subsoil the veld is sour and innutritious. Some of the most important species composing the mountain grassveld include: Eulalia villosa, Themeda triandra, Setaria sphacelata, Monocymbium ceresiforme, Sporobolus centrifugus, Loudetia simplex, Rendlia altera, Harpechloa falx, Ctenium concinnum, Eragrostis plana, Trachypogon spicatus, Alloteropsis semialata and Pentaschistis natalensis. All these and other highveld grasses are perennial species, with annual grasses only occurring in areas disturbed by cultivation and road-making. The mountain grassveld is still well represented, but is under growing pressure from an expanding population.

The extensive areas of pure montane grassland are occassionally interrupted by subsidiary highveld associations of:

(1) Groups of trees arising in the shelter of surface boulders distinct from those of the montane forests. Among the most frequent are Halleria lucida, Ficus ingens, Cussonia paniculata, Psychotria capensis, Burchellia bubalina, Pachystigma macrocalyx, Pavetta cooperi, Cephalanthus natalensis, Maesa lanceolata, Rapanea melanophloeos, Bequaertiodendron magalismontanum, Ochna natalitia and Grewia occidentalis.

(2) Upland swamps, especially in the catchment of the Black Mbuluzi river, which contain herbaceous vegetation comprising a great range of species, though no woody plants are present. The prevailing vegetation consists of grasses and sedges. Botanically, these swamps are, for their size, richer in species than any other plant community in Swaziland. However, these swamps are being drained and consequently invaded by dry-land plants.

(3) "Alpine" flora characteristic of outcrops of rock (generally other than granite) similar to the "alpines" of the mountains of Europe and Asia. The most characteristic of these are the "composites" Ursinia saxatilis and the "everlastings" Helichrysum chionosphaerum, H. galpinii and H. nanum. At somewhat lower altitudes, frequently on granite outcrops, other characteristic plants occur, including Vellozia clavata (often very abundant), Aloe suprafoliata, Coleochloa setifera (very characteristic on exposed surfaces), Crassula argyrophylla, Senecio galpinii, and a wide range of other plants.

(4) Montane forests at altitudes from about 4,000 feet upwards in the deeply cut and steep ravines. These montane forests are all of limited extent, occupying a small portion of the total Highveld zone. These forests usually end abruptly at the rims of the ravine, having a well-defined line of separation from the surrounding grassland. The best examples of montane forest are in the ravines of Emlembe and adjacent mountains, while smaller forests occur in many of the ravines surrounding Mbabane. The trees composing the forest are almost entirely distinct from those found among the scattered boulder groups, and the shrubs and herbaceous plants forming the lower strata of the forest vegetation are also distinct from those found outside. Taken as a whole, the forest forms a well-marked ecological entity rich in species and forming a natural vegetational climax.

A considerable number of tree species occur, sometimes reaching heights of 80-100 feet, their crowns forming a continuous canopy casting deep shade below. Some of the most characteristic large trees are Syzygium gerrardii, Podocarpus latifolius and P. henkelii (yellowwoods), Cussonia umbellifera, Garcinia gerrardii, Rawsonia lucida, Xymalos monospora, Pittosporum viridiflorum, Trichocladus grandiflorus, and Kiggelaria africana. The woody undergrowth or "shrub layer" in the forest consists partly of young trees which have not yet reached the canopy (primarily Podocarpus) and partly of shrubs belonging to characteristic species. The herbaceous layer of ground flora consists largely of ferns, but a few flowering plants can be found. A number of epiphytes also occur.

Extensive afforestation has taken place in the region, consisting primarily of large commercial plantations of exotic species (pines and eucalypts).

Middleveld - Biogeographically, the Middleveld does not constitute a distinct ecological zone, but rather is a transition between the very distinct vegetational types of the Highveld and Lowveld. The flora, which may extend into the Highveld or Lowveld (or both), has been extensively modified by cultivation, burning, and overgrazing. The Middleveld is divided into middleveld grassveld in the west and middleveld bushveld in the east.

The grassveld is usually sour. Forest in the grassveld region, usually riverine or on south-facing slopes, is now extremely rare, having been reduced or eliminated by man. Savanna occurs mainly as valley bushveld. Broadleaf savanna, both wet and moist, was once abundant on the plains but is now very scarce. Tall and short grassveld that ranges from sour to mixed to sweet is very rare in naturally viable expanses. Of the veld subtypes, valley bushveld occurs as westerly intrusions into middleveld grassveld and is the most abundant form of savanna. Bushclumps, usually boulderbased, occur as do thickets that are characteristic of forest verges. Thickets also occur in more open areas where it is characterized by the encroachment of species such as Lippia javanica (msutane).

In the bushveld region forest is usually riverine, with some forest occuring along ravines and on west or south-facing slopes. This forest is at risk of disappearing under severe human pressure and is periodically reduced by fire. Savanna, normally not as open or tall as lowveld savanna but with greater species diversity, is still plentiful. However, the savanna is being encroached upon due to poor management and the spread of cultivation. Well preserved high quality savanna is now extremely scarce.

Of the subtypes, valley bushveld occurs very slightly as a transition from middleveld grassveld. Vleiveld is associated sparingly with seepages and drainage, often with Phragmites mauritianus as a dominant species. Broadleafveld is fairly extensive. Thornveld, consisting primarily of Acacia nilotica, was once abundant but is now largely modified or threatened by pasture improvement. Due to the extensive encroachment by man, the region has been invaded by weeds to a greater extent than other regions. There is sparce interceptive capacity (even bare ground in some places) and much soil erosion.

Lowveld - The vegetation of the Lowveld is made up of different types of bushveld and savannah. The ground flora is predominantly sweet grasses with comparatively few herbaceous and bulbous plants and some local succulents. These grasses form the foundation of the ranching industry. The most significant include Panicum maximum, P. deustum, P. coloratum, Sehima galpinii, Themada triandra, Lintonia nutans, Sporobolus pyramidalis, Aristida congesta, and Eragrostis superba. The savanna is still extensive, but is being increasingly encroached upon by thicket and cultivation, particularly monoculture. High quality open canopy savanna is becoming extremely rare.

There are a large number of species of trees and shrubs in the region, with most occuring in the European ranching areas. Due to the high degree of cultivation on Swazi Nation land, only certain species of trees still occur; primarily Sclerocarya birrea for its fruit, and species of Ficus. It is rare to find bushveld vegetation in an unaltered condition, and land which has been cultivated and abandoned is colonised by a few species of grasses and a number of exotic weeds. It is only in the European areas used for cattle ranching that the indigenous flora of trees, shrubs, grasses, etc. remains in anything like its natural condition. Riverine forest is practically extinct due to overexploitation. Dry Spirostachys africana dominated the forested areas but is now very rare and under great pressure by agriculture. Thicket is becoming the most common feature in the Lowveld and is seriously degrading the quality of the savanna. Broadleafveld is also extensive. Thornveld, consisting primarily of Acacia nilotica, A. senegal, and Dichrostachys species, is still abundant.

Lubombo - In terms of rainfall and altitude, the region is similar to the Middleveld, but the natural vegetation is much more densely bushy with a relatively small number of Acacias. Forested areas include deciduous, semi-deciduous, moist and dry forests. Trees cover most of the steep slopes of the escarpment and merge into the lowveld associations below. The density of the tree cover is dependent on the rocky nature of the surface. The ravines beyond the escarpment contain forest with many large trees, and on slopes in the Mbuluzi catchment special types of forest (especially Androstachys) cover the ground. Along the rivers that cut through the range are special types of riverine forest, including Ficus sycamorus and Acacia xanthophloea. A notable feature of the Lubombo Range are the cycads; with Encephalartos ubomboensis occuring in groups on rocky outcrops on the ridge itself, and E. umbuluzensis commonly found in the deep ravines. Lubombo pastures have close affinities with the Middleveld, although rare plants occur that are more closely linked with the Zululand coastal belt. Striking termitaria-based bushclumps also occur. Finally, climax thicket on rhyolitic slab supporting very shallow soil is fairly abundant.

3.3 Climate

Despite its small size, Swaziland has significant variations in its climate; which ranges from the subtropical and near-humid conditions of the Lubombo to the humid, near-temperate climate of the Highveld. Swaziland has two distinct seasons - summer (October to March) and winter (April to September). Figure 11 below illustrates the climatic conditions prevailing during the two seasons.

Typically, 75-83% of the annual rainfall occurs during the summer half of the year, while the winter is primarily a dry period. Moisture laden southeast trade winds blowing inland off the warm Mozambique current lead to cloud formation at the base of the Lubombo (see Fig. 12). These cloud formations become colder and heavier as they pass over the upper reaches of the Lubombo escarpment, until they can no longer hold the moisture and precipitation occurs. Light air descending on the lee side of the escarpment is warmed and becomes very dry.

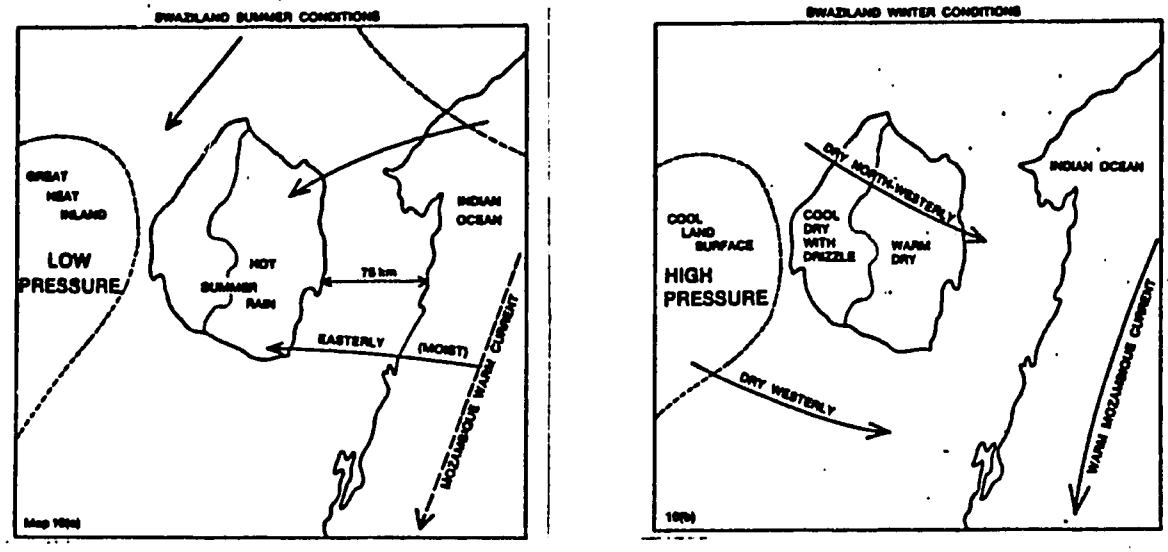


Figure 11. Summer and winter climatic conditions.

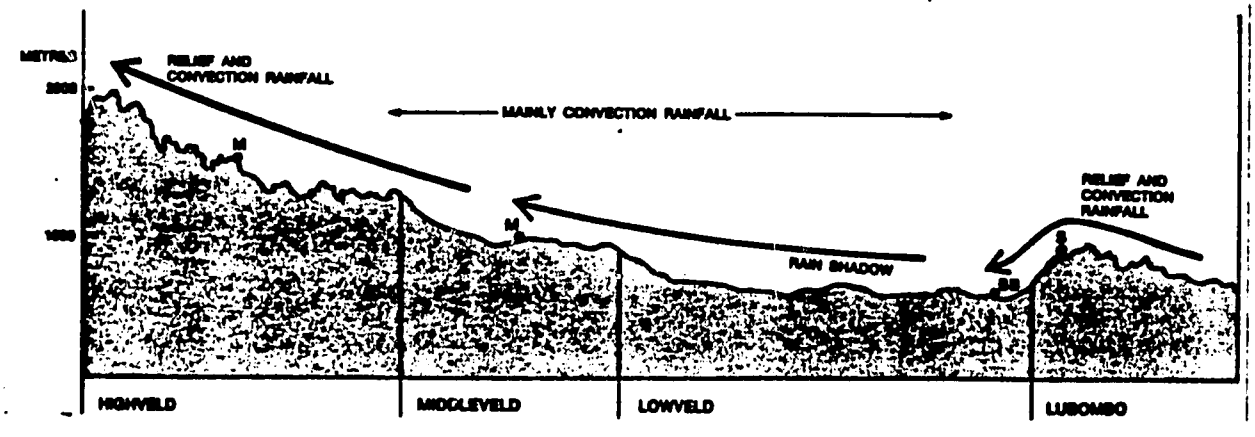


Figure 12. Rainfall pattern.
Source: Bowen, 1975 (5).

The warm, dry air passes over the Lowveld, which receives the least amount of precipitation of the four regions (and faces the greatest threat of drought). The cloud formation process is repeated as the warm air mass rises over the Middleveld and up the Highveld. The cloud formations again become colder and heavier until precipitation occurs. The air mass then descends on the lee side of the Highveld and is warmed and becomes very dry. The rains are seriously deficient, even in the Highveld, on an average of one year in ten.

Table 11. Temperature at Selected Stations (Degrees C)

	1975				Longterm Data			
Station	Absolute Max.	Mean Max.	Mean Min.	Absolute Min.	Absolute Max.	Mean Max.	Mean Min.	Absolute Min.
Highveld								
Havelock	32.4	22.0	11.2	-1.2	35.6	22.4	11.1	-1.2
Mbabane	32.5	21.9	10.5	-3.8	37.2	22.5	10.8	-8.4
Hlatsikulu	30.6	31.2	11.4	0.5	37.2	21.0	11.5	-2.8
Middleveld								
Matsapa	35.0	24.7	13.9	2.0	42.5	26.2	13.8	0.0
Nhlangano	33.4	22.9	11.7	-1.5	38.4	23.7	11.8	-5.4
Lowveld								
Big Bend	38.0	27.9	14.5	-1.9	42.4	28.9	14.9	-3.5
Lavumisa	41.5	29.0	13.6	1.1	44.5	29.6	15.2	-0.5
Lubombo								
Siteki	35.7	24.1	13.8	4.5	41.4	25.0	14.1	-2.4

Source: Annual Statistical Bulletin, 1976 (7).

Table 12. Rainfall at Selected Stations

	Longterm Mean		1975	Maximum		Minimum	
Station	Years	mm	mm	Year	mm	Year	mm
Highveld							
Havelock	39	1,697	1,808	1955	2,706	1970	1,034
Mbabane	68	1,396	1,887	1939	2,080	1912	899
Hlatsikulu	68	1,138	1,228	1939	1,703	1935	671
Middleveld							
Matsapa	72	900	838	1909	1,602	1945	468
Kubuta	57	791	1,192	1918	1,380	1930	318
Nhlangano	40	862	929	1960	1,273	1935	550
Lowveld							
Homestead	60	682	943	1918	1,173	1935	325
Big Bend	46	563	984	1973	907	1945	308
Lavumisa	41	566	300	1942	853	1935	201
Lubombo							
Siteki	72	864	994	1918	1,515	1935	366

Source: Annual Statistical Bulletin, 1976 (7).

3.4 Water

The following types of natural and man-made bodies of water occur in Swaziland:

Natural Bodies	Man-Made Bodies
Rivers	Canals (main and distributary)
Springs	Reservoirs and/or dams
Lakes	Gravel pits
Natural drains	Fish ponds
	Constructed drains
	Oxidation ponds
	Field channels
	Wells

3.4.1 Surface water

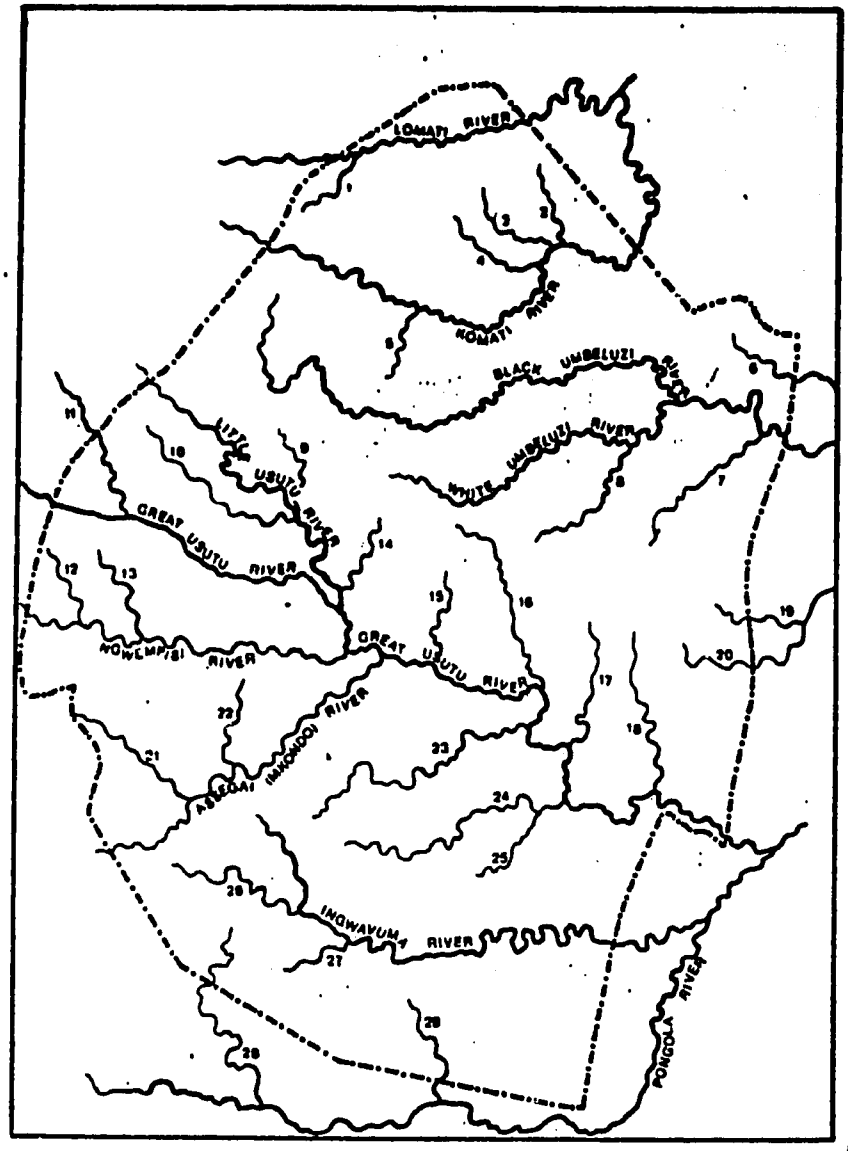
Swaziland forms part of the eastern watershed region of southern Africa between the Drakensberg range and the eastern coastline. Swaziland is well endowed with surface rivers, which provide the main source of water for people outside the main towns. The river system originates in the highlands of the Drakensberg range and flows across the country in an easterly or northeasterly direction, draining in the Indian Ocean (see Fig. 13). Most of the rivers have a seasonal flow. In the dry season (winter) the volume of water is greatly reduced and some of the minor tributaries dry up altogether. However, most of the larger rivers are perennial since some precipitation is received throughout the year. It should be noted that dams are being built west of Swaziland's borders, and the Republic of South Africa will thus be in a position to control a significant proportion of the flow of water to Swaziland's rivers. No agreement exists as yet guaranteeing this water supply.

3.4.2 Groundwater

The regional water table is deep-seated throughout most of Swaziland because of aridity in the Lowveld and the high amplitude of relative relief in the rest of the country. Even in a favorable location such as the Malkerns basin, wells normally strike groundwater at 30 to 60 m. The complex geology and compartmentation by dykes, faults, and veins restrict the sources of groundwater (and make any assessment of groundwater resources difficult). Perched watertables occur frequently at various depths and are recharged from percolation after prolonged rains. However, they are subject to great fluctuations depending on the nature of the aquifer, its location, and attitude. 1/ Swaziland has no known acquifers capable of sustaining large irrigation or industrial uses. 2/ In 1974, the Geological Survey Division initiated a program for the assessment and development of groundwater resources, with emphasis on rural water supply in the Lowveld. The British Government provided the Division with a hydrogeologist to assist in the program.

Eight thermal springs have been identified in Swaziland. These springs have temperatures ranging from 33-53 degrees C and yields ranging from 72-455 cu. m

1/ Roder, 1977 (29).
2/ Trelease, 1977 (34).



Main Rivers and Tributaries

Lomati River
1 Popenyane

Komati River
2 Mhlangatane
3 Mpofu
4 Mzimnene
5 Mkomazane

White Umbeluzi River
9 Maulatane

Black Umbeluzi River
6 Nkalashane
7 Mawula
19 Mnyame
20 Palala

Little Usutu River
9 Umtilane
10 Mhlambanyatsi
14 Mzimnene

Great Usutu River
11 Umpikusi
15 Mhlamanti
16 Mzimpofu
17 Mlindekwa
18 Nyetane
23 Mhlatuzane
24 Mhlatuze
25 Nhloya

Ngwempisi River
12 Mponono
13 Ngwempisane

Assegai (Mkondo) River
21 Ndlozane
22 Mozane

Ingwavuma River
26 Ngongweni
27 Mantambe

Pongola River
28 Nyamane
29 Sitilo

Figure 13. The river system.
Source: Bowen, 1975 (5).

per 24 hours. All the springs are associated with granitic rocks of Precambrian age, and are often adjacent to fault or joint systems. Na, Cl, sulfate, carbonate, bicarbonate, silicic acids, nitrogen, oxygen, helium, and some argon are present in considerable amounts in the waters of these springs. 1/

3.4.3 Water resources development

Several large-scale irrigation systems have been developed in Swaziland since the 1950's (see Fig. 14). Irrigated agriculture is important given the number of perennial rivers flowing through Swaziland. An estimated 25,000 ha are now under irrigation, mostly concentrated in the Lowveld. Most irrigation is in large estates, with over 60% of freehold title cropland under irrigation. The irrigation potential for cropland on freehold title land has been largely developed. It has been estimated that irrigation from surface sources could be expanded by only about 50%, while sub-surface water potential is limited. 2/ However, on Swazi Nation land the irrigation potential has remained largely untapped. There is potential for small irrigation schemes of under 50 ha throughout the country. 3/ Under the Rural Development Area Program, there will be ex-

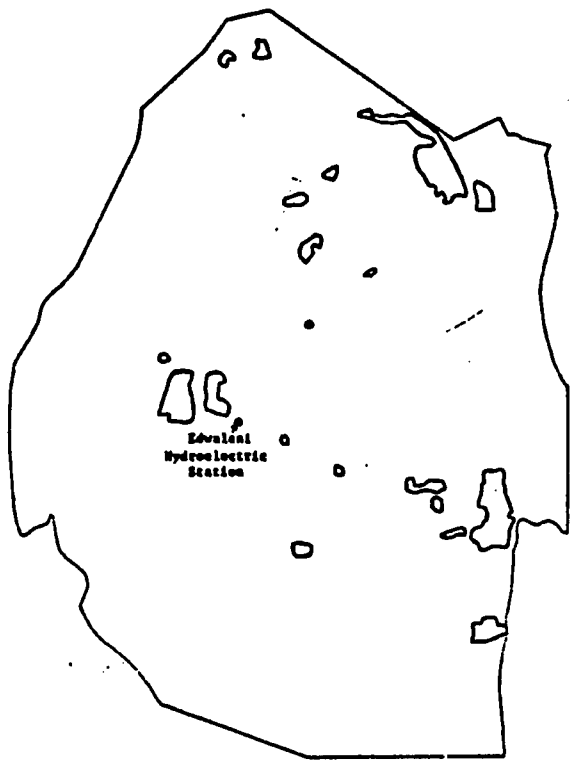


Figure 14. Major irrigation schemes.
Source: World Bank, 1977 (38).

1/ Hunter, 1969 (18).
2/ Stallings et al, 1979 (31g).
3/ World Bank, 1977 (38).

tensive water resources development. These water resource schemes include the development of canals and various types of irrigation systems, dams, domestic water supply systems, cattle watering systems, oxidation ponds, drainage systems, and fish ponds. Swaziland's only hydroelectric power station was completed in 1964 at Edwaleni. The station utilizes water from both the Great and Little Usutu rivers (see Fig. 14).

3.5 Minerals

Swaziland is well endowed with mineral resources and the mining industry makes a significant contribution to the country's economy, contributing about 13% of GDP in 1976. The exploitation of mineral resources has been undertaken primarily by foreign concessions (see Figures 15 and 16). Mineral production is concentrated in iron ore, asbestos, and coal, while smaller amounts of granite, kaolin, and tin on a small-holder basis are mined (see Table 13). The small production of barites was discontinued in 1978, though future production on a larger scale is planned. 1/

Asbestos has been mined at Havelock since 1939. The mine is one of the world's most important sources of long-fibre chrysotile asbestos. The mining of high

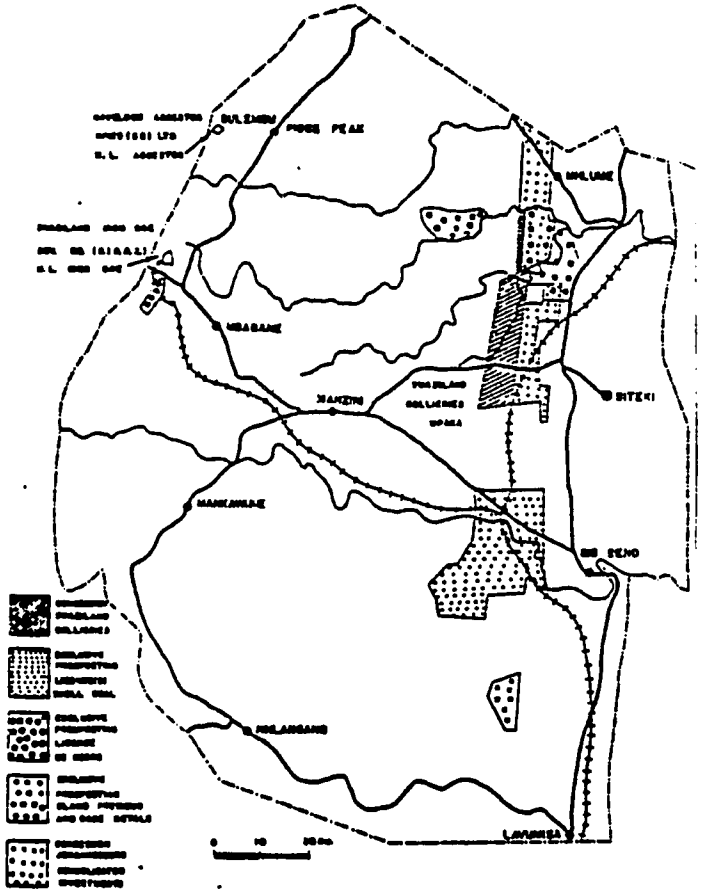


Figure 15. Mining and prospecting rights as of December, 1977.

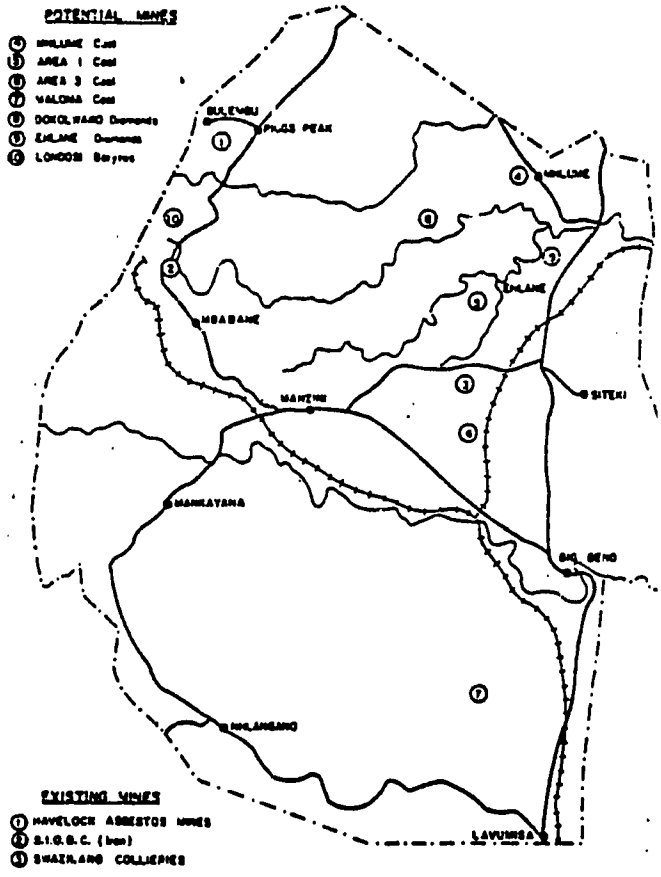


Figure 16. Existing and potential mines as of December, 1977.

1/ SADAP - Robert Dean Consultants, 1979 (31d).

Table 13. Mineral Production, 1971-75 ('000 metric tons)

Minerals	1971	1972	1973	1974	1975
Chrysotile asbestos	38.1	33.5	36.9	37.8	37.6
Iron ore	2,264.3	1,983.7	2,147.0	2,076.5	2,239.8
Coal	150.5	143.0	140.4	116.5	126.9
Barites	0,0	0.0	0.1	0.3	0.2
Kaolin	2.1	2.2	1.6	2.2	2.7
Quarried stone 1/	23.3	45.3	46.2	41.0	40.7

1/ '000 cubic meters.
Source: Central Statistical Office, 1976 (7).

and medium-grade iron ore at the Ngwenya mine has been completed. The remaining low-grade deposits (34% Fe) are estimated at 576 million tons. Coal is mined at Mapaka at a rate (in 1978) of 150,000 tons per year. Extensive exploration of other coal deposits in the eastern Lowveld have indicated mineable reserves of 224 million tons. The Geological Survey Department, with technical assistance from Britain, Canada, the UNDP, and Germany, is carrying out various surveys to complete the mapping program, stream-sediment reconnaissance, regional gravity surveys, and groundwater surveys (particularly in the Lowveld for agricultural needs). It is believed that the mountainous northwest corner of the country has potential for deposits of nickel, copper, chrome, asbestos, and molybdenum. 1/

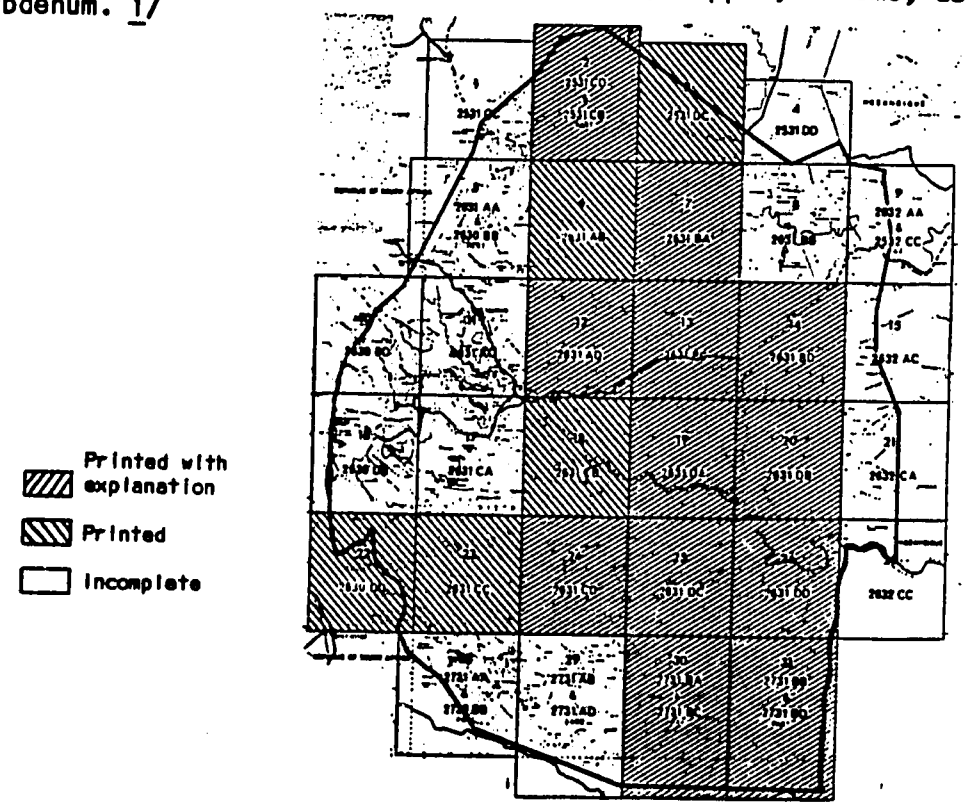


Figure 17. Geological survey of Swaziland.

1/ SADAP - Robert Dean Consultants, 1979 (31d).

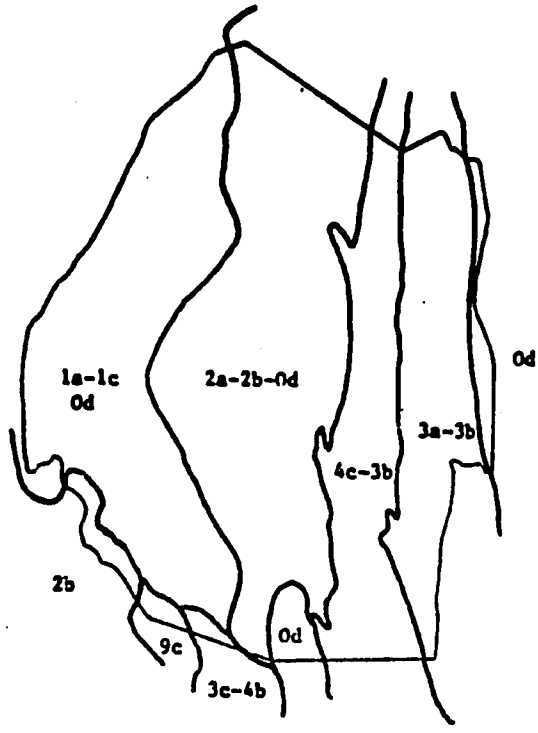
3.6 Soils

The soils of Swaziland are complex, as the distribution of the major soil types is closely related to relief and local geological structure. Except for areas of alluvial soils, the soils have developed in place from underlying parent rock, and thus reflect the weathering and chemical characteristics of the rock base. In the Highveld, upper Middleveld and Lubombo the main soil types are deep, acid and freely drained red and yellow ferrisolic and ferrallitic soils. Many soils are underlain by quartz stonelines. Although their natural fertility is low because there is little or no reserve of weatherable minerals due to leaching (except in the Lubombo), with adequate fertilizer and lime applications these soils yield well. Drainage, infiltration rates, and available moisture-holding capacity are excellent for dryland or irrigated cropping, except in areas with s'eep slopes. On the steep slopes of the Lubombo the soils are often thin. Soils of the lower Middleveld are characteristicly grey or red light textured soils derived from granite or gneiss. The rooting depth is between 40-70 cm, although on the flatter slopes it increases to 100 cm or more. Shallowness and light texture restrict available moisture-holding capacities for rainfed cropping. Fertility is generally low and erodibility high. The western Lowveld is underlain by sandstones and shales which give rise to heavy textured clay-pan soils, often covered with light textured material. Poor subsoil drainage and high exchangeable sodium restrict their use for irrigated cropping, while low available moisture-holding capacities in the light textured topsoils tend to reduce rainfed crop yields. The eastern Lowveld is underlain by basalt which gives rise to an association of red, brown and black clays. Shallow variants (20-40 cms) of these clays cover about 45% of the area. The fertility of these soils is excellent, although they are deficient in phosphorous. Poor drainage is a problem with the black clays, and sodicity and salinity occurs in some low-lying soils. However, for rainfed cropping (of cotton) these soils yield well, provided rainfall is sufficient.

Figure 18 provides a general schematic presentation of the major soil types in Swaziland. The map groups the major soils of the region into categories which not only have relevance to the distribution of the natural vegetation, but which also reflect the genetic factors of soil formation. The first of the set of symbols refers to the dominant soils in a particular mapping unit, and the remainder refer to other constituents in order of incidence. 1/

Information on the soils of Swaziland is based on a reconnaissance soil survey of the country conducted by G. Murdoch in 1968 (which was unavailable to the author). The survey is regarded as an excellent general tool but, according to operational and research scientists, there are severe limitations to using the existing survey for detailed planning. There is a need for more detailed soil surveys on arable lands and/or other areas where intensive use is planned. In addition, there is also a need for more extensive basic laboratory data to support sound soil survey interpretations. Very little reliable data exists on the physical, chemical, and mineralogical properties of the country's soils. There is presently some limited laboratory data available through the Malkerns Research Station, but it is reportedly difficult to relate to different soil types. 2/

1/ Werger, 1978 (37).
2/ Stallings et al, 1979 (31g).



Ferrallitic soils

1a Ferrallitic sands and loams, mainly red
1c Ferrallitic sands and loams, mainly yellow

Fersialitic soils

2a Fersialitic sands and loams, mainly red
2b Fersialitic clays, mainly red

Black and red Montmorrillonitic clays

3a Montmorrillonitic clays, mainly black
3b Montmorrillonitic clays, mainly red
3c Red and black montmorrillonitic clays

Solonetzic and planosolic soils

4b Solonetzic and planosolic soils with sandy loam A-horizons
4c Solonetzic and planosolic soils with clayey A-horizons

Weakly developed shallow soils of arid regions

9c Lime rare, may be common in bottomland sites

Lithosols

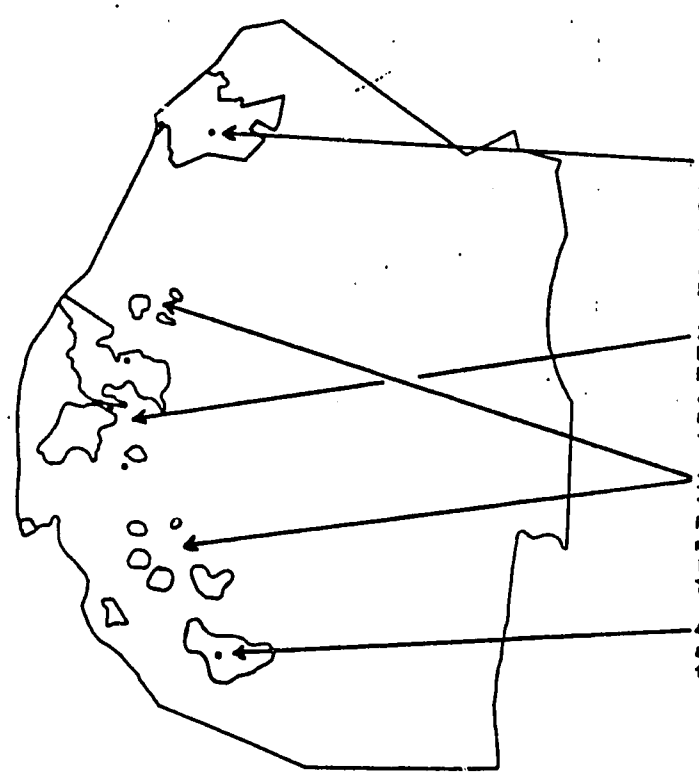
0d Acid igneous rocks

Figure 18. Schematic soil map of Swaziland.

3.7 Forests

Even where not directly affected by agriculture or plantation forestry, the flora of Swaziland has been greatly modified by man in all four ecological regions. The primary cause of change has been fire, which has eliminated most of the indigenous forest of the Highveld and has probably changed the natural pattern of grasses and herbs almost everywhere. Large areas of indigenous forest have been cleared in Swaziland in efforts to increase the amount of agricultural land. The forests of Swaziland are composed primarily of large plantations of exotic species in the Highveld and indigenous species that grow in the Lowveld and Lubombo. A number of the exotic species of trees and shrubs have gone wild and threaten to suppress indigenous vegetation. The most serious of these is the wattle tree, which has established itself in the Highveld to such an extent that it is almost impossible to find a landscape in which it does not occur. The spread of wattle is encouraged by grass fires. 1/

Afforestation was started on a large scale in 1942 in the Highveld for commercial purposes, and now constitutes the bulk of forested area in the region (see Fig. 19). Commercial forestry was concentrated in the Highveld due to the favorable ecological conditions; especially the rapid rate of growth of the conifers in the warm, temperate climate of the region. Species that would take 45



1. Coniferous forests - Peak Timbers Ltd (1947) and Swaziland Plantations Ltd (1942). Wood products include boxes, shooks (parts for fruit packing cases), and chipboard. Exports are sent by road to Hectorspruit where they are then transferred to the railway and on to the South African mills or to Lourenco Marques.

2. Coniferous forests - Started by the Commonwealth Development Corporation in 1948, leased to the Usutu Pulp Co. in 1959 for 60 years. Pulp mill is located at Bhunya where water is available from the Usutu river. Exports of pulp go by road to Matsapha and then by rail to Lourenco Marques.

3. Wattle plantations - The largest areas are near the southwest border. The bark is processed at Piet Retief and wattle timber is sent to the Lothair sawmills. Tannin is extracted from wattle bark and used in the leather industry. Pit props are also produced. The trees are cut after about 9 years.

4. Eucalyptus plantations - Plantations are expanding around Nhlangano. Logs are used primarily for mining timbers. There are also large stands at Usutu.

Figure 19. Map of commercial forestry.

1/ Grimwood, 1973 (14).
2/ The remainder of this section is based on Krohn, 1977 (20).

years to mature in Europe can be harvested here in just 15 years. The commercial forestry sector, like other sectors of the Swazi economy, is sharply dualistic. 2/ Large areas of expatriate owned and intensively managed plantations of exotic species exist alongside unmanaged forests owned individually by Swazis. The plantations are composed of commercial species (pines, eucalypti, and black wattle) that are native to the southern United States, Mexico, and Australia. The commercial forests comprised almost 6% of total land area in 1976 (over 100,000 ha), and the man-made pine forests are the largest in all of Africa. Forestry provides Swaziland's second most important group of export products, especially wood pulp.

Figure 20 gives a breakdown of the various species of the afforested areas of the Highveld. The pines - loblolly (Pinus taeda), slash (P. elliottii), and patula (P. patula) - support the country's one large pulpmill and two sawmills. These mills produce 100,000 short tons of pulp and 1.5 million cubic feet of lumber per year. Saligna gum (Eucalyptus saligna) is converted into mining timbers and poles. Black wattle (Acacia mearnsii) is grown for its bark and as a source of mining timbers.

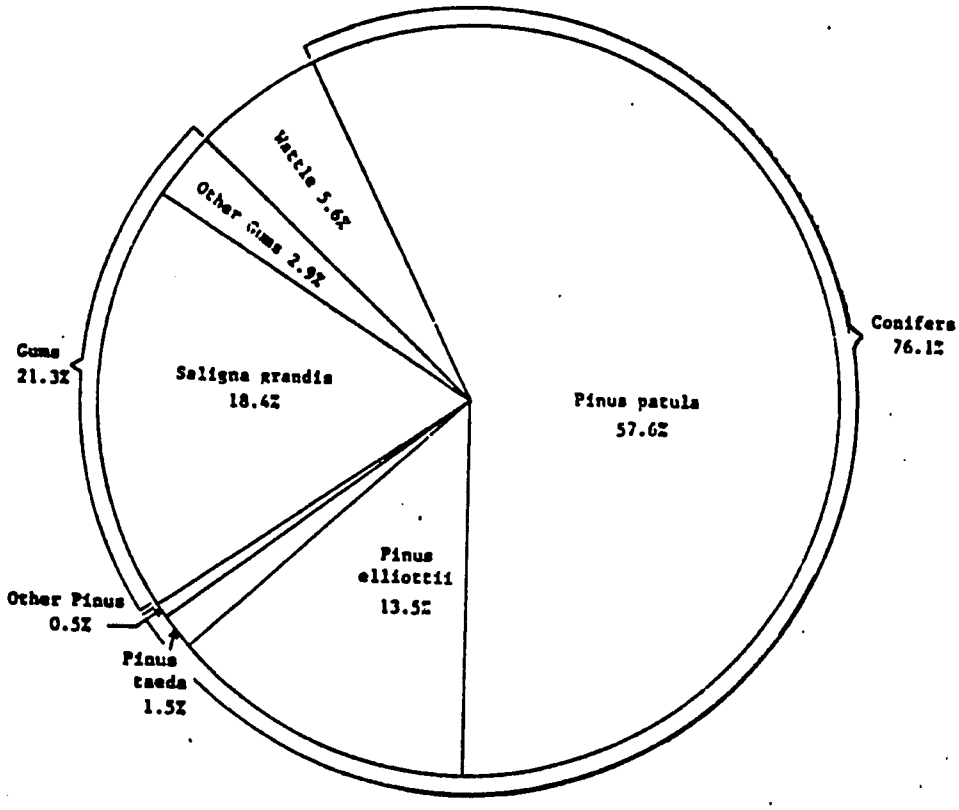


Figure 20. Afforested area by species, 1975.
Source: Central Statistical Office, 1976 (7).

Though the commercial forests are intensively managed, most of the work from nursery to harvest is done by manual labor. Nursery seedlings are grown under two methods. Under the Swazi bed method, seeds are sown in beds and seedlings pruned to create short-branched roots that can hold a ball of soil. Under the other method, seeds are sown directly into soil-filled black plastic sleeves 2 inches in diameter and 4 inches long. The sleeves are removed immediately

before the trees are planted. In both methods soil is carried with the seedling to protect it from desiccation when planted.

Hand tools are used to prepare sites for planting. Seedlings are set at a spacing of 9 feet by 9 feet. A survival rate of 90% is considered acceptable. Pulpwood is rotated on a 15-20 year cycle and timber on a 25-30 year cycle with at least one thinning. It takes 7 years to grow gum poles and mining timbers, and 8-12 years to grow wattle bark mining timbers. Saligna gum may yield 3,000 cubic feet per acre at harvest, while black wattle may produce 12 long tons of fresh bark and 2,400 cubic feet of timber per acre. Harvesting is usually done by clear cutting areas of up to several thousand hectares. For pulpwood and saw timber, rubber-tired skidders move tree-length logs to collection points; this method is often used on steep slopes where high-lead skidding would be more appropriate. Mules are sometimes used on the steepest slopes. Gum and wattle timbers are loaded directly onto trucks in the field. Hand-stacked rows of slash, which often run up and down the slopes, are left to decay.

In the Swazi sector, commercial forestry consists of growing and harvesting black ("jungle") wattle. The Swazi do not have the training to employ the forestry management practices used on the plantations. The average Swazi havests, by himself or with a few laborers, about 10-15 tons of green bark per year. The wattle stands have poor bark and timber yields because exploitation has been heavy and management lacking.

In contrast to the plantations of fast-growing exotic species of the Highveld, slow-growing, noncommercial indigenous scrub forests cover the Lowveld and Lubombo Plateau. These species are mostly thorny acacias with little value except as firewood. However, a few valuable species do grow to commercial size. These include tamboti (Spirostachys africana), stinkwood (Ocotea bullata), and kiaat (Pterocarpus angolensis). The Swazi use these species primarily for firewood and building poles, though in certain areas large quantities of kiaat are used for handicrafts. Europeans use those trees which can be made into furniture lumber. In addition, both Swazi and Europeans exploit the cycads (Encephalartos spp.), which are smuggled out of the country as rare garden and lawn ornaments.

3.8 Wildlife

Though once abundant, the wildlife population in Swaziland has been greatly reduced and is now very scarce outside of the two existing game reserves. There is a dearth of written records, but a few authenticated accounts exist dating from the late 1800's of vast herds of wild animals over the whole of Swaziland. Transport riders reported "that more than occasionally, wagon trains were caught up in the wake of migrations which left the veld as locusts would, without grazing..." 1/ The great herds of wildlife were wiped out during the first half of this century largely through hunting by foreigners. Today, pressure is being exerted on wildlife through loss of habitat due to agricultural expansion. Of the ungulates, all that is left outside of the reserves are greatly reduced numbers of the grey duiker and a few isolated groups or individuals of impala, blue wildebeest, greater kudu, vaal rhebok, steenbuck, red duiker, oribi, reedbuck, waterbuck, and klipspringer. Of the predators, nothing larger than several cats and jackals remains. Small numbers of vervet monkeys persist in widely separated areas, as do even smaller numbers of chacma baboons. Crocodiles have either been exterminated or are on the point of extermination in all the rivers, and the sole surviving group of hippopotamus is believed to number less than a dozen individuals. 2/ Birdlife, however, is abundant and includes a few rare species with northern affinities, such as the European stork, the sacred ibis and hadedah. Other more conspicuous species are the hammerhead, the gray heron, the lisakabuli (widow bird), the hornbill, and the lilac-breasted roller. Waterfowl occur in significant numbers around waterbodies in the Lowveld, including Knob-billed duck, Spurwing and Egyptian geese, Yellowbill duck, Redbill teal, White-faced duck, South African Pochard and, in much smaller numbers, Black duck, Cape teal, Fulvous tree duck, and White-backed duck. These species are also common in the Highveld with the exception of Knob-billed duck, which are rare at higher altitudes. Waders, both migratory and resident, are also common on these wetlands, and at times occur in spectacular numbers. 3/

The following species have been placed on the U.S. Fish and Wildlife Service's list of endangered and threatened wildlife: 4/

Common name	Scientific name	Status
Mammals:		
Anteater, scaly	Manis temminckl	Endangered
Antelope, Bontebok	Damaliscus dorcas dorcas	Endangered
Cat, black-footed	Felis nigripes	Endangered
Cheetah	Acinonyx jubatus	Endangered
Elephant, African	Loxodonta africana	Threatened
Hyena, brown	Hyaena brunnea	Endangered
Lechwe	Kobus leche	Endangered
Leopard	Panthera pardus	Endangered
Zebra, mountain	Equus zebra zebra	Endangered

1/ Reilly, 1979 (27).
2/ Grimwood, 1973 (14).
3/ Riley, 1979 (28).
4/ U.S. Fish and Wildlife Service. "List of Endangered and Threatened Wildlife and Fish." Federal Register, vol. 44, no. 12 (January 17, 1979).

Reptiles:

Crocodile, Nile	Crocodylus niloticus	Endangered
Turtle, geometric	Geochelone geometrica	Endangered

A survey on the conservation status of the larger mammals of southern Africa based on the opinions of senior conservationists identified the following additional species as endangered, threatened or rare in Swaziland: 1/

Common name	Scientific Name	Status
Rhinoceros, black	Diceros bicornis	Extinct
Rhinoceros, white	Ceratotherium simum	Rare
Antelope, roan	Hippotragus equinus	Extinct
Antelope, sable	Hippotragus niger niger	Threatened
Wild dog	Lycaon pictus	Extinct/Rare
Oribi	Ourebia ourebi	Threatened
Hippopotamus	Hippopotamus amphibius	Threatened
Waterbuck	Kobus ellipsiprymnus	Rare
Lion	Panthera leo	Extinct
Serval	Felis serval	Rare
Reedbuck	Redunca arundinum	Rare
Reedbuck, mountain	Redunca fulvorufula	Threatened
Eland	Taurotragus oryx	Threatened
Buffalo, cape	Syncerus caffer	Extinct
Klipspringer	Oreotragus oreotragus	Threatened
Civet	Viverra civetta	Rare
Aardvark	Orycteropus afer	Threatened
Pangolin, cape	Manis temminckl	Threatened
Bushbuck	Tragelaphus scriptus	Rare
Steenbok	Raphicerus campestris	Rare
Hyena, spotted	Crocuta crocuta	Threatened
Hedgehog	Erinaceus frontalis	Threatened
Tsessebe	Damaliscus lunatus lunatus	Extinct
Aardwolf	Proteles cristatus	Threatened
Giraffe	Giraffa camelopardalis	Threatened
Hartebeest, Lichtenstein's	Alcelaphus lichtensteini	Extinct
Hartebeest, red	Alcelaphus buselaphus	Extinct
Suni	Neotragus moschatus	Extinct
Nyala	Tragelaphus angasi	Rare
Duiker, blue	Cephalophus monticola	Extinct/Threatened
Duiker, red forest	Cephalophus natalensis	Rare
Wildebeest, black	Connochaetes gnou	Extinct
Vaalribbok	Pelea capreolus	Threatened

1/ Bothma, 1975 (4). The categories "extinct," "threatened," and "rare" are based on those in the IUCN Red Data Book and are defined as follows:
Extinct - Taxa occurring in the area in recent times but no longer found there.
Threatened - Corresponds with the terms "endangered" and "vulnerable" as used in the Red Data Book.
Rare - Taxa with small populations which are not at present threatened with extinction but which are at risk due to being localized within a restricted geographical area or habitat or thinly scattered over a more extensive range.

3.8.1 Protected Areas 1/

As a signatory to the African Convention for the Conservation and Management of Wildlife, Swaziland has pledged to create national parks and to take any other steps necessary to preserve representative areas of the country's most outstanding natural regions and their indigenous flora and fauna. To carry out this responsibility, the National Trust Commission Act was passed in 1972. The Act created the National Trust Commission, which is charged with the establishment and maintenance of a system of national parks, together with the creation of a Swaziland National Center and the care of national monuments, relics and antiques.

The Commission faces several difficulties in establishing such a system of protected areas. To begin with, there is no longer any state-owned land available for the creation of reserves and, under the National Trust Commission Act, Swazi Nation Land cannot be included within a national park without the express consent of the King. Normally, the only land available to be set aside for conservation purposes is freehold title land, which will have to be purchased. Another problem is the extent to which the flora and general landscape in all four regions of the country has been modified by man, making it difficult to find areas in a pristine state. Even more severe is the extent to which the wildlife has been depleted. Thus, the establishment of a national park will in most cases require the purchase of land and extensive measures to return the area to its original state.

In providing for the establishment of national parks on privately-owned land, the Act allowed that part or all of a park would remain under private ownership until the Commission had sufficient funds to purchase the land. In such cases, the owner of the land would retain the right to enclose or cultivate his land or graze domestic livestock on it. However, the establishment of a national park under these conditions would not comply with the definition of a national park in the African Convention. To remedy this situation, the Act was amended to reserve the title "national park" for protected areas in which all land has been acquired by the Government, and to create a second form of protected area called a "nature reserve" for those areas which still have privately owned and managed land within their boundaries.

Swaziland has a total of five protected areas - the Mlilwane and Hlane Wildlife Sanctuaries, and the Ndzindza, Malolotja, and Mbabane Nature Reserves established under the National Trust Commission Act (see Fig. 21). 2/

Mlilwane Wildlife Sanctuary

Location: 22 km south of Mbabane in the Ezulwini Valley - Highveld/Middleveld.

Area: 4,545 ha (11,230 acres).

Administration: The sanctuary was founded in 1960 on the private initiative of Mr. T. E. Reilly, who turned over his farm to the preservation of wildlife. The sanctuary was officially opened to the public in 1964, and in 1969 ownership

1/ This section is based on Grimwood, 1975 (14) and Riley, 1979 (28), which contains a more detailed description of existing and proposed protected areas.

and management were vested in a perpetual, non-profit making trust that answers directly to the King.

Description: The Mlilwane Wildlife Sanctuary covers both Highveld and Middleveld ecosystems, lying at an altitude of from 660 to 1,437 m (2,150-4,700 ft). The area is underlain primarily by medium to coarse grained granite, with some coarse grained quartz diorite and granodiorite and granodioritic gneiss. Soil types include rock outcrops and stoney ground (60%); deep red loams that are very acidic (20%); and other types.

The Sanctuary is divided by the Usushwana or Little Usutu river, but is best viewed as comprising three different sections - the southern sector, the northern sector, and the Usushwana Valley (see Fig. 22). The southern sector, which is the original core of the sanctuary, is a Middleveld ecosystem composed primarily of gently rolling land at an average altitude of 670 m (2,200 ft). It also includes the southern slopes of the impressive granite pinnacle of Nyonyane mountain and the narrow ridge which connects it to the other high ground further west and outside the sanctuary. The southern sector appears to mark the western limit of a pronounced annual movement of Middleveld wildlife, so that almost all species indigenous to that region of the country appeared there at least seasonally. All the level ground has been under cultivation at one time or another and the indigenous trees and shrubs have been largely eliminated and replaced in many areas by plantations of exotic species. The slopes of Nyonyane have been denuded of almost all vegetation by former title-less occupants of the land.

The southern sector has been the focus of development in the sanctuary. An extensive rehabilitation effort expected to last several decades has been underway to restore the area to its original condition. An earth dam has been constructed to crown one of the worst mine scarred valleys and to provide a waterfowl, crocodile and hippopotamus habitat; a series of "paddles" have been made to attract waters, and these lead into another large pool near the visitor's camp where several hundred duck and geese regularly congregate; a nursery garden for indigenous trees has been established and a number of areas planted with mixed saplings and fenced to prevent damage by wildlife; exotic trees and plantations are being progressively eliminated as indigenous vegetation grows to replace them; mining scars are being allowed to grass over and there are plans to terrace some of the vertical faces when the funds are available. There has also been a steady effort to reintroduce the indigenous wildlife of the area, while the populations of other species that had not completely disappeared have reestablished themselves under protection. As a result, of the larger mammals there are now established populations of zebra, white rhinoceros, hippopotamus, warthog, giraffe, eland, greater kudu, nyala, bushbuck, sable antelope, common waterbuck, southern reedbuck, blue wildebeest, impala, grey duiker, red duiker, oribi, klipspringer and steenbuck, all representative of the Middleveld fauna, as well as of mountain reedbuck, vaal rhebok, blesbok, black wildebeest and springbok, which are more typical of the Highveld. The Nile crocodile, which has probably vanished from the Usushwana river, has been introduced into the main dam and connected water system.

The northern sector consists of the 2,300 ha purchased by the Mlilwane Trust in 1970 and is a relatively undisturbed example of a Highveld ecosystem. It comprises the steep upper slopes and the plateau-like top of the range of hills that form the western wall of the Ezulwini valley, and extends from near to Mbabane southward to the rock pinnacles known as Sheba's Breasts, which form

the northern portal to the Usushwana valley. Most of this land lies at over 1,200 m (4,000 ft) and consists of short grassland, but there are numerous granite cliffs and outcrops with summits rising to 1,430 m (4,700 ft).

The vegetation is typical of the Highveld, but most of the forest patches which must have filled the hollows have been destroyed by fire, and overgrazing by trespassing cattle has caused considerable erosion, and vegetational changes in some parts. The wildlife of this part of the sanctuary has been seriously depleted, with few ungulates left except for some grey duiker and perhaps steenbuck. A single pair of klipspringer is also known to survive.

The valley of the Usushwana river, which separates the northern and southern sectors, should form the core of the sanctuary on ecological as well as geographical grounds as it contains a series of ecosystems unique to the area. Two private estates located on the northern bank of the valley cut the sanctuary almost in half and deprive it of the most important part of the valley bottom forest ecosystem. The upper half of the valley, above the spectacular Mantenga Falls, is narrow and the river runs in a series of rapids and pools between steep wooded banks with many cliffs. In its lower half, from the falls downstream to where the river flows into the Ezulwini Valley, the river becomes less turbulent and the valley floor widens out and is largely covered with indigenous forest, particularly on the northern bank.

The following veldtypes are represented:

Forest

montane	- wet, evergreen
ravine	- wet, tall, evergreen
riverine	- tall, moist, semi-deciduous
incorporating:	
thicket	- successional, forest fringe

Savanna

valley bushveld	- sour (incorporating stoneveld, boulderveld, rockface)
broadleaf	- remnant: Syzygium or Combretum dominated
bushclumps	- boulder-based
incorporating:	
thicket	- riverine (incorporating snadveld)

Grassveld

montane	- highveld, short, sour (incorporating stoneveld, boulderveld, summitveld, rockface)
mountain	- transitional, sour, short and tall (incorporating boulderveld, summitveld, rockface)
middleveld	- sour, tall and short (incorporating sandveld and stoneveld)
incorporating:	
vleiveld	
bushclumps	- boulder-based
thicket	- termiteria-based and riverine (incorporating sandveld)

Hlane Wildlife Sanctuary

Location: Hlane is located in the Lowveld between Mpaka to the southwest and Mlawula to the northeast.

Area: 14,219 ha (35,135 acres).

Administration: The Hlane Wildlife Sanctuary is part of a former private estate that was purchased with Lifa Fund money in the mid 1940's to become Swazi Nation land. The King set aside part of the purchased land as a wildlife area. In 1968, due to a sharp decline in game stocks, the King asked Mr. Reilly of the Mkhiwane Wildlife Sanctuary to take over administration of the area, which he has done with the support of the Mkhiwane Trust. In 1968 that part of the wildlife area lying to the west of the highway that cuts through it was declared a Game Sanctuary under the Game Act. The remaining part of the area to the east of the road was left out of the Game Sanctuary and declared to be a Royal Hunting Reserve for limited hunting under the personal authorization of the King.

Description: The Hlane Sanctuary is virgin lowveld that comprises rather flat land lying at an altitude of from 210 to 330 m (690 to 1,080 ft). The area is underlain primarily by basalt, with some sandstones. The soils are very diverse, with intermittent patches of 12 soil sets. It lacks water except where a short stretch of the nonperennial Mlawula stream crosses its eastern tip and to the north where it fronts the Mbuluzi and White Mbuluzi rivers. The vegetation is typical of the best areas of the Lowveld, consisting mainly of open mature woodland with some thickets on higher ground, particularly in the west. The most prominent features of Hlane are the expanses of open, scrub-free sweetveld savanna. Representative veldtypes include:

Forest

semi-deciduous - stunted, saline: Euclea dominated
deciduous - dry drainage: Spirostachys africana dominated

Savanna

thornveld - sweet, open: Acacia nigrescens dominated
dense: Dichrostachys sp., Acacia nilotica, A. senegal dominated
broadleaf - mixed (incorporating stoneveld, sandveld, rockface)
incorporating:
thicket - riverine: Phoenix reclinata, Lippia javanic, Nuxia dominated
- successional, encroachment: Dichrostachys sp. dominated

Old records indicate that this part of the Lowveld used to be inhabited by almost all of the large animals that occur today in the Kruger National Park, whose southern tip lies just 75 miles to the north; including elephant, black rhinoceros, giraffe, wild dog, lion, leopard, cheetah, eland, roan antelope, tsessebe, and buffalo. All these species are now extinct, and all that was left when the Mkhiwane Trust took over the area in 1962 were no more than 200 zebra and blue wildebeest, perhaps 600 impala, and very small numbers of grey duiker, greater kudu, bushbuck, steenbok, and probably Sharpe's grysbok. Under proper management poaching has been reduced to acceptable limits. The pop-

ulations of zebra, wildebeest and impala have recovered very well and now number about 500, 4,000 and 6,000 respectively. Greater kudu have also recovered well, but the process has been much slower with the smaller antelopes. A number of white rhinoceros, nyala, and ostrich have been reintroduced and are doing well.

Ndzindza Nature Reserve

Location: East of Mlawula on the border with Mozambique, formerly the Blue Jay Ranch - Lubombo.

Area: 5,503 ha (13,600 acres).

Administration: The area has been donated to the National Trust Commission, but has not yet been officially transferred.

Description: Ndzindza is an excellent representative sample of the Lubombo range with its unique flora and other prominent features. The area lies at an altitude of between 120 to 565 m (390 to 1,850 ft), and is underlain by rhyolitic ignimbrites. The soil consists primarily of raw mineral soils on rock outcrops and stoney ground (50%) and lithosols (35%). The vegetation of this region is of special scientific interest and the mixed woodlands which cover most of these ranches are comprised of a much wider range of trees than is found in the Lowveld. The pasture is of poor quality and sourveld is prevalent on higher ground. There is no land under cultivation and the natural vegetation probably still contains a full range of the botanical associations for which this region is famous. Large groves of ironwood or Bukumku (Androstachys johnsonii) fill the gullies falling to the Mbuluzi gorge and the cycads Encephalartos umbuluzensis, which is unique to this small area, grows abundantly in their shade, making that an area of particular botanical interest. In addition, E. lebomboensis, E. villosus, Aloe keithii, and Euphorbia keithii are represented. The veldtypes of the area include:

Forest

ravine	- semi-deciduous, tall, moist
riverine	- evergreen: Breonadia microcephala dominated
mountain	- tall dry and stunted dry: Androstachys johnsonii dominated (incorporating bouldervеld and rockface)
lowveld dry drainage incorporating:	- Spirostachys africana dominated
thicket	- successional and climax

Savanna

varied Lubombo	- sour to mixed (incorporating extensive stoneveld, bouldervеld, rockface, summitveld)
bushclump	- termitaria-based, well represented on summitveld
broadleaf	- dry, sour: Combretum dominated (incorporating extensive stoneveld and some rockface
thornveld incorporating:	- sour, sweet, and mixed
thicket	- successional, mountain climax, riverine

The wildlife of this part of the Lubombo range has been seriously depleted and many species have disappeared altogether. The area supports essential habitat for locally endangered species, including: Nsamango monkey, Sharpe's grysbok, spotted hyena, leopard, klipspringer, oribi, fishing owl, crowned eagle; regionally endangered species of crested guineafowl and fish eagle; and the only recorded locality in Swaziland of the very rare snake Amblyodipsas concolor. In addition, the area contains sites of historical and archaeological significance.

Malolotja Nature Reserve

Location: The reserve encompasses the Malolotsha drainage system in the Highveld, between Havelock to the north and Oshoek to the south.

Area: 18,065 ha (44,640 acres).

Administration: National Trust Commission.

Description: The Malolotja stream rises near Forbe's Reef mine at an altitude of about 1,220 m (4,000 ft), and flows north for some 8 mi to join the Komati river at a point about 3 mi below where it enters Swaziland. For its first 2-3 mi the Malolotsha is a very small stream with thickets of wattle lining its course and with considerable cultivation on its banks. It then enters a deep rock cleft where the exotic vegetation is replaced by isolated trees of a variety of indigenous species that cling to crevices in the rocks, along with small patches of montane forest in the gullies. A mile further down this cleft the stream widens and drops over the Malolotsha Falls, the highest waterfall in the country at several hundred feet. After continuing in a steepsided gorge for another mile, the stream enters a flat-bottomed box valley at a point where a left bank tributary also enters by a spectacular cascade. This box valley continues for about 2 1/2 mi, becoming slightly wider, after which the river again enters a deep gorge which extends for a further 1 1/2 mi to the Malolotsha's junction with the Komati river. At this point the Komati itself is enclosed by steep hills, rising several thousand feet on either side.

The entire Malolotsha drainage system consists of short grassland covering steep slopes that culminate, to the west, in the 1,680 m (5,512 ft) sugar loaf peak of Silotwane and, to the east, in a series of ridges dropping from 1,525 m (5,000 ft) in the south to 1,035 m (3,400 ft) in the north where they end above the Komati Gorge. The land to the north of the Komati river comprises a tangle of similar but even steeper hills. The rock is mainly quartzite throughout with some phyllites in the north. The soils are primarily raw mineral soils on rock outcrops and stoney ground. The reserve supports a representative sample of the Swaziland system (composed of ancient metamorphosed rocks) which contains the oldest known origin of life on earth (estimated at 3.5 billion years).

Flowering plants are abundant among the grasses, most notably those of the genera Aloe, Moraea, Aristea, Scilla, Watsonia, Gladiolus, and Dierama. Trees are almost entirely confined to the immediate valley of the Malolotsha, but there are patches of montane forest near the Malolotsha Falls and in gullies on the

on the eastern slopes of Silotwane. The area supports what Compton (1966) has described as Swaziland's most diverse viei community, in addition to other spectacular flora indigenous to the Highveld. The area includes the following veldtypes:

Forest

montane	- wet, tall, evergreen, ravine
mountain	- wet, tall, evergreen, ravine
riverine	- moist, tall, semi-deciduous
incorporating:	
thicket	- successional, forest fringe

Savanna

valley bushveld	- sour (incorporating stoneveld, boulderveld, rockface)
bushclumps	- boulder-based
thicket	- successional
broadleaf	- stunted sub-alpine Protea savanna
	- Protea and Syzygium savanna, remnant

Grassveld

montane and mountain	- short, sour (incorporating stoneveld, boulderveld, rockface, summitveld)
middleveld	- tall, sour
incorporating:	
vleiveld	- supporting Sphagnum moss and Drosera sp.
bushclumps	- boulderbased
thicket	- riverine

Most of the larger mammals have completely disappeared from this area, though chacma baboons and vervet monkeys occur in the gorge of the Malolotsha and local residents report mountain reedbuck, vaal rhebok, grey and red duiker, oribi, klipspringer, and steenbuck still exist in very small numbers. Leopard and hippopotamus occurred until recently, and crocodile may still exist in the Komati near the Transvaal border. The uniform nature of the land is not conducive to a very wide range of birds being present, but Bald Ibis are frequently seen near the Malolotsha Gorge and the cliffs may prove to be a breeding place of this uncommon species.

Mbabane Nature Reserve

Location: Immediately north of Mbabane in the Highveld.

Area: 321 ha (790 acres).

Administration: National Trust Commission.

Description: A description of the reserve was not available.

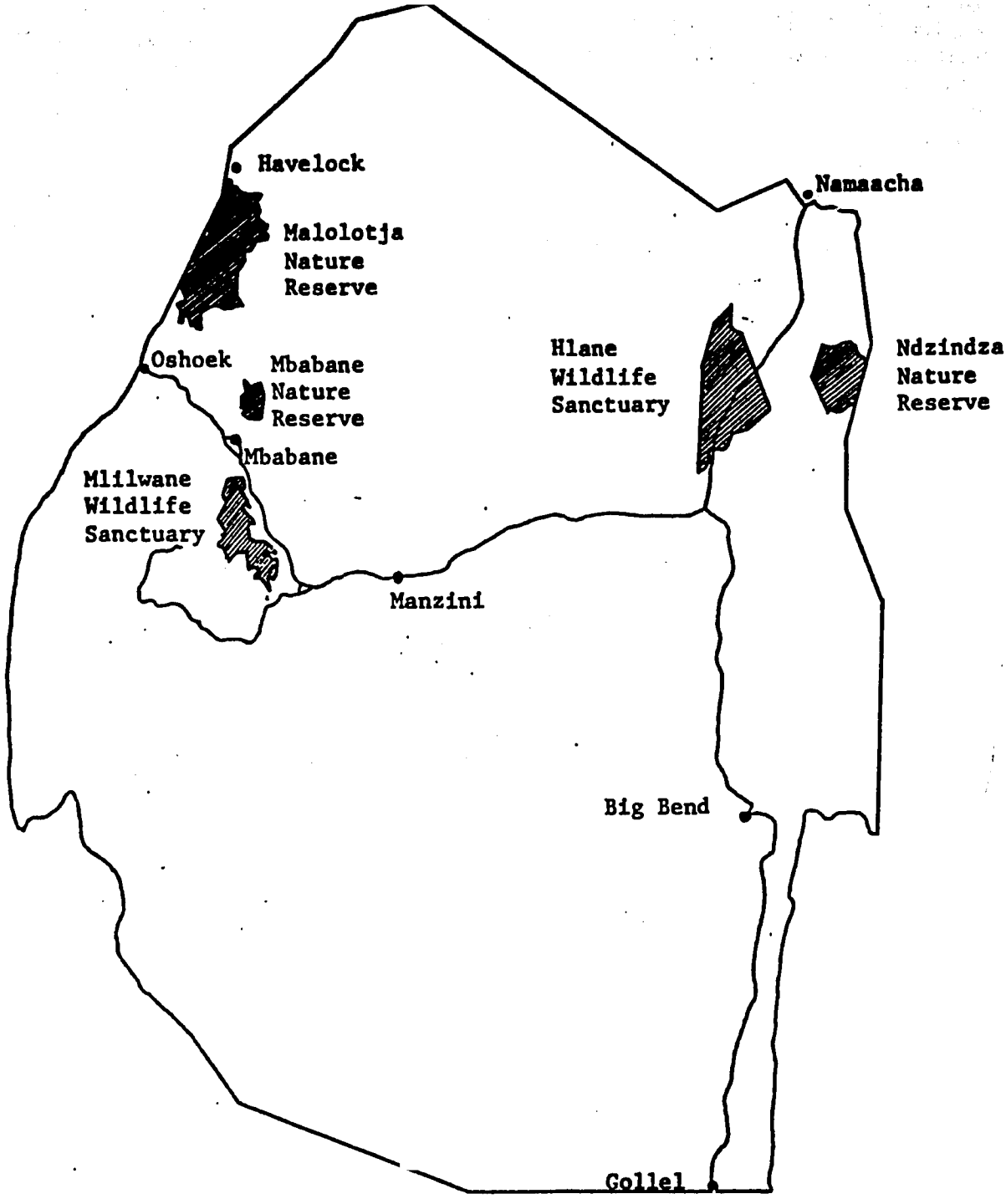


Figure 21. Existing and proposed protected areas.

3.9 Fisheries

The potential for fisheries development in Swaziland is just beginning to be explored. A fisheries progam is being developed with external assistance within the Ministry of Agriculture. This effort is aimed at exploring the potential for fisheries; especially through the promotion of fish ponds, the exploitation of fish in existing dams, and fishing in rivers. Swaziland has excellent potential for fish pond development and, as of 1977, about 200 fish ponds were located within Rural Development Areas. The fish ponds are mostly built by hand by women, who also usually operate them. Commercial fish farming operations are expanding with the opening of three new farms during 1975, and the expected opening of another three farms in 1977. A commercial fishery operation has been established on the Sand River Dam (below the Komati river in the Lowveld) which has been very successful. The species of fish usually used to stock the ponds are Tilapia mossambica, Tilapia melamoplema, and Cyprinus Tarpio. The potential for trout farming is reportedly being explored in the Highveld. 1/

1/ World Bank, 1977 (38) and Bruce and Unrau, 1977 (6).

4.0 ENVIRONMENTAL PROBLEMS

4.1 Soil erosion and degradation

The most significant environmental problem facing Swaziland today is the deterioration of arable and communal grazing land in the traditional sector. The problem stems from the increasing pressures being exerted on Swazi Nation land by a growing population and livestock herd. The problem is less severe on arable land, although there are some signs of erosion along badly aligned waterways and the nature of the soil presents conservation problems. Much of the arable land is characterized by slopes of 3-12 percent with relatively shallow soil. Under intense rainfall, these fragile soils are subject to severe sheet and gully erosion as the major crops grown on Swazi Nation land are clean tilled, which leaves the soils unprotected by plant foliage during much of the year. 1/ The erosion of arable lands has been largely checked by the introduction in the late 1950's of mandatory grass contour stripping between fields, contour ploughing, and the prohibition of cultivation within 100 feet of a stream or river bank.

The problem is most severe on Swazi communal grazing land, particularly in the southern regions of the country, as a result of overstocking. Overstocking has led to the denudation of pasture and widespread soil erosion, bush encroachment (particularly by thorny scrub in the Lowveld), drying up of springs, dam silitation, and low animal productivity. One official in the Land Use Planning Section of the Ministry of Agriculture estimates that the rate of erosion may be as high as 25-35 tons of soil loss per hectare per year. A maximum acceptable soil loss is usually recommended to be no greater than about three tons per hectare per year. The stocking density is now at an average of 1.9 hectares per livestock unit. The urgency of the soil degradation problem due to overstocking is shown in the following tables:

Table 14. Current and Optimum Stocking Rates

Region	Current Rate ha/animal unit	Optimum Rate ha/animal unit
Highveld	1.94	2.65
Middleveld	1.33	2.65
Lowveld	2.10	4.00 1/

1/ The figure for the Lowveld is higher because of the extent of bush encroachment and the small proportion of arable crops which could provide fodder during winter.

Source: World Bank, 1977 (38).

1/ U.S. AID/Swaziland, 1979 (35).

Table 15. Grazing Intensity and Life Expectancy of Soils

Estimate of Grazing Intensity ha/animal unit	Area Affected ha	Life Expectancy of Soils years
.50 - .75	16,790	5
.75 - 1.00	55,200	5 - 10
1.00 - 1.25	65,280	10 - 15
1.25 - 1.50	91,600	15 - 25
1.50 - 2.00	79,355	25 - 50
2.00 - 2.50	256,190	50 - 100
over 2.50	690,165	100

Source: Roder, 1977 (29).

The overstocking problem is largely the result of two factors associated with Swazi traditional culture. First, is the system of communal grazing land which eliminates individual responsibility for maintaining the land. Second, is the tendency to retain or increase cattle numbers even under adverse environmental conditions, a widespread and characteristic feature of many African societies. In traditional Swazi society, attitudes toward cattle holding are significantly influenced by the fact that cattle are regarded as a store of wealth (conferring security, prestige, and status on the owner), and are only sold to meet specific cash needs. The cash value of animals is important so far as current consumption needs are concerned; but numbers of animals are often more important than value so far as the security, prestige, and status aspects of wealth are concerned. Thus, there has been little interest in the past in maximising the offtake rate (slaughter rate in relation to herd size) for sale. This was verified in a study by the Monitoring and Evaluation Unit of the RDA program which found that offtake from the Swazi Nation herd is inversely related to price. That is, because Swazi sell cattle only to meet immediate cash needs, fewer cattle need to be sold as price increases to meet these needs. In addition, increased subsistence or cash crop production will reduce the need to sell cattle. Short-term increases in farm income as a result of the RDAP, unless complemented by an effective destocking program, could therefore accelerate the deterioration of the natural resource base. At present, the Ministry of Agriculture views livestock and crop development as two separate entities. There is a need for an integrated approach in which crop development is complemented by an effective grazing control strategy.

The grazing situation is considerably aggravated, particularly in the Highveld, by the deliberate lighting of grass fires. The most serious effects of fire are the damage done to grass systems and soils. Fire bares the soil of its protective cover, exposing it to isolation and raindrop action. This decreases the rate of infiltration of rain into the soil, while increasing runoff, erosion, soil capping, and the rate of desiccation (drying up of the soil).

4.2 Waterborne disease

The incidence of waterborne disease in Swaziland, particularly bilharzia, is the country's most serious environmental health problem. Due to the uncertainties and limitations of groundwater supply, the bulk of the population relies

on surface water where disease vectors thrive. Bilharzia and other waterborne diseases occur in all parts of the country where purified water or protected supplies are not available. Current estimates indicate that approximately 30% of the population is infected with bilharzia. It is thought that climatic conditions cause incidences to be lower in the Highveld than in the subtropical Lowveld. 1/ The upper reaches of the river basins in the Highveld are substantially free of bilharzia due to the low temperature of the water and its rapid flow. As the rivers pass through the Middleveld and Lowveld, conditions become ideal for the propagation of bilharzia and other waterborne diseases due to lower stream velocities, higher water temperatures, and greater population densities.

Present plans by the Government to expand irrigation, construct stock-watering reservoirs, and build fish ponds will likely increase the incidence of bilharzia, at least in the short term. Existing estimates indicate that infection rates in irrigated areas are significantly higher than in non-irrigated areas. The incidence of bilharzia is spreading with the development of irrigation in spite of the fact that 24,000 out of a total of more than 70,000 irrigated areas are under snail control through molluscicide activities. 2/ Other snail control methods such as fluctuating reservoir water levels and biological controls (fish, ducks, predator snails) have not been tried in Swaziland.

The Government has a limited program underway to control bilharzia and other water-related diseases. The major components of the program include (i) treatment of infected individuals, (ii) reducing the host snail population, (iii) the provision of clean water and sanitary facilities, and (iv) health education.

4.3 Protected areas

The establishment of protected areas is needed in order to conserve for present and future use the diversity and integrity of biotic communities of plants and animals within natural ecosystems, and to provide areas for ecological and environmental research, particularly baseline studies. The need for a protected area system in Swaziland is increasingly urgent due to the spreading activities of man and subsequent modification of the natural environment. Fortunately, the leadership in Swaziland is already taking steps in this direction through passage of the National Trust Commission Act (and establishment of the National Trust Commission) and a recently completed survey of recommended sites for designation as national parks and nature reserves. A total of 31 areas were identified in the survey (see Table 16 and Fig. 22), covering approximately 164,485 ha, divided as follows:

Designation	No. of sites	Area (ha)	%
National Parks	8	95,498	58%
Nature Reserves	5	21,979	13%
National Landscapes	13	39,554	24%
National Wetlands	5	7,454	5%
		164,485	100%

1/ U.S. AID/Swaziland, 1979 (35).
2/ Bruce and Unrau, 1977 (6).

This amounts to 9.47% of total land area in Swaziland. Much of the area proposed for protection is unfit for agriculture. According to Murdoch's study of soils and land capability, nearly 70% of the area is composed of "unfit soil on too steep slopes," while only 3.5% is classified as "good soil on suitable slopes." Of the 31 areas marked for protection, only two would require extensive resettlement - Sibebe and Ndlotane - both of which are considered top priority areas. The following criteria were used in the selection of areas: uniqueness; ecological importance; conservation importance; aesthetic qualities; exceptional visual impact; natural intactness.

Table 16. Proposed National Parks and Nature Reserves

		Area (ha)
National Parks		
Area 1	Milwane	5,713
Area 2	Hlane	24,705
Area 3	Malolotja	18,210
Area 4	Ndzindza	31,138
Area 5	Sibebe (incorporating portion of present Mbabane Nature Reserve)	3,318
Area 6	Ndlotane	7,980
Area 7	Mnyame	11,946
Area 8	Ngudzeni	7,032
Proposed Nature Reserves		
Area 9	Mkondo	3,028
Area 10	Hhele Hhele	1,194
Area 11	Jilobi Forest	1,336
Area 12	Siteki Forest	1,850
Area 13	Ntabamhloshane	27
Proposed National Landscapes (to be proclaimed Nature Reserves)		
Area 14	Luhlokohlo	64
Area 15	Ntungulu	8,905
Area 16	Mdzimba	5,734
Area 17	Sondeza	1,600
Area 18	Makhonjwa	2,676
Area 19	Bulembu	530
Area 20	Ndzeleni	562
Area 21	Mahamba	2,624
Area 22	Nsongweni	1,033
Area 23	Lubombo	12,793
Area 24	Tulwane	1,313
Area 25	Milba	110
Area 26	Mananga	1,610
Proposed National Wetlands (to be proclaimed Nature Reserves)		
Area 27	Matsapha	180
Area 28	Pongola	867
Area 29	Nyetane	397
Area 30	Njoli	4,280
Area 31	Tjaneni	1,730

Source: Riley, 1979 (28).

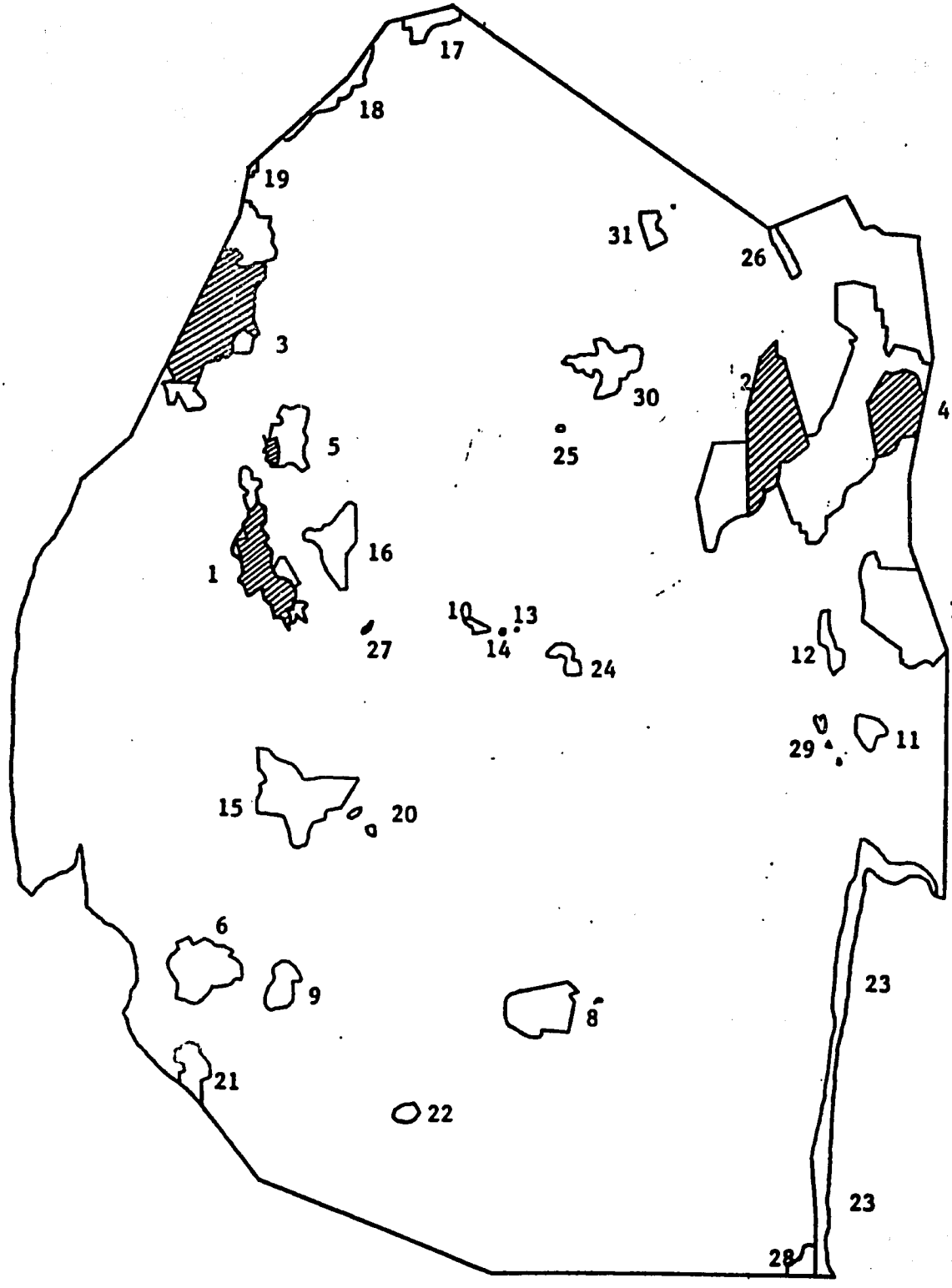


Figure 22. Proposed National Parks and Nature Reserves.

4.4 Urbanization

Though Swaziland is still a predominantly rural society, the country is moving rapidly through an early stage of industrialization and urbanization, most notably in the Mbabane - Manzini corridor. This area contains the centers of Government administration, residential areas, light industries, and tourist facilities, and thus already requires careful physical planning and environmental controls. As an example, the Water Resources Division in the Ministry of Public Works has prohibited all development in a 17 mile corridor of the Black Umbuluzi river watershed, extending north from the currently developed area of Mbabane, because of pollution dangers.

The expansion of urban areas has led to the development of squatter settlements on the urban fringe. As much as 50% of annual shelter production in Mbabane and Manzini is now in squatter areas. As of 1978, some 14,600 existing urban housing units were nondurable or partially durable in character, and over 4,500 were without access to potable water and adequate sanitation facilities. 1/

4.5 Air and water pollution 2/

Air and water pollution are not priority problems in Swaziland as of yet. Because Swaziland receives some orographic rainfall throughout the dry winter season, the country is not plagued by the smog characteristic of savanna climates from dust and grassland burning. The quality of surface waters is high because collecting grounds tend to be acid igneous rocks or deep highly leached soils. For instance, estimates for 1957-63 indicate that chlorides range from 3-10 ppm in major rivers. More recent data (1976) indicate that the situation has not changed.

Concern about surface water pollution is presently focused on the effects of a pulp mill, other industries, and large irrigation estates in the Lowveld. Pollution from fertilizer runoff is presently regarded as low, and may in fact provide nutrients to marine life in the rather sterile streams of Swaziland. Quantitative data on pesticide use and runoff into surface water are lacking as the Water Quality Lab does not have the monitoring capability for these chemicals. Roder (1977) claims that because not more than 30% of Swazi Nation land will ever be cropland and most rivers in Swaziland are perennial, it is unlikely that pollution from agricultural activities will, if ever, pose a serious problem.

It is very difficult to assess the effects of present or probable pollution of groundwater resources because of the complex geology of the ancient basement formations. Recharge areas for the many springs are insufficiently known, thus the quantity and reliability of flow cannot be estimated. The extent of any existing pollution of groundwater from fertilizer, pesticides, and domestic sewerage is considered to be small and bound to remain highly localized in its effects.

1/ Rivkin, 1979 (31f).
2/ Roder, 1977 (29).

4.6 Environmental Impact of the Rural Development Area Program (RDAP)

The RDAP has three fundamental objectives: to improve the quality of rural life; to increase crop and livestock production, and thereby farm income; and to protect the natural resource base. Existing and proposed major modifications of the environment include:

(i) Land protection (terraces, contour strips, etc.) - 17,600 ha;
(ii) Access and feeder roads - 1,650 km;
(iii) Stockwater and irrigation dams and reservoirs - 137 km;
(iv) Small irrigation canals and ditches - 72 km;
(v) Land clearing for additional arable - 10,100 ha;
(vi) Diversions, grassed waterways, gully reclamation - 64 km.

In his assessment of the RDAP, Roder (1977) gives the following summary of likely environmental impacts:

Environmental Resource or Value	Net Effect 1/ 1 2 3 4 5 6 7	Quantity (if known) or Comments
Topography	x	130,000 ha terraced, contoured
Geology	x	
Soils - arable	x	130,000 ha protected
- grazing	x	280,000 ha eventually improved
Surface water	x	Small increase in ppm N
Groundwater	x	
Wildlife and endangered vegetation	x	Protection of valleys in Lubombo that serve as habitat for rare species of flora and fauna
Woodland reforestation and protection	x	70,000 ha eventually
Air	x	
Noise	x	
Climate	x	
Public health and safety - short term	x	25-50% increase in bilharzia
- long term	x	More and better access to clinics
Historic and cultural resources	x	

cont'd.

Environmental Resource or Value	1 2 3 4 5 6 7	Quantity (if known) or Comments
Natural resources (soil, range, forest)	x	482,311 ha enhanced
Aesthetic factor	x	More pleasing landscape
Human resources	x	200,000 people served by extension

1/ Net effects are classified as: (1) large loss; (2) significant loss; (3) small loss; (4) no significant change; (5) small gain; (6) significant gain; (7) large gain.

5.0 ORGANIZATIONS RELEVANT TO ENVIRONMENTAL AND NATURAL RESOURCE MANAGEMENT

5.1 Political and administrative structure

Swaziland has a dualistic political system, the result of its colonial period from 1906 to 1968, consisting of a modern bureaucracy and the traditional hierarchy of elites. Since the suspension in 1973 of the post-independence Constitution, the King (or Ngwenyama) has exercised full authority over all aspects of Swazi government, in both the traditional and modern sectors. Figure 23 below outlines the organization of the Swazi government.

The modern government comprises a Cabinet of Ministers and a civil service. Invested with the executive authority of Swaziland, the King names a cabinet comprising a Prime Minister and a flexible number of Ministers. The cabinet is responsible for the operation of the modern bureaucracy. The traditional branch of government, presided over by the King, consists of the Libandla Laka Ngwane (Council of the Ngwane, i.e. Swazi Nation), the Standing Committee of

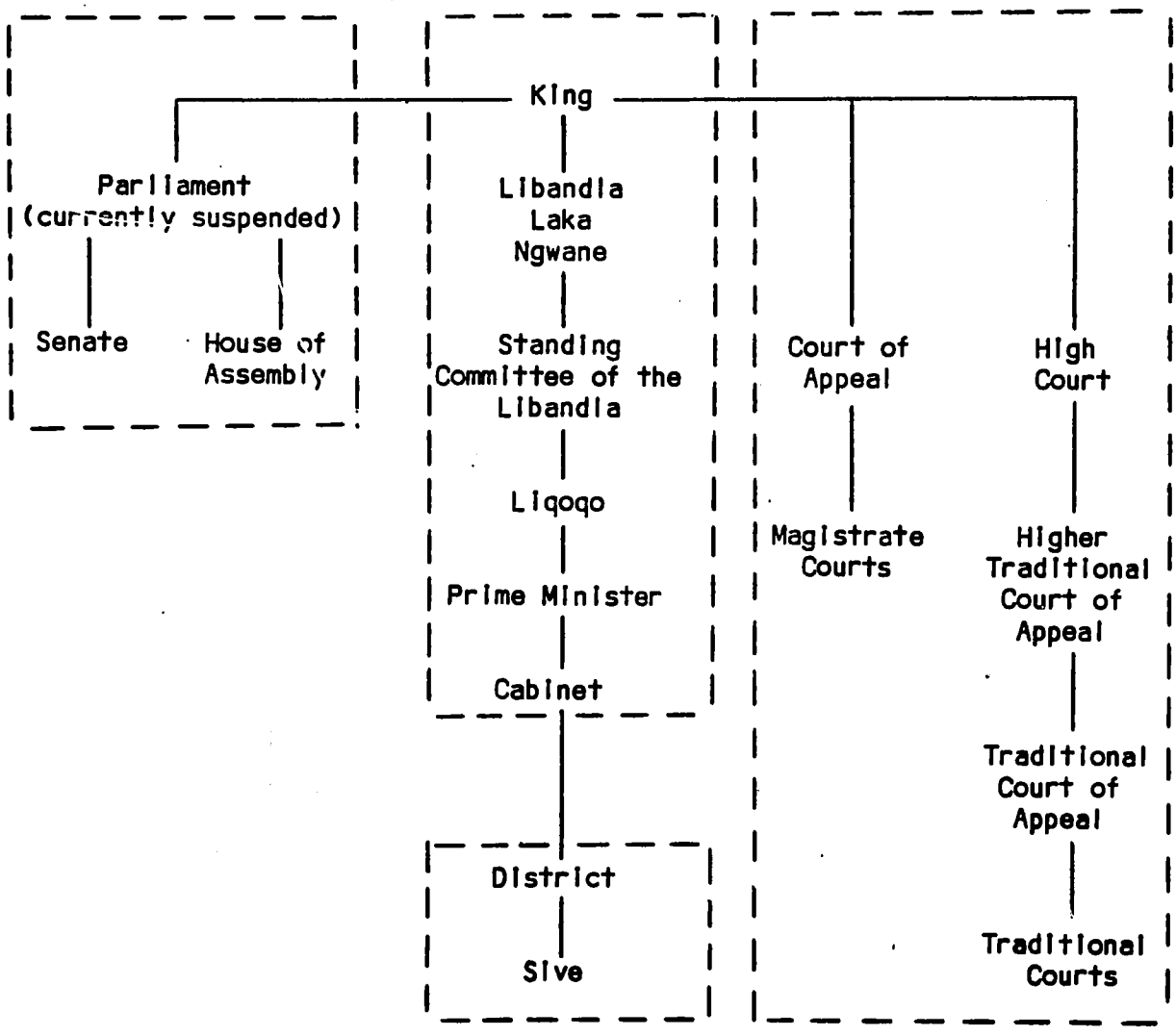


Figure 23. Organization of the Swazi Government.

the Libandla, and the Liqoqo, or advisory council. It is charged with maintaining and protecting Swazi law and custom and with examining, approving, and supervising all proposals which concern land use, insuring that these are in keeping with customary law, rights and obligations. The Libandla consists of all the chiefs (or bantfanenkosi) and other notables chosen for their wisdom. When the King approves a decision by the Libandla it becomes law. The Liqoqo, or Swazi National Council (SNC), is a more informal body that acts as an advisory body to the King. In theory, every adult male Swazi can attend and participate in the deliberations of the SNC, though in practice attendance is limited to those with special functions, the aristocracy, and those who live nearby.

For purposes of territorial administration, Swaziland is divided into four districts: Manzini, Hhohho, Shiselweni, and Lubombo (see Fig. 24). The Ministry of local government is responsible for all territorial administration. Each district has a commissioner who serves as a coordinator of all government activities within his district. However, his role is somewhat limited since basic planning and budget decisions are made at a central level. The urban areas of Mbabane and Manzini have municipal governments. At present, there is no system of local government within the modern government structure. Administration tends to be highly centralized, with virtually all administrative and political matters referred for decision to the Central Government. The chiefs remain the principal instruments of local government on Swazi Nation land. The SNC communicates with the people through regional meeting centers called "tinkhundla" (singular "inkhundla"). Here Council officials, chiefs, and some government officers, especially the district commissioners, call meetings with local people to make announcements, exchange ideas, and debate issues and proposals.

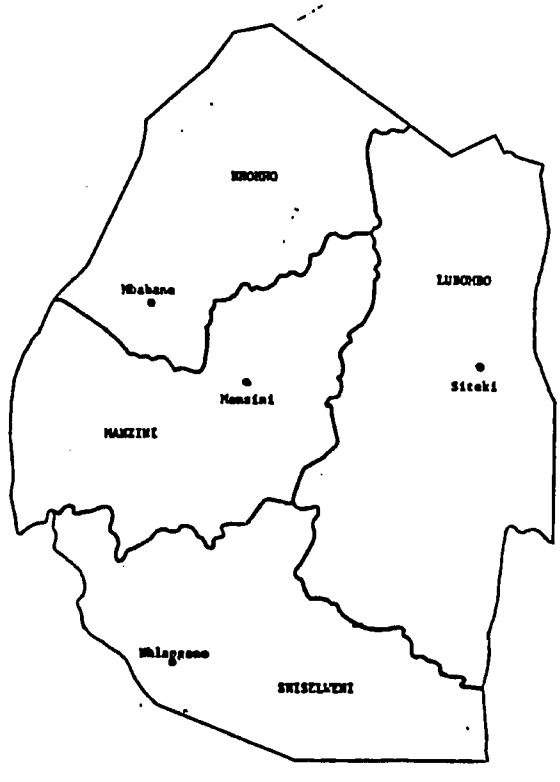


Figure 24. Administrative districts and their capitals.

There is a movement now to increase the importance of the tinkhundla, not only for socioeconomic organization, but also for the dispensing of rural social services. This decentralization was extended further in October 1978 by the creation of a Regional Council of popularly elected members for each of Swaziland's four administrative Districts. The Regional Councils have a two-fold responsibility in the development process: to coordinate national and economic activities at the District level, and to identify priority projects needed by residents of their Districts. Each Regional Council functions under a Regional Administrator, who reports to a Ministry.

5.2 Planning

The institutional framework for rural development is very complex given the juxtaposition of traditional and modern authority described above. Because of this structure, a dual decision making process is involved in both planning and implementation. While the Ministry of Finance has primary responsibility for designing and selecting development projects, the Swazi National Council, through the Central Rural Development Board, must finally decide which projects are going to be approved. The approval of projects is a lengthy process as provisions are made for significant involvement of the population and, in particular, the local chiefs. Thus all projects and proposals must go through two different channels of approval, in which different criteria are applied, prior to implementation.

5.3 Government organizations

This section is divided into institutions within the "modern" branch of government and those within the traditional branch.

5.3.1 Modern sector

Office of the Prime Minister

Economic Planning Office

This newly created office is responsible for preparing the five year development plans and for providing review and advice on long-term development strategies, duties formerly handled by the Ministry of Finance.

Coordinating Cabinet Committee

This committee was established to oversee the implementation of the Rural Development Area Program. The committee is under the chairmanship of the Secretary to the Cabinet and encompasses all the Ministries involved in rural development. Parastatal and other non-government organizations are also represented. Directly below the Cabinet Committee are four District Team Committees, each of which has 3-5 tinkhundla centers under it.

Ministry of Agriculture

The Ministry has been reorganized since the advent of the Rural Development Area Program. Figure 25 outlines the structure of the Ministry based on the proposed

changes. As no information was available to verify the chart, it may not be wholly accurate.

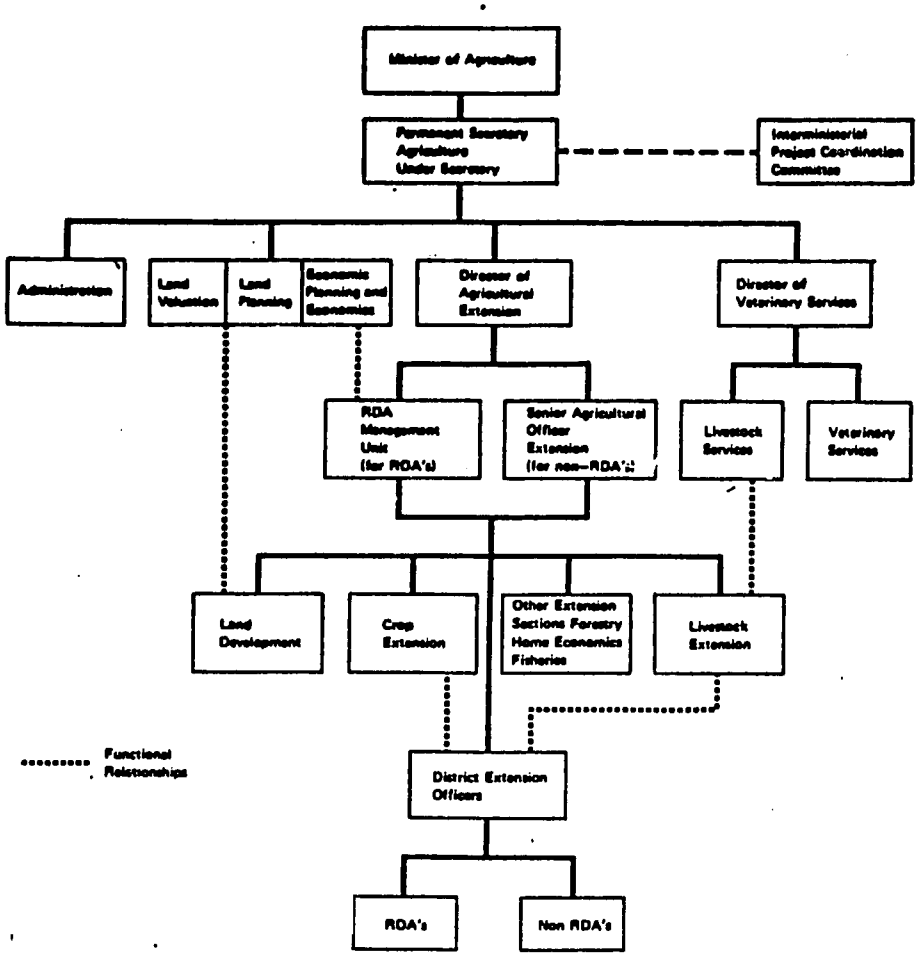


Figure 25. Organization chart of the Ministry of Agriculture.

Agricultural Extension Service

Extension services are organized on a district basis and are divided between Rural Development Areas and areas outside of RDA's. In non-RDA's each district has a senior extension officer (SEO) who is responsible for supervision of extension staff. RDA's are outside the jurisdiction of SEO's, although they may intervene when political difficulties arise. There is a separate management unit for the RDA program headed by a senior agricultural officer, who oversees all Agriculture staff working in RDA's. Within the RDA management unit is a monitoring and evaluation unit which produces reports on various aspects of the program.

Crop Extension Section

The Crop Extension Section was established as part of an FAO/UNDP funded crop development project. Its purpose is to develop specialized services for crop promotion and to upgrade extension services.

Forestry Extension Section

The Section's objectives are to promote afforestation on Swazi Nation land, to oversee legislation on forestry, and to monitor protected flora. The Forestry Section is responsible for forestry inputs, such as the planting of communal woodlots, under the Rural Development Area Program.

Fisheries Extension Section

This Section was established in 1972 with the assistance of UNDP. The Section has been active in the development of rural fish ponds for farm consumption and for sale.

Livestock Extension Section

Economic Planning and Economics Section

The Section is responsible for project preparation and monitoring and for overall planning for the Ministry.

Land Planning Section

The Section has been principally responsible for the definition and selection of RDA's, the establishment of priorities among them, and for preparation of specific physical development plans (to be reviewed by the chiefs and the local population affected). These plans must receive the approval of the Central Rural Development Board.

Land Development Section

The Land Development Section is responsible (as a contractor) for all development works; including soil conservation, terracing, construction of dams and waterways, bush clearing, fish pond development, and feeder roads.

Natural Resources Board

The Board is a statuatory body established under the Natural Resources Proclamation No. 71 of 1951. The Board is responsible for supervision of the natural resources on non-Swazi Nation land. The Board submits an annual report to the Minister of Agriculture which includes the recommendations regarding natural resources made by it to the Minister and a summary of the extent to which these recommendations have been adopted.

Ministry of Health

The office of the Senior Medical Officer of Health in Mbabane, in addition to holding administrative responsibility for the public health program as a whole, deals with environmental health and hygiene, health education, the enforcement of health legislation, as well as supervision of the two town health departments (in Mbabane and Manzini) and the public health nursing unit. A newly formed Health Education unit is located in the Mbabane Public Health Unit. The health office at Manzini is responsible for the control of malaria and schistosomiasis. The Central Laboratory at Manzini serves both public health facili-

ties and private physicians. The Ministry is overseeing the development of rural health clinics in the Rural Development Area Program.

Public Health Section

The Section is responsible for dealing with community health issues. Its specific aims include the provision of potable water supplies, refuse disposal and sewage facilities, pest control, improved standards of nutrition, and improved housing.

Nutrition Council of Swaziland

The Council is an interministerial body originally established in 1945 and since reconstituted. The Council presently serves an advisory role and is charged with investigating and reporting on all matters pertaining to the prevention of malnutrition and improvement of diet. The Government is seeking to strengthen the policymaking and executive functions of the Council, and changes in the constitution have been proposed.

Ministry of Commerce, Industry, Mines and Tourism

Geological Survey and Mines Department

The Department is concerned with investigating and recording the geology of the country, its mineral deposits, and groundwater resources. It also administers the mining law and regulations and, in various ways, promotes and assists the development of Swaziland's mineral resources. The Department provides advice on mineral resources and their development to the Swazi Government, the Swazi Nation, and to private companies and individuals.

Ministry of Works, Power and Communications

Department of Public Works

Water Resources Division

This agency is responsible for maintaining water quality. Under its charge to limit pollution of rivers and ensure fair distribution of water among users, it is effectively the principal environmental protection (pollution) agency of Swaziland. In this regard, the Division, through the Minister of Public Works, has prohibited all development in the Black Umbuluzi river watershed (a 17 km corridor extending north from the currently developed area of Mbabane) because of pollution dangers. This is the first application of the 1967 law permitting such land conservancy by the Ministry (Rivkin Associates, 1978).

Ministry of Local Administration

The Ministry is responsible for the organization and management of town government as well as for physical planning, land use regulation, and a wide variety of community services. The Ministry, through the District Commissioners, assists in coordination and implementation of rural development schemes. Local chiefs, the principal agents of local administration, also have substantial responsibilities at both the planning and implementation stage.

Land Allocation Committee

This committee makes recommendations and decisions on the use of government-owned lands.

Physical Planning Office

This office is responsible for preparing all urban area plans, and functions as an adviser to other ministries and agencies.

Community Development Office

The office provides support, primarily to the Rural Development Office of the Ministry of Agriculture, throughout the country in organizing rural self-help projects.

Swaziland Development and Savings Bank (SDSB)

The SDSB, owned and controlled by the Government, is the principal institution concerned with agricultural credit. Its primary aim is the development of agriculture with particular attention to aid for the small farmer.

5.3.2 Traditional sector

Central Rural Development Board (CRDB)

The CRDB, established in 1954, oversees all activities on Swazi Nation land on behalf of the Swazi National Council. It reports directly to the King and includes important traditional leaders and chiefs. The CRDB must approve all projects and plans for rural development schemes and normally acts on proposals at a conceptual level and when detailed land use plans are prepared. An important part of the approval process is consultation with local chiefs and the local population. The CRDB appoints Rural Development Officers to assist in preparing, presenting , and carrying out development schemes. These officers often act as facilitators, working actively to enforce CRDB decisions on development schemes, and have been effective in advancing rural development programs in the past. The Board is responsible for the approval and implementation of land use plans developed in the Rural Development Area Program. In addition, the Chairman of the Board is responsible for submitting a report to the King on the state of resources (water, soil, grass, timber) on Swazi Nation land.

The Tibiyo Taka Ngwane (Tibiyo Fund)

"Tibiyo" are minerals and "Tibiyo Fund" refers to a fund created by the King and the SNC into which mineral royalties are paid by all mining concerns operating in Swaziland. The fund is not part of the Government Treasury, but is a separate institution controlled by the SNC. The funds are used to buy back Swazi land from expatriate owners. This land is typically used for commercial purposes.

Swaziland National Trust Commission

The Commission is a statuatory body established under the National Trust Commission Act of 1971. The Commission is responsible for the establishment and administration of a system of national parks; the protection of places of scenic or unique interest, historical monuments and archaeological sites; and the creation of a Swaziland National Center which will include a museum and archives. No information was available on the composition of the Commission.

5.4 Parastatal sector

Central Cooperative Union (CCU)

The CCU was established in 1971 to coordinate cooperatives in Swaziland. It is an autonomous body run by an elected Board of Directors.

National Industrial Development Corporation (NIDCS)

The Corporation was created by the Government to promote or assist in the promotion of industrial, commercial, agricultural or mining activities, with primary emphasis on large-scale enterprises within the industrial sector. The Corporation operates within the framework of policy guidelines laid down by the Ministry of Industry, Mines and Tourism.

Small Enterprise Development Co. (SEDCO)

SEDCO was established in 1970 to provide technical assistance and some financing to small, Swazi-owned enterprises.

Water and Sewage Board

The Board was formed in 1974 within the Ministry of Works, Power and Communications to build and operate water supply and distribution systems and sewerage facilities on a self-sustaining basis mainly for urban centers. Its water program is operating in about 15 towns, and it is developing sewerage systems in Mbabane, Manzini, Matsapa and Piggs Peak. Together with the Public Works Department, the Board maintains a water lab that is responsible for monitoring the quality of surface waters. The lab samples streams at 29 points in Swaziland once every month and a half. Water analysis is carried out for chloride salts, other minerals, suspended solids, and chemical oxygen demand (all testing is chemical rather than biological).

Swaziland Electricity Board

The Electricity Board is an autonomous authority established in 1963 to develop a national power grid and distribution system. It operates hydroelectric facilities in Swaziland but imports some power from South Africa.

Swaziland Iron Ore Development Company

Swaziland Sugar Association

Swaziland Meat Corporation

5.5 Non-government organizations

University of Botswana and Swaziland (UBS)

The University offers agricultural training at senior levels.

Agricultural Research Division

In 1971 the Research Division was transferred from the Ministry of Agriculture. Consideration was being given to placing the Division back under the direct administration of the Ministry, but no information was available on this. The Division functions under policy guidance of the National Research Council; an agriculture committee establishes priorities for research within the Council's broad policy structure. The basic objective of the Research Division is to produce practical, economic recommendations on crop and animal production which will assist in the economic improvement of the agricultural industry. Research stations are operated at the following locations: the Lowveld Experiment Station at Big Bend, the Niangano Experimental Farm, the Hebron Research Plot, the Mangcongco Research Plot, and the Luve Research Plot. In 1977 a proposal was under consideration to establish a research plot at Mdimba.

The Research Division is directed by a Chief Research Officer, who is also responsible for maintaining close liaison with two industry-financed research units; for some years Government policy has encouraged the modern sector of agriculture to assume responsibility for running its own affairs and meeting its own research requirements. Since 1966, with financial aid from the U.K. and elsewhere, non-government research units have been set up for pineapple, citrus, forestry and, to a limited extent, breeding and entomology research. The Research Division has 12 sections, which reflect its principal research activities:

Crop Agronomy - Trials concentrating mainly on variety evaluation have taken place for many crops. These have been followed by population, times of planting, fertilizer application, and herbicide testing trials. From results of this work, general husbandry recommendations for most regions of the country have been formulated, including varieties, plant population and spacing, times of planting, fertilizer, weed control, and cultivation techniques.

Soil Fertility and Crop Nutrition - This section focuses on the definition of crop response to changing soil types and regions, and to major and minor nutrients within Swaziland.

Horticulture - This section focuses on fresh market vegetables with the following objectives:

(i) The introduction of new varieties of vegetables and fruits to improve the quality and eventually develop year round production;
(ii) To investigate all aspects of vegetable growing in order to produce a complete list of recommendations for the various climatic zones of Swaziland;
(iii) To assess the feasibility of growing crops for export to Europe.

Recommendations for growing most vegetables in the Middle and Lowveld have been completed, and the following are fully documented: asparagus, cabbage, eggplant, onion, pumpkin, green beans, carrot, green peas, peppers, squash, melon, beetroot, cauliflower, lettuce, Swiss chard, and tomato. Further work includes a complete appraisal of subtropical fruit production potential, including: (i) strawberry, youngberry, granadilla; (ii) paw-paw, pineapple, banana; (iii) avocado, guava, litchi; (iv) macadamia, pecan; (v) mango, citrus, and (vi) temperate fruits (apple, plum, pear, peach, apricot).

Pasture and Veld Management - There are three main activities: plant introduction and testing; nutritional studies; and the development of management techniques using field scale trials with livestock. Experiments are being conducted on the use of vigorous legumes as a control for bush encroachment.

Plant Pathology - The unit serves both a service and a research function.

Entomology - The Entomology Unit was established in 1976 with the following objectives:

(i) Compilation of a checklist of all insect pests for the major and minor crops within Swaziland;
(ii) The development of a research program to provide practical and economic recommendations for the control of the various insect complexes;
(iii) To maintain and enlarge the existing insect collection.

Soil Chemistry - In the course of providing backup plant and soil analysis for the Ministry of Agriculture, the section carries out the following functions:

(i) Continuation of the present cooperative soil and plant analysis service to other research sections;
(ii) Development of plant and soil analysis techniques to provide information for more detailed and accurate fertilizer recommendations;
(iii) Determining more closely the interaction between lime application, soil pH, and availability of major nutrients on plant growth and productivity;
(iv) In cooperation with the Soil Fertility Section, to assess the micronutrient status of soils;
(v) In conjunction with the Soil Physics Section, to provide recommendations on reclamation and management of saline and sodic soils with particular reference to irrigation schemes.

Soil Physics - This section was established in 1976 in response to the continued deterioration of prime agricultural soils and the almost total lack of data on soil physical properties (infiltration rates, hydraulic conductivity, water holding capacity, aggregate size distribution, stability, and porosity) and their relation to dryland and irrigated crop production practices.

Dryland Crop Agronomy - The main objective of this section is to develop economic methods of crop production suitable for the management of raingrown crops. The emphasis is on the development of farm management practices and farming systems.

Biometrics -

Cotton Breeding -

Cotton Entomology - Emphasis is on pest control.

6.0 LEGISLATION RELEVANT TO ENVIRONMENTAL AND NATURAL RESOURCE MANAGEMENT

6.1 Summary of legislation by sector

General

The Swazi Administration Act, No. 79 of 1950

The Natural Resources Act, No. 71 of 1951 (Amended P.42/1960)

The Public Health Act, No. 5 of 1969.

The National Trust Commission Act, 1971

Water

The Natural Resources Act, No. 71 of 1951

The Natural Resources (Public Stream Banks) Regulations, No. 71 of 1951(1)

The Water Act, No. 25 of 1967 (Amended A.1/1969; A.40/1970; A.12/1971; A.5/1972)

Rules of the Water Court, 1969 (Issued under section 62 of the Water Act)

The Purification of Industrial Water and Effluent Regulations, No. 25 of 1967(1)

The Mining Act, No. 5 of 1958

Minerals

The Mining Act, No. 5 of 1958 (Amended P.63/1961; P.18/1964; L.N. 38(7)/1967; L.N. 8/1969; K.O-I-C. 34/1973)

Mining Regulations, No. 5 of 1958(1) (Amended L.N. 8/1969, L.N. 19/1972)

Soils

The Natural Resources Act, No. 71 of 1951

Forests and other flora

The Forest Preservation Act, No. 14 of 1910

The Private Forests Act, No. 3 of 1951 (Amended P.3/1963; P.25/1964)

The Flora Protection Act, No. 45 of 1952 (Amended G.N. 146/1974)

The Grass Fires Act, No. 44 of 1955

The Plant Protection Act, No. 10 of 1958 (Amended G.N. 85/1964)

Plant Protection Regulations, No. 10 of 1958(1) (Amended G.N. 101/1964)

The Wattle Bark Control Act, No. 38 of 1960

Wattle Bark Control Regulations, No. 38 of 1960(1) (Amended G.N. 20/1963)

The Control of Tree Planting Act, No. 7 of 1972.

Wildlife

The Wild Birds Protection Act, No. 45 of 1914 (Predatory birds excluded by H.C.N. 64/1914)

The Game Control Act, No. 37 of 1947

The Game Act, No. 51 of 1953 (Amended P.13/1964; Added L.N. 47/1968)

Game License Fees, No. 51 of 1953(1)

Temporary Protection of Game, No. 51 of 1953(2) (Amended G.N. 26/1963; L.N. 47/1969; L.N. 40/191970)

Variation of Closed Season, No. 50/1953(3)

Fisheries

The Protection of Freshwater Fish Act, No. 75 of 1937

Freshwater Fish Regulations, No. 75 of 1937(1) (Amended H.C.N. 172/1952; Replaced L.N. 32/1973)

General land legislation

See Section 6.9 for listing.

The following description of existing legislation in Swaziland does not comprehensively cover each law (which is beyond the scope of this paper), but rather points out those provisions of the law most relevant to environmental and natural resource management.

6.2 General legislation

The Swazi Administration Act

Section 10 of the act provides for measures to be taken for the conservation and improvement of natural resources on Swazi Nation Land. This Act was unavailable to the author.

The Natural Resources Act

Implementation

Part III - A Natural Resources Board was created to carry out the provisions of the Act. The Board reports to the Minister of Agriculture, who is responsible for appointing its members. The broad functions of the Board include:

Except in respect of Swazi areas;

(I) to exercise supervision over natural resources;
(II) to stimulate by propaganda and such other means as it may deem expedient a public interest in the conservation and improvement of natural resources;
(III) to recommend to the Minister legislation it deems necessary for the proper conservation, use and improvement of natural resources.

The Board submits an annual report to the Minister which includes the recommendations made by it to the Minister and a summary of the extent to which these recommendations have been adopted.

Provisions

Part I - This Act provides for the conservation and improvement of natural resources on land other than Swazi Nation Land. "Natural resources" are defined as:

(I) soil, water, and minerals;
(II) animal, bird, and fish life;
(III) such other things as the Minister (of Agriculture) may by notice in the Gazette declare to be natural resources, including landscapes and scenery which, in his opinion, should be preserved on account of their aesthetic appeal or scenic value; and
(IV) royal graves or grave sites.

Part III - The Act allows for the setting aside of Government land or the purchase of other land for the conservation or improvement of natural resources. In addition, the Act provides for the construction and maintenance of works on

any land or the cessation or suspension of any activities deemed necessary or desirable for any of the folowing purposes:

(i) the protection of the source, course or feeders of a public stream;
(ii) the disposal or control of storm water;
(iii) the mitigation or prevention of soil erosion;
(iv) the conservation of water.

Owners or occupiers of land may be given orders to comply with the above provisions. These orders may relate only to:

(i) the construction and maintenance of soil conservation works;
(ii) the preservation and protection of the source, course and banks of rivers and streams;
(iii) the depasturing or limitation of stock;
(iv) the method of cultivation and irrigation of land;
(v) the prohibition or restriction of cultivation or irrigation of any part of the land;
(vi) the control of water, including storm water;
(vii) in consultation with the officer in charge of the Department of Publi Works, the method of construction of any roads;
(viii) the control or prohibition of the burning of grass or other vegetatio including the burning of fire breaks.

Part IV - Landowners who wish to initiate measures to conserve or improve the natural resources of an area may petition to have the area declared an intensiv conservation area. The owners of at least two-thirds of the land must consent to the petition. If such an area is formed, the owners of land in the area will form a conservation committee, which will have all the rights of a corporate body.

The Public Health Act

This Act was unavailable. Part III, Section 11 of the Act gives an exhaustive list of the sources and media of nuisances.

The National Trust Commission Act

Implementation

The Act established a corporate body known as the Swaziland National Trust Commission, which is charged with the establishment and maintenance of a system of national parks, together with the creation of a Swaziland National Center and the care of national monuments, relics, and antiques.

Provisions

The Act stipulates that no part of Swazi Nation land shall be included in a national park without the express consent of the King in his capacity of Ngwenyama. Thus, the establishment of national parks will usually require the purchase of freehold title land. The Act has been amended to provide for the

establishment of both national parks and a second, lower form of protected area called a "nature reserve." The title "national park" is to be reserved for protected areas in which all land has been acquired by the Government, and in which the Commission consequently has complete control of all activities (thus complying with the IUCN's definition of a national park). "Nature reserves" are areas which have been declared to be protected but which still have private land within their boundaries, thus limiting the absolute powers of the Commission. Basically, the establishment of a nature reserve is intended to serve as an interim step to prevent further deterioration of important areas until they can be purchased and come under the full control of the Commission. The inclusion of private land within a nature reserve is subject to separate agreements between individual owners and the Minister of Agriculture, with the minimum requirements that the owner shall not sell or lease the land, hunt or permit the hunting of any animal, cut or destroy indigenous trees or plant exotic species, cause brush fires, construct buildings, roads, dams or bridges, or excavate quarries on his land without the consent of the Commission.

6.3 Water

The Natural Resources Act

Provides for the conservation or improvement of water resources on land other than Swazi Nation land - see above.

Natural Resources (Public Stream Banks) Regulations

Prohibits the cultivation or planting of any crops, or the injury or destruction of any natural vegetation in any area within 100 feet of either bank or the verge of a public stream.

The Water Act

Implementation - The Minister of Works, Power, and Communications is responsible for the administration of this Act. Provisions are made for the Minister to assign powers to lower authorities.

Provisions

This Act consolidates and amends the laws in force in Swaziland relating to the control, conservation and use of water for domestic, agricultural, urban and industrial purposes and provides for the control of certain activities on or in water in certain areas.

Part I - Defines relevant terms of the Act. 'Private water' is defined as "all water, not being public water, which rises naturally or is obtained by artificial means on any land or which falls or naturally drains on to any land, so long as it remains visible on the surface of such land." 'Public water' means "any water flowing or found in or derived from the bed of a public stream, whether visible or not." 'Public stream', in turn, means "a natural stream of water which flows in a known and defined channel, whether or not such a channel is dry during any period of the year, and whether or not its conformation has

been changed by artificial means."

Part II - Describes the general powers of the Minister of Works, Power, and Communication.

Part III - Describes rights and duties regarding the control and use of private and public water. Key sections of relevance here include:

Sec. 5 - Ownership of public and private water.
Sec. 8 - Irrigation or flooding of veld and soil erosion control.
Sec. 9 - Use of normal flow of a public stream.
Sec. 12 - Use of public water for mining purposes.
Sec. 18 - Purification and disposal of industrial water and effluents.
Sec. 19 - Disposal of effluents by local authorities.
Sec. 20 - Prevention of water pollution.
Sec. 21 - Commencement of Sec. 18 in relation to certain persons.
Sec. 22 - Regulations as to permits and control of pollution of water.

Part IV - Establishes the Water Apportionment Board. The purpose of the Board is to foster, plan, and promote effective and coordinated exploitation, development and use of the water resources of Swaziland, and the conservation and utilization of public water in the best interests of agricultural, urban and industrial development. The Board consists of seven members appointed by the Minister, to whom it reports.

Part V - Empowers the Minister to establish water courts for the hearing and determination of any matter which may be referred to a water court under this or any other law. The decisions of a water court are binding and are not subject to appeal.

Part VI - Government waterworks and Government control of water. The Minister has the right to construct any Government waterwork for the purpose of conserving or utilizing any water for the drainage of land, for storing or preventing the waste of or controlling groundwater, or for the generation of electricity. Especially significant is the right of the Minister to establish catchment control areas. Areas can be so designated which, in the opinion of the Minister:

(I) it is in the public interest to regulate the flow of a public stream so as to improve the water resources, for the prevention or control of silt, or for the purpose of lessening the possibility of damage to land riparian to the stream in the event of flood;
(II) land is required for the protection of any portion of the catchment area of a public stream;
(III) any part of a public stream or any area should, in the public interest, be set aside as a reserved area for the future construction of a storage dam.

Part VII - Provides for the establishment of "water sport control areas."

Part VIII - Provides for the establishment of irrigation districts and boards for the purpose of exercising control over an area under irrigation or proposed

to be irrigated. The Minister may assign functions to an irrigation board enabling or requiring it (among other things) to:

(i) protect the sources of water of any public stream within the irrigation district;
(ii) prevent the leakage or flow of any public water from the surface to subterranean channels;
(iii) exercise general supervision over all public streams within the irrigation district and to cause any such stream to be cleansed, deepened widenend, straightened, restored to its former channel or otherwise improved whenever it appears necessary or expedient to do so.

Part IX - Servitudes. Defines the servitude of abutment, servitude of aqueduct servitude of drainage, and the servitude of storage.

Part X - General and Miscellaneous

The Purification of Industrial Water and Effluent Regulations

These regulations were issued under the Water Act, but were not available.

The Mining Act

Section 110 provides that any person requiring water for mining purposes may use such water only in terms of a water permit or water-right granted in accordance with the Water Act.

Section 129 empowers the Minister of Commerce, Industry, Mines and Tourism to make regulations regarding (i) the disposal of any poisonous or noxious product arising from mining operations, and (ii) the defiling or waste of wate .

6.4 Minerals

The Mining Act

This Act amends and consolidates the law relating to prospecting, mining and mineral concessions.

Implementation

A Mining Board and a Commissioner of Mines appointed by the King are responsible for implementing the provisions of this Act.

Provisions

Part I - Under the Act, "mineral" and "minerals" are defined as:

(i) metalliferous ores and other substances in their natural state which are obtainable only by mining or in the course of prospecting operations;

(ii) metalliferous ores and other substances in their natural state mined or obtained in the course of prospecting operations;
(iii) the valuable parts of such ores or other substances for marketing or export;
(iv) the product of treating or dressing such ores or other substances for marketing or export.

The rights to all minerals are vested in the King in trust for the Swazi Nation. Part II - Administration. Unless granted an exception by the King, prospecting and mining is prohibited within 100 meters of: land dedicated or set apart for any public purpose other than mining; a place of burial; and any spring, well, borehole, reservoir, dam, artificial watercourse, or waterwork. In addition, the holder of a prospecting right, location, or lease can be required to restore any land disturbed by prospecting or mining operations.

Part III - Prospecting. Unless granted an exception, it is forbidden to prospect in an area declared to be a private forest or game reserve.

Part IV - Mining. Mining locations and mining leases are granted at the King's discretion.

Part V - Disputes. A District Commissioner may inquire into and decide any dispute between persons engaged in prospecting or mining operations.

Part VI - Possession, Purchase, and Sale of Minerals.

Part VII - Inspections and Accidents.

Part VIII - Passageways and Roads.

Part IX - Prospecting and Mining on Mineral Concessions.

Part X - Swazi Affairs.

Part XI - Taxation of Mining Rights.

Part XII - Registration.

Part XIII - Miscellaneous. The Minister may make regulations regarding:

(i) the rehabilitation of any land damaged by prospecting or mining works;
(ii) the grazing of cattle or other animals and the cutting down and use of timber for the purposes of carrying on prospecting and mining operations;
(iii) the safety, health, welfare, and housing conditions of persons employed in mines and the carrying on of prospecting or mining operations in a safe, sanitary, proper and effectual manner;
(iv) the disposal of any poisonous or noxious products from the mining process;
(v) the defiling or waste of water.

Mining Regulation No. 87 - When a prospecting or mining operation is terminated or abandoned the mining inspector is empowered to require the holder to take any necessary steps he dems fit to restore the surface of the land.

6.5 Soils

The Natural Resources Act

This Act provides for the protection and conservation of soils. Part III of the Act provides for the construction and maintenance of works on any land or the cessation or suspension of any activities deemed necessary or desirable for the mitigation or prevention of soil erosion.

6.6 Forests and other flora

Implementation

The Minister of Agriculture is responsible for the implementation of legislation protecting flora.

The Forests Preservation Act

This Act makes provision for the preservation of trees and forests growing on Government and Swazi Nation land.

Provisions

Unless permission is granted by the Minister, it is prohibited to:

(I) cut down, damage, remove, sell, or purchase indigenous or government timber;
(II) clean, break up, or cultivate any Government land or Swazi Nation land on which or within thirty yards of which indigenous or government timber is growing.

These provisions may be applied by the Minister to private forests for the purpose of their better preservation.

The Private Forests Act

This Act makes provision for the preservation of private forests in Swaziland.

Provisions

Major offences in private forests are committed by anyone who:
(a) without the authority of the owner or his agent in a private forest:

(I) cuts, injures, destroys, collects, takes, or removes any tree, timber, or other forest produce;
(II) injures, alters, shifts or removes, or interferes with any beacon, boundary mark or fence;
(III) lights, assists in lighting, or rekindles any fire.

(b) on any private forest or within one mile of the boundary of a private forest:

(I) leaves a fire unattended before it is thoroughly extinguished;
(II) lights or uses a fire which through his negligence spreads or causes damage or injury.

The Act also prohibits the unauthorized removal of forest produce form a private forest.

The Flora Protection Act

This is an Act to protect the indigenous flora of Swaziland.

Provisions

The Act defines "protected flora" to be any plant, shrub, or tree included in the Schedule (see Appendix), and includes the flower, bulb, tuber, stem, or root or any other part of these plants, shrubs, or trees.

The Minister is empowered to:

(I) add or delete from the Schedule any species or kind of plant, shrub, or tree indigenous to Southern Africa;
(II) establish indigenous flora reserves;
(III) extend the boundaries of or cancel any indigenous flora reserve.

The Act prohibits any person from plucking, gathering, cutting, uprooting, injuring, breaking, or destroying any protected flora, except under the following conditions:

(I) by special permit;
(II) on land specifically set aside for cultivation of the protected flora;
(III) on land required for cultivation or construction.

The export and sale of protected flora is prohibited except by permit issued by the Minister and, in the case of the selling of flora, if the protected flora is cultivated on land specifically set aside for this purpose.

The Grass Fires Act

Provisions

It is prohibited to set fire to standing or uncut grass (I) less than 24 hours after the grass was previously burned and (II) between the months of May and September, except by permit issued by the Minister. This does not apply to the burning of grass on land that is required for cultivation and which is actually cultivated within three months after burning.

The Plant Protection Act

This is an Act to control the movement and growing of plants in order to prevent the introduction and spread of plant diseases and insect pests.

Provisions

The Act defines a "plant" to be any tree, shrub, or vegetation (including fruit, leaves, cuttings or bark) and includes any living portion of a plant, whether severed or attached, and any dead portion.

As provided for in the Act, the Minister has issued regulations covering the following areas:

Part II - Nursery registration and quarantine.
Part III - Importation of plants.
Part IV - Insect pests in timber.
Part V - Penalties.

The Wattle Bark Control Act

This is an Act to control the production, sale, grading, and processing of wattle bark.

Provisions

The Act defines "wattle trees" to be trees of the species Acacia mollissima willd (black wattle), Acacia decurrens willd (green wattle), and Acacia pycnantha benth (golden wattle). It is prohibited to strip immature bark and to strip wattle trees less than eight years old for the sale or processing of bark. Inspectors may be appointed to inspect wattle plantations.

Wattle Bark Control Regulations

A wattle grower is required to have his plantations surveyed annually, and the disposal and processing of wattle bark is regulated by permit.

The Control of Tree Planting Act

This is an Act to provide for the control of the planting of certain trees grown for commercial purposes in specified areas.

Provisions

After the promulgation of this Act in 1972, the Natural Resources Board conducted a comprehensive survey of the entire country to develop a tree control areas plan (unavailable to the author). This plan classifies all rural land into three categories - agricultural land, intermediate land, and marginal land - defined as follows:

(1) Agricultural land - any rural land which is clearly capable of sup-

porting a reasonable standard of agricultural production subject to moderate limitations or hazards and without the application of intensive protection measures.

(ii) Intermediate land - any rural land, except that which can be classified as marginal land, which is capable of supporting a reasonable standard of agricultural production subject to severe limitations or hazards and the application of intensive protection measures.

(iii) Marginal land - any rural land which cannot be classified as agricultural or intermediate land or which, though classifiable as intermediate land, has an average slope of at least 15%.

The planting of commercial trees in tree control areas (agricultural and marginal land) is regulated by permit.

6.7 Wildlife

The Minister of Agriculture is responsible for the implementation of legislation protecting wildlife.

The Wild Birds Protection Act

This Act prohibits, with certain exceptions, the sale and exportation of the plumage and skins of wild birds, and provides for the protection of birds. Predatory birds, such as the varieties of the eagle and hawk families belonging to the order of Accipitres, are excluded.

The Game Control Act

This Act makes provision for the control of the numbers of game.

Provisions

The Minister is empowered to reduce the numbers of game if any species, by number or circumstances, constitutes a danger to stock, crops, grazing or other natural resources.

The Game Act

This Act provides for the preservation of game and other types of wildlife.

Provisions

"Game" includes royal game, large game, and small game (see Sec. 3.7 for lists). It is prohibited to hunt royal game without a valid permit. The Minister may define areas within which large and small game are protected for a specified period of time. The following rulings are currently in force:

(i) Throughout the country the following game are protected until further notice - Reedbuck, Duiker (Red), and Quail.

(ii) Within the Pigg's Peak, Mbabane, and Mankaiana Districts and Hlatikulu District (other than that portion lying south of the Ngwavuma river and east of the eastern boundary of Swazi Area No. 31) and within that portion of the Manzini District lying to the west of Main Roads Nos. 5 and 18, the following game are protected until further notice - Bushbuck, Duiker (Grey), Impala, Rooi Rhebuck, and Steinbuck.

The Minister may declare an area to be a game reserve, within which the hunting of royal, large, and small game is prohibited except by special permit. The Minister may also establish sanctuaries for the protection of any specified game or class of game, within which the hunting of such game is prohibited except by special permit. Other general prohibitions include:

(i) hunting by plane or motor vehicle;
(ii) the use of nets, pits, enclosures, gins, traps, snares, poisons, etc.
(iii) the sale or export of game meat without possession of a license;
(iv) the export of hippopotamus tusks or teeth, wild skins, or game heads (the head, tusk, skull or horns of royal and large game) without the special written permission of the Principal Veterinary Officer;
(v) to remove, disturb, or destroy the nest of any bird, unless the nest is on cultivated land.
(vi) to remove, disturb, or destroy any egg or the young of any game without the permission of a District Commissioner.

The African Convention for the Conservation and Management of Wildlife

As a signatory to the African Convention for the Conservation and Management of Wildlife, Swaziland has pledged to create national parks and to take any other steps necessary to preserve representative areas of the country's most outstanding natural regions and their indigenous flora and fauna. Under the Convention, a "national park" is defined as "an area placed under the control of the state.....throughout which any form of hunting.....any undertakings connected with forestry, agriculture or mining, any grazing, any excavation or prospecting, drilling, levelling of the ground or construction, any work affecting the configuration of the soil or the character of the vegetation, any pollution and, generally, any act likely to disturb the fauna and flora, and the introduction of any exotic animal or plant species, shall be strictly forbidden."

6.8 Fisheries

Implementation

The Minister of Agriculture is responsible for the implementation of fishery legislation.

The Protection of Fresh Water Fish Act

Under the Act the Minister may:

(i) prescribe for any district, area, or waters the periods of close sea-

son during which it is illegal to fish for, capture, or destroy a particular kind or kinds of fish;
(ii) prescribe a list of fish not subject to such periods of close season in any district, area, or waters;
(iii) prohibit for a specified period the fishing for, capture, or destruction of all or any particular kind or kinds of fish in any area of waters.

In addition, the Minister may make regulations for any or all of the following:

(i) fishing permits;
(ii) the conditions to be observed while fishing;
(iii) prohibiting or regulating the capture or destruction of fish by any particular method;
(iv) the cultivation of fish and the protection of fish, fish spawn, and fish food;
(v) the stocking or removal of fish
(vi) prohibiting the dumping, deposit, or discharge into any waters of any substance or liquid potentially injurious to fish;
(vii) prohibiting the fishing for, capture, or destruction of non-indigenous species of fish.

The Act prohibits:

(i) the catching of fish during the close season;
(ii) the catching of non-indigenous species of fish except by permit;
(iii) the wilful killing or destruction of fish by use of explosives or poisonous substances;
(iv) the possession or sale of protected fish.

The Fresh Water Fish Regulations

Permission must be obtained from the Ministry of Agriculture to stock any waters with fish, to remove any fish from one body of water to another, to cultivate fish, to fish for commercial purposes, or to fish for sport.

6.9 General land legislation

Concessions Act, No. 3 of 1904 (Amended 1961)

Fencing Act, No. 7 of 1904

Concessions Partition Act, No. 28 of 1907

Crown Lands Disposals Act, No. 13 of 1911

Crown Lands Disposals Regulations, No. 13 of 1911

Crown Lands Act, No. 9 of 1949

Ancillary Rights Act, No. 59 of 1950

Sud-division of Land Act, No. 7 of 1957 (Amended 1961; 1961)

Acquisition of Property Act, No. 10 of 1961 (Amended 1963; 1973; 1974)

Private Townships Act, No. 17 of 1961

Private Townships Regulations, No. 17 of 1961

Town Planning Act, No. 45 of 1961 (Amended 1962; 1962; 1967)

Land Survey Act, No. 46 of 1961 (Amended 1973)

Qualification of Land Surveyors Regulations, No. 46 of 1961 (Amended 1974)

Land Survey Regulations, No. 46 of 1961 (Amended 1971; 1971; 1974; 1975)

Rights of Way (Cancellation) Act, No. 16 of 1962

Immovable Property (Race Discrimination) Act, No. 46 of 1963

Crown Lands (Temporary Occupation) Act, No. 22 of 1964

Crown Lands (Temporary Occupation) Regulations, No. 22 of 1964 (Amended 1965; 1966)

Farm Dwellers Act, No. 21 of 1967 (Amended 1973)

Farm Dwellers (Agreement) Regulations, No. 21 of 1967

Crown Lands (Conditions) Act, No. 2 of 1968

Deeds Registry Act, No. 37 of 1968 (Amended 1973; 1975)

Deeds Registry Regulations, No. 37 of 1968 (Amended 1973)

Land Speculation Control Act, No. 8 of 1972 (Amended 1974)

Land Speculation Control Regulations, No. 8 of 1972 (Amended 1974)
Exemption Under Section 20, No. 8 of 1972

Land Concession Order, No. 15 of 1973

Vesting of Land in the King's Order, No. 45 of 1973

Appendix 1

Crop Calender

Crop	Sowing Period	Harvesting Period
Beans (rain grown)	After the first spring rains (Highveld)	2-3 months after sowing
	January - February	May - June
(irrigated)	Throughout the winter, best in March	September - October
Cotton	Usually early in October	March - June
Groundnut	October - November	February - April
Maize	September - November	March - May
Potatoes: Highveld	September - December	December - February
Middleveld and Lowveld	February - March	May - June
Rice	December - January	July - August
Sorghum	September - October	April - June
Sweet Potatoes	March September - November	May - June January - March
Wheat	May	October
Sugarcane	March - May	July - August (15-18 months after planting)
Tobacco	October	January - March
Pineapple	March and September	Mid-January to April (15-18 months after planting)
Citrus Crops	April - June	May - August

Source: Central Statistical Office, 1975 (7).

Appendix 2

List of Protected Species of Flora

Common name	Swazi name	Scientific Name
Stapeliads	-	Riocreuxia spp.
	-	Ceropegia spp.
	-	Brachystelma spp.
	-	Caralluma spp.
	-	Huernia spp.
	-	Stapelia spp.
	-	Duvalia spp.
	-	Stultitia spp.
Cape Primrose	-	Streptocarpus spp.
Barberton Daisy	-	Gerbera Jamesonii Bolus
Yellowwood	Umsonti	Podocarpus spp.
African Beech	Siqualaba	Faurea saligna
Sandklaat	Umvangatana	Albizia versicolor
Fever Tree	Umhlafuffu	Acacia xanthophloea
Tree Fuschia	vovovo	Schotia brachypetalata
Pod Mahogany	Umkhollkholl	Afzelia cuanzensis
Tree Wisteria	Umhohlo	Bolusanthus speciosus
Klaat	Umvangati	Pterocarpus angolensis
Mountain Mahogany	Umkhollkholl	Entandrophragma caudatum
Sneezewood	Umthathe	Ptaeroxylon obliquum
Lebombo Ironwood	Ubukhunku	Androstachys johnsonii
Tambotie	Umtfombotsi	Spirostachys africana
Wild Plum	Umgwenya	Harpephyllum caffrum
Winged Atalaya	-	Atalaya alata
Red Ivory	Umneyi	Rhamnus zeyheri
Leadwood	Umpulumbu, Umbondotendlovu	Combretum imberbe
Sausage Tree	Umvongothi	Kigelia pinnata
African Teak	Umhlume	Adina microcephala
Tree Ferns	Inkhomankhoma	Cyathea spp.
Maidenhair Fern	-	Adiantum capillusveneris
Cycads	Gebeleweni, Isitshubho, umtsokwane	Encephalartos spp. Stangeria eriopus Zantedeschia spp.
Arum Lilies	-	
Red Hot Pokers	-	Kniphofia spp.
Aloes	-	Aloe spp.
Haworthias	-	Haworthia spp.
Paint-brush or Pincushions	-	Haemanthus spp.
Clivias	-	Clivia spp.
Nerinas	-	Nerine spp.
Cyrtanthus or Fire Lilies	-	Cyrtanthus spp.
Gladioli	-	Gladiolus spp.
Watsonias	-	Watsonia spp.

Common Name	Swazi name	Scientific name
Stone Plants	-	Lithops spp.
		Frithia spp.
Water Lilies	-	Nymphaea spp.
-	Likhatsato	Alepidea spp.
-	-	Chironia transvaalensis
Summer flowering Impala Lily	-	Adenium swazicum
Impala Lily	-	Adenium multiflorum
-	Sikumbyambya	Pachypodium saundersii
-	-	Plectranthus floribundus
-	Umkhunku	Erythrophleum guineense
Wild Olive	Umnquma	Olea spp.
	Sitimane	Linociera foveolata
	-	Pleurostylia capensis
	-	Drypetes spp.
	-	Mimusops spp.
Torchwood	-	Balanites maughamii

Common Name	Swazi name	Scientific name
Stone Plants	-	Lithops spp.
		Frithia spp.
Water Lilies	-	Nymphaea spp.
-	Likhatsato	Alepidea spp.
-	-	Chironia transvaalensis
Summer flowering Impala Lily	-	Adenium swazicum
Impala Lily	-	Adenium multiflorum
-	Sikumbyambya	Pachypodium saundersii
-	-	Plectranthus floribundus
-	Umkhunku	Erythrophleum guineense
Wild Olive	Umnquma	Olea spp.
	Sitimane	Linociera foveolata
	-	Pleurostylia capensis
	-	Drypetes spp.
	-	Mimusops spp.
Torchwood	-	Balanites maughamii

16. Hughes, A. J. B. Land Tenure, Land Rights and Land Communities on Swazi Nation Land in Swaziland. Durban: Institute for Social Research, University of Natal, 1972.

17. Hunter, D. R. The Geology of Swaziland. Mbabane: Geological Survey and Mines Department, 1961.

18. Hunter, D. R. "Thermal Waters of Swaziland." Proceedings of Symposium II on Mineral and Thermal Waters of the World, Report of the 23rd Session of the International Geological Congress, 1969, pp. 165-170.

19. Jeske, Joachim. Botswana - Lesotho - Swaziland: Agrargeographische Struktur und wirtschaftliche Verflechtung im sudlichen Afrika. Munich: Weltforum Verlag, 1977.

20. Krohn, Timothy. "Swaziland - Contrasts in Forestry." World Forestry, vol. 75, no. 8. (August, 1977), pp. 534-535.

21. Legg, Ronald L. Rural Development in Southern Africa: Reports on Projects Visited by a Study Tour Party in Botswana, Rhodesia, Northern Transvaal and Swaziland. Transvaal: Inter-Church Aid, 1973.

22. Milstein, P. le S. and E. A. Zaloumis. "The Conservation of Wetland Habitats for Waterfowl in Southern Africa." Supplement to African Wildlife, vol. 29, no. 1 (Autumn, 1975).

23. Murdoch, G. Soils and Land Capability in Swaziland. Mbabane: Ministry of Agriculture, 1968.

24. Palgrave, Keith C. Trees of Southern Africa. Cape Town: C. Struik Publishers, 1977.

25. Pielemeier, Nancy R. Syncrisis: The Dynamics of Health - Botswana, Lesotho and Swaziland. Washington: U.S. Department of Health, Education and Welfare, Office of International Health, 1975.

26. Population Reference Bureau. 1979 World Population Data Sheet. Washington, 1979.

27. Reilly, Elizabeth and Ted. "The Political Alternative." African Wildlife, vol. 33, no. 4 (April, 1979), pp. 18-21.

28. Riley, Terry. Kingdom of Swaziland: Survey of Nationally Protectionworthy Areas. Report to the Government of Swaziland. IUCN, 1979.

29. Roder, Wolf. Environmental Assessment of the Rural Development Area Program, Swaziland. University of Cincinnati and University of Zambia, 1977.

30. Snook, J. A Geography of Swaziland. Cape Town: Longman Southern Africa, 1972.

31. Southern Africa Development Assistance Project (SADAP). A Report to Congress on Development Needs and Opportunities for Cooperation in Southern Africa: Annex A - Swaziland. Washington: U.S. Agency for International Development, 1979.

Other SADAP consultant reports:

31a. Family Health Care and Africare. Health and Development in Southern Africa: A Review of Health Care in Swaziland.

31b. Giles, B.D. A Macro-Economic Study of the Southern African Area.

31c. Pacific Consultants. Manufacturing in the Southern Africa Region.

31d. Robert Dean Consultants. Mining in the Southern Africa Region.

31e. Pacific Consultants. Transportation and Telecommunications in the Southern Africa Region.

31f. Rivkin Associates, Inc. Swaziland Shelter Sector Assessment.

31g. Stallings et al. Swaziland Agriculture Sector Assessment.

32. "Swaziland Economic Survey." African Development, vol. 9, no. 8 (August, 1975), pp. 61-70.

33. Steele, David. Game Sanctuaries of Southern Africa. London: Robert Hale and Co., 1973.

34. Trelease, Frank J. "New Water Legislation: Drafting for Development, Efficient Allocation, and Environmental Protection." Land and Water Law Review, vol. 12, no. 2 (1977), pp. 385-429.

35. U.S. AID/Swaziland. "Request for Environmental Information." U.S. Department of State Telegram (January, 1979).

36. de Vletter, Fion. Subsistence Farmer, Cash Cropper, or Consumer?: A Socio-Economic Profile of a Sample of Swazi Rural Homesteads. Prepared for the Programmes for Better Family Living, Ministry of Agriculture. Mbabane, 1979.

37. Werger, J. A. (ed.). Biogeography and Ecology of Southern Africa. The Hague: Dr. W. Junk bv Publishers, 1978.

38. World Bank. Swaziland: Rural Development Project Appraisal Report. Prepared by the Agricultural Credit and Livestock Division, Eastern Africa Region. Washington, 1977.