Title	Desertification in africa with special reference to east africa
Author(s)	Ojany, Francis F.
Citation	Geographical Reports of Tokyo Metropolitan University(21): 23-34
Issue Date	1986
URL	http://hdl.handle.net/10748/3551
Rights	
Type	Departmental Bulletin Paper
Textversion	publisher

DESERTIFICATION IN AFRICA WITH SPECIAL REFERENCE TO EAST AFRICA

Francis F. OJANY*

Abstract Desertification is the process of vegetation and soil deterioration. It is a result of improper landuse primarily by man (sometimes unwittingly). It brings about reduction in plant and animal biomass in the affected area.

This paper examines the causation and the extent of desertification in Africa. It reveals that over 2/3 of the surface of the continent is adversely being affected by desertification. The main causes of desertification are overgrazing, deforestation, bush fires, extension of cultivation into marginal areas and generally, inappropriate agricultural practises. These activities in turn, generate/accelerate soil erosion by water and wind. They are turning large parts of the continent into deserts. Clearly the most susceptible areas are the marginal lands-hence the idea of the advancing Sahara Desert southwards. However the savanna and other tropical areas are also under threat of desertification.

The most important point is how to effectively combat desertification over the continent. Significant constraints are discussed in the paper including the problems of underdevelopment and the inability of many states in Africa. Detailed inventory of land potential and of desertification 'threat' map as it were, should be compiled. Also, many of the affected areas are unmapped and understudied. Combating desertification sometimes requires transnational measures which commonly require international support. The efforts of many African states to combat desertification is noted and in this regard, the work being done in northern Kenya with the help of UNESCO and the West German Federal Government under the Integrated Project on Arid Lands (IPAL) and now, Kenya Arid Lands Research Station (KALRES), promises to provide a most appropriate method for understanding (before rehabilitating), these rather degraded (desertified) parts of the continent. The paper concludes by showing that research into desertification process and management is still incomplete and appeals to other international scientists to be involved. The subject is interdisciplinary with all the earth scientists, sociologists, ecologists, geographers, demographers and agriculturists all being capable of contributing usefully.

* Department of Geography, University of Nairobi, Kenya.

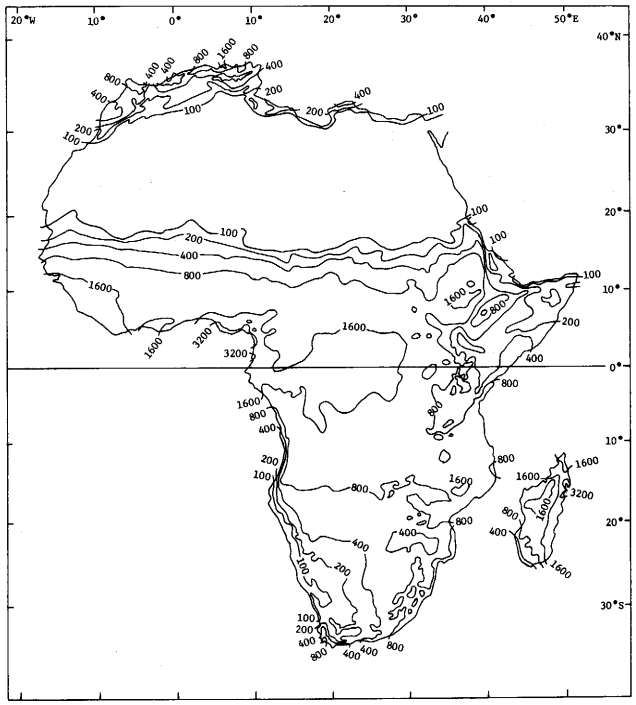

Fig. 1 Mean annual rainfall of Africa : 1931-1960. (After Tompson, 1965).

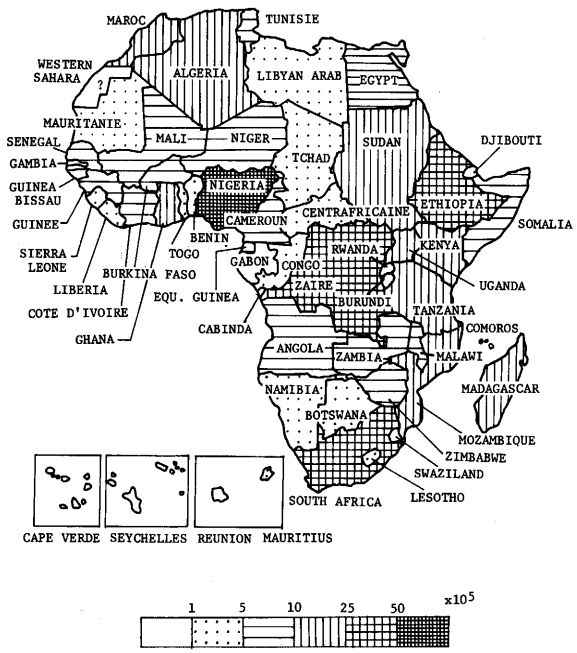

Fig. 2 Population of African countries as of mid-1983. (Source : African Population Profile, ECA, 1984).

1. Introduction

The African continent is 30,319,000 km^2 in area with a population of some 554 million people. The continent is diverse in configuration and is actively undergoing transformation in all aspects of human endevour. Africa is the driest continent after Australia (Fig.1), and is politically the most fragmented continent. There are some 53 independent states in Africa (Fig.2). So many nations do not easily allow for uniform planning which is so important at times, while some of the states are too small to cope meaningfully, with the challenges of nationhood.

It is estimated that recent drought affected 34 or so, countries of Africa (*i.e.* nearly 66% of the continent). Statistics from World Meteorological Organization (WMO), Regional Office for Africa (1985), estimate that "pastoral area in the arid and semi-arid regions of Africa has been reduced by 25% since 1968. The rain deficits amounting 40-80% of the normal in most areas have lead to severe reduction in stream and water tables thus adversely affecting the availability of water...". The total effect of all these has been to make African surface, fragile and easily susceptible to vegetation and soil deterioration. Holdgate *et al.* (1982) estimated that the land of 1,067,757 million hectares in Africa is affected by desertification.

2. Definitions

What is desertification? Historically, the word desertification was first used as a terminology by a French scholar who was working in the humid tropical Africa in 1949 when **A. Aubreville**, published his book "Climats, Fôrets et Dêsertification de l'Afrique Tropicale" . He defined desertification to mean-*the changing or transformation of productive land into a desert through soil erosion caused by man.* As he recorded it, man caused soil erosion by:—

(1) indiscriminate tree felling,
(2) use of fire (widespread burning) and
(3) through cultivation methods.

From 1949 to 1974, desertification, as defined to us by Aubreville, seems to have continued with very limited containment, until the process as it were, got out of hand and had to receive international press coverage following the catastrophic Sahelian famine which ravaged the Sahelian countries between 1968 to 1974. On the spot investigations to find out why *the Sahelian countries of Senegal, Mauritania, Mali, Niger and Chad,* in particular could not produce enough food to feed their inhabitants, it was clearly shown that in the preceding years, their human numbers had increased as did their livestock (due to good rainfall they had enjoyed prior to 1968). Estimates vary, but it is generally agreed that the Sahelian population by 1968, was around 20 million people and 11 million cattle (small stock was as many as 40 million). The ensuing drought claimed between 100,000-250,000 people and at least half of the livestock.

The Desertification Conference (Nairobi, 1977)

The international community was concerned that the deaths just described above should not be repeated. It was realised that the Sahelian countries could not produce enough food because their agricultural lands had been severely degraded into deserts. In other words, the desert fringe had encroached by spreading further south. The General Assembly of the United Nations had empowered the Secretary General in December, 1974, to prepare for the convening of a special meeting *to examine the causes of desert encroachment and find remedial measures.* This was the basic purpose for the meeting which was eventually held in my country from 29th August to 9th September 1977. Most nations had come with their national position papers of evidence of desertification in their countries and how they thought it could be stopped. The Secretary-General had also invited experts to prepare background information for the help of members assembled.

What is desertification?

Can one improve on Aubreville's definition? Not really. May be only an elaboration and use different semantics. In 1982, defined it by these words:—

Desertification is the improverishment of terrestrial ecosystem through the impact of human activities. It is the process of deterioration in the ecosystems. It results in reduced productivity of the affected ecosystem.

How can one diagnose that an ecosystem is undergoing desertification?

The deterioration can be noticed through reduced productivity of desirable plants and by negative alterations in the biomass; by the reduction in the divertsity of the macro fauna and flora; by accelerated soil erosion; and increased hazards for human occupancy. It means the destruction of good land by the creation of destructive erosion channels and the productin of a rugged terrain mainly by water and wind erosion. It is the outcome of a process of vegetation and soil deterioration. Other scholars, *e.g.* U.N. Conference (1977), Ibrahim *et al.* (1982), Eckholm (1984) have rightly stressed that in marginal lands in particular, but also in other parts of the world, the process affects the water balance and the ensuing ecological stress triggers off a series of harmful socio-economic consequences of which drought and famine are the most obvious.

The process of desertification

The process of desertification can therefore be perceived as: the encroachment of desert ecosystem into areas hitherto productive however marginally. This implies environmental deterioration-that is, an upset of the pre-existing ecosystem which can range from tropical humid forest to semi-desert scrubland. The moment the average net productivity of that *environments' dry matter or living phytomass is reduced below the normal yield,* then the decline could be because desertification has set in. Once it sets in, it easily spreads because the process is dynamic, feeds on itself and is at work in most lands undergoing degradation. In tropical forests, fire is the primary agent.

3. Differences between Desertification, Drought and Famine

Drought is commonly defined as a temporary drop in expected amount of rainfall for an area. Usually it results in decline in water and food productivity in the area for both man and livestock. In the tropics, it is associated with high temperatures and dry air. When it is so and man has not made provision for appropriate adjustment, famine (starvation, due to shortage of water, grazing land and human food for consumption) sets in and can reach serious proportions depending on the magnitude and length of the rain failure.

The above view differentiates clearly the differences between these three terms. However, these shortages (of water and food) can also come as the result of decline in land productivity, or due to inadequate food because production has not expanded rapidly enough to match increase in human or livestock numbers, or because of lack of new areas to absorb increase in population. In particular, it demonstrates lack of administrative adjustment to the hazard. Overgrazing comes when land is grazed beyond its carrying capacity. Bad cultivation is important especially when man extends cultivation into marginal lands. This allows wind erosion to set in and reduces grazing areas so causing overgrazing. It is these inappropriate uses of land by man, which causes desertification. If during a year of severe drought, man and livestock, over harvest land already in severe stress, then ideal conditions for rapid desertification is created. This was the situation during the 1984 drought over much of Africa. Fortunately, the rains for 1985 were good. So desertification, drought and famine, are interelated. The trio commonly co-exist with desertification living on drought and famine. Recurrent droughts and increasing demands on land by man for increased food production using inappropriate techniques, accentuates desertification. Desertification is a dynamic process which spreads imperceptibly, and if not checked before critical threshold is reached, can be irreversible.

4. Causes of Desertificaton

Let us now attempt to enumerate the main causes, if only to help us see the dynamic and interelated nature of the process. These are:

(1) Excessive human pressure on land. That is population increase without alternative source of livelihood other than the land in the traditional sense.
(2) Overgrazing-from livestock (domesticated and wildlife).
(3) Deforestation-for fuelwood, cultivation space, timber, fencing materials, settlements and lopping of trees for fodder.
(4) Extention of agriculture and uncontrolled settlements in marginal lands.
(5) Lack of water from over-harvesting of existing sources especially in marginal areas.
(6) Improper revegetation and inadequate Forest Laws in most countries.
(7) Lack of adequate environmental awareness.
(8) Lack of education.
(9) Inacceptable standards of civil engineering and other building works in most work

sites.

(10) Lack of protection of water catchments, river banks and steep and unstable slopes from cultivation and clearance.

(11) Unnecessary burning and other bushfires which destroy forage and vegetation.

(12) Lack of maintenance of many large/small engineering works such as water dams.

(13) Lack of comprehensive national land utilization policies including human settlements.

5. Land Use and Land Management in Africa

(1) The traditional uncontrolled grazing that typified the mode of living in Africa since the turn of the present century is now obsolete. It could not cope with increasing population and with modern governmental structures. For example, in Kenya the Gabbra, the Borana, the Turkana and the Masai moved almost without control into Ethiopia, Somalia, Sudan and Tanganyika. The people had little cause to recognise territorial rights of modern governments. They were in their own "grazing territories" and even today, some are not convinced that times have changed. Famine and land degradation has worsened on them since their grazing territories (domains) have shrunk with the establishments of the new administrative arrangements. In short, the traditional grazing methods where non milking cattle (*fora* herds) would be matched long distances in search of pasture, or temporary homes (*manyattas*) moved at the dictate of climate are no longer possible.

(2) In modern technology, Africa faces another dilemma. Dams for water and hydroelectric power, are constructed by engineering firms without due regard to environmental protection or siltation control. Dams planned to last say 50-80 years are now not given more than half their livespans due to rapid siltation. Many are therefore not economical undertakings. Similarly, road construction and road cuttings are left unprotected from soil erosion and soon become major sources for soil erosion.

(3) The unsupervised use of the tractor in large-scale agriculture has had almost similar dangers in accelerating soil erosion over many parts of the continent. It encourages wind and water erosion.

6. Population and Desertification

It is common to read that population increase in Africa is a cause of desertification. This view is hardly consistant with the fact that the population density of the continent is only around 12 persons/km^2. What then is the basis of this assertion? Africa is still primarily agricultural in its resource base since only 4 or so states have discovered minerals and are industrializing fairly rapidly. For most countries in Africa, the increasing population ends up needing more land to cultivate, more trees to cut for

fuelwood and other domestic needs. Lack of industrial and commercial developments mean a high rate of unemployment. This last point mean that the majority of people are in rural areas where their lifestyles are traditional peasants relying heavily on land for livelihood. The governments have to try and export the little they can to get in order to earn foreign exchange which must be used to import much needed machinery, mineral fuels, manufactured goods, chemicals, *etc*. Little revenue is therefore left to be used in developing and in providing the needs of the growing population. It is in the above context that the population of Africa is seen as growing faster than their economics can provide for.

7. Some Examples of Desertification from African Countries

Lesotho

This land-locked small country in southern Africa is very severely desertified through overgrazing by sheep, cattle and goats, population pressure and cultivation. Urgent corrective measures are necessary.

Swaziland

Another small land-locked state in southern Africa. Parts of southwestern areas are badly desertified through (mainly) overgrazing.

Tanzania

Population pressure (from both man and animal) is causing moderate to high land degradation. Christiansson (1972) and Darkoh (1982) estimate that some 45% of the country is already affected and another 35% threatened. The semi-arid areas of Sukumaland, Sindiga, Gogoland and Masai steppe are most affected.

Elsewhere, near the northern town of Arusha, Murray-Rust (1972), has shown how ill-planned Kisongo Reservoir, in grazing area built in 1960, was rapidly silted through sheet and gully erosion. The dam had original capacity of 121,000 m^3. In 9 years this capacity was reduced to 69% and further reduced to 59.2% of its original capacity by 1971.

Sudan

Here studies especially by Bakhit and Ibrahim (1982) have shown that overpopulation necessiting millet cultivation, and tree cutting for various domestic needs are the main causes of desertification. Ibrahim (1978) shows that each household in a settled situation uses about 200 trees or bushes a year. They show that the introduction of cultivation in the 450-650 mm rainbelt has greatly accelerated desertification in this belt of Western Sudan.

Ethiopia

The experience is the same as Sudan but aggravated by lack of political stability due to cessessionist activities in its marginal areas.

Uganda

Which is otherwise the 'pearl of Africa' has witnessed large-scale destruction of her forests to the detriment of her environment. Again, this is blamable to her rather rapid population growth.

8. Kenya

The country is also threatened by desertification especially in its grazing marginal lands which cover 85% of the country. Worst hit are the Kerio Valley Development Authority areas, much of Eastern and North Kenya and Kajiado areas of South Kenya. Serious sedimentation in man-made dams especially along Tana River threatens the usefulness of these hydroelectric projects. The natural vegetation shows the dictates of climate (Fig. 3).

National efforts to combat desertification

They include the recent creation of Presidential Commission on Soil Erosion and Afforestation. The starting of a tree nursery in every district and the designation of May Day, as a national tree planting day. Thirdly, the local agricultural extention officers are to be more active in encouraging proper agricultural practices.

International activities

UNESCO's Integrated Project on Arid Lands (IPAL and now, KALRES) started in 1976 as a pilot project of research, training and demonstration. Its primary task was to find direct solutions to the more urgent environmental problems associated with desert encroachment and ecological degradation of arid lands. It was then to develop new strategies for pastoral land management and regional development. It is part of UNESCO's MAB programme. This programme's task is to find scientific management principles to the environment and to use these findings to improve living conditions of the people.

Area of concentration of IPAL's work

Western Marsabit—occupied by the Rendille, the Gabbra, the Borana and partly into parts of Samburu and Turkana people of North Kenya. Since mid-1980, it has been funded by funds in trust to UNESCO by the Federal Republic of Germany (FRG) Government besides Kenya Government's small contribution.

It has concentrated its research on:

(1) Human ecology component — to ascertain the peoples perception of their needs and aspirations.
(2) Physical environment component — climate and hydrology, surface and ground. water.
(3) Vegetation component—rangeland and woodland ecology.
(4) Animal ecology component — introduction of integrated approaches to pastoral management.

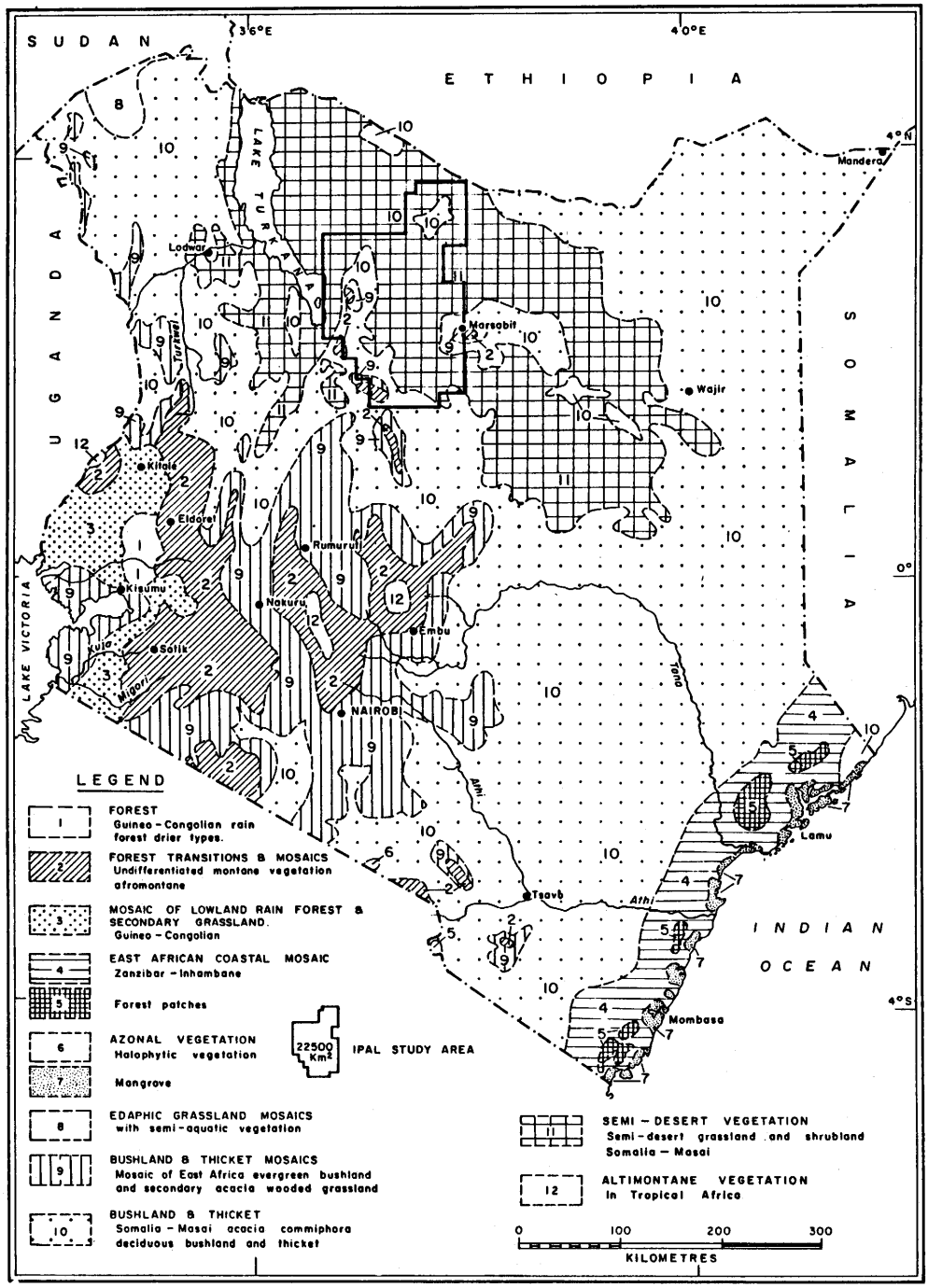

Fig. 3 Vegetation map of Kenya.
(Source: Vegetation Map of Africa Scale 1: 5M. UNESCO, 1981).

(5) Education, training and extension component.

Progress made by IPAL and its transformation into 'KALRES': Kenya Arid Lands Research Station

After working in Marsabit District for some years, UNESCO, the FRG Government and the Kenya Government agreed that the facilities already established by the project be transformed into a national research station for Kenya's arid zones. This gave birth to KALRES with its headquarters in Marsabit township. Its work has been appreciated by the people who feel that it could do more than it is currently capable of doing.

The main problems facing the new research station are financial support and manpower. Research in areas far from national headquaters tend to be costly and in the case of KALRES, this is aggravated by working in a difficult terrain requiring at all times, the use of 4-wheel drive vehicles. The station must be self equipped even with its own mechanics and aeroplane for rapid movement in case of need. It is therefore the hope of the current friends of KALRES that international support will be available for its formative years until the Government of Kenya can afford to go it alone. The station is already being used by other donor agencies to provide vital background information for their own work in the other districts in Kenya. In Turkana, it is assisting NORAD in this way while other adjoining districts would like it to extend its operations into their areas.

Food for work programme in arid Kenya

Following recent and periodic droughts due to bad weather and desertification, affected inhabitants who have had to be moved into famine relief camps are having to do productive work for food given to them. In Wamba (Samburu) and Turkana where the F.R. Germany and Norwegian Relief Programmes are working, the inhabitants are engaged in soil erosion control measures including the development of tree nurseries and tree planting. These efforts are proving useful and of much assistance in the general fight against desertification besides teaching the people the need for them to continue similar activities once they return to their original places of residence.

9. Consequences of Desertification

The main message has been clearly brought out in the preceding paragraphs. Desertification is a main threat to sustained productivity of the environment in most developing countries. In some countries urgent control measures are necessary so that irreversible damage is to be avoided.

Many countries affected will not be able to feed their rapidly growing populations. The great need for most countries so threatened is well-formulated integrated development plans affecting all aspects of their systems-land, settlement, population, water management and agriculture to mention only a few main ones.

10. Some Conclusions

(1) Desertification is not confined to marginal and arid and semi-arid lands alone. Bad land use enables it to spread imperceptively from any nucleus.

(2) Desertification can only be contained through all round ecologically sound land management. Commonly, this requires transnational action.

(3) The main cause of desertification in Africa is increased human demands on available land. The solution to this lies in industrialization and better land use.

(4) Environmental education appears can help in the fight against the menace. This is still largely absent over much of the face of Africa.

(5) Many African countries must find urgently alternatives to fuelwood and charcoal. No country can advance if its main energy source is fuelwood.

(6) Scientific studies the type already achieved or being supported by UNESCO in Northern Kenya's IPAL deserve the support of the international community of the living standards of the local pastoralists are to be improved. Support here will include training of local scientists who must be encouraged and made to return and serve their countries after their training. Such research stations will also continue to need logistic support.

(7) I have deliberately not examined irrigation and desertification, as this aspect is not so appropriate for this paper but certainly a note must be made of soil salinization and other environmental complication that come to light in arid zone irrigation works.

Acknowledgements

This paper is based on my lectures given at Graduate School of Environmental Science, Hokkaido University, Sapporo and the 6th Regular Meeting of the Arid Zone Research Group of the Association of Japanese Geographers, Tokyo when I was invited to visit Japan by the Grant-in-Aid for Overseas Scientific Survey of the Ministry of Education, Science and Culture, the Government of Japan, under Grant No. 60043004 (Head Investigator: Prof. H. Kadomura, Hokkaido University). I wish to record my gratitude to the Government of Japan and academic colleagues concerned.

I wish to dedicate this paper to Professor Hiroshi Toya, who made pioneer geomorphological studies in Kenya's arid lands in the 1960s, in commemoration of his retirement from Tokyo Metropolitan University.

Selected Bibliography

Allen, J.C. and Barnes, D.F. (1985): The causes of deforestation in developing countries. *Ann. Assoc. Amer. Geogr.*, **75**, 163-184.

Bankhit, A. and Ibrahim, F.N. (1982): Geomorphological aspects of the process of desertification in Western Sudan. *GeoJournal*, **6**, 19-24.

Biswas, M.R. and Biswas, A.K. (1980): *Desertification*. Pergamon, Oxford, 523p.
Christiansson, C. (1972): Notes on morphology and soil erosion in Kondoa and Singida Districts, Central Tanzania. *Geogr. Ann.*, **54A**, 3-4, 319-324.
Darkoh, M.B.K. (1982): Population expansion and desertification in Tanzania. *Desertification Control*, 8, 26-33.
Dunne, T. (1979): Sediment yield and landuse in tropical catchments. *J. Hydro.*, **42**, 281-300.
Eckholm, E. (1984): Poverty, population growth and desertification. *Desertification Control*, **10**, 37-41.
Faure, H. and Gac, Y. (1981): Will Sahelian drought end 1985? *Nature*, **291**, 475-478.
Grove, A.T. (1977): Desertification in the African environment. In Balby, D., Church, R.J.H. and Bezzaz, F. (eds.): *Drought in Africa*, International African Institute, 54-64.
Hamilton, A.C. (1984): *Deforestation in Uganda*. Oxford Univ. Press, Nairobi, 92p.
Heathcote, R.L. (ed.) *Perception of Desertification*. UNU Publ., 134p.
Holdgate, M.W., Kassas, M. and White, G.F. (1982): World environmental trends between 1972 and 1982. *Environmental Conservation*, **9**, 11-29.
Ibrahim, F.N. (1978): Anthropogenic causes of desertification in Western Sudan. *GeoJournal*, **2**, 243-254.
——(1982): The role of women peasants in the process of desertification. *GeoJournal*, **6**, 25-30.
——(1983): The role of nomadism in the process of desertification in Western Sudan. In *Applied Geography and Development*, **22**, Georg. Hauser, Metzingen, 46-57.
Mabbutt, J.A. and Wilson, A. (eds.) (1980): *Social and Environmental Aspects of Desertification. Proc. of an Inter-Congress Meetings of the IGU Working Group on Desertification in and around Arid Lands, Tucson, Arizona, USA, 3-8, 1979*, UNU Publ., 40p.
Murray-Rust, D.H. (1972): Soil erosion and reservoir sedimentation in a grazing area west of Arusha, Northern Tanzania. *Geogr. Ann.*, **54A**, 3-4, 325-343.
Ojany, F.F. (1982): Desertification in Kenya. *The Kenyan Geographer*, **4**, 1-12.
Pereira, H.C. (1967): Effects of landuse on the water and energy budgets of tropical watersheds. In Sopper, W.E. and Lull, H.W. (eds.): *Intern. Symp. on Forest Hydrology*, Pergamon, Oxford, 435-450.
Potter, G.H.W.E., Ellsaesser, H.W., MacCracken, M.C. and Luther, F.M. (1975): Possible climate impact of tropical deforestation. *Nature*, **258**, 697-698.
Sagan, C., Toon, O.B. and Pollack, J.B. (1979): Anthropogenic albedo changes and the earth's climate. *Science*, **206**, 1363-1368.
Tucker, J.C., Townshend, L.R.G. and Goff, T.E. (1985): African land-cover, using satellite data. *Science*, **227**, 369-375.
UN Conference on Desertification (1977): *Desertification: Its Causes and Consequences*. Pergamon, Oxford, 448p.
UNESCO-MAB/Integrated Project in Arid Lands (1976-): Various publications available from UNESCO Regional Office for Africa (Nairobi).
Verstappen, H.Th. (1983): *Applied Geomorphology*. Elsevier, Amsterdam, 437p.
Whyte, R.O. (1974): *Tropical Grazing Lands: Communities and Constituent Species*. Junk, The Hague, 220p.
WMO-Regional Office for Africa (1985): Newsletter No.1.
Wood, C.A. and Lovett, R.R. (1974): Drought and solar cycle. *Nature*, **251**, 594-596.