

276



Desertification Control Bulletin

United Nations Environment Programme

Number 25, 1994



Fixation of sands in a desertified area by the planting of Eurotia ceratoides. Kalmykia, the Russian Federation. (Photo: L. Kroumkatchev, UNEP)

TECHNICAL SECTION

Summary of the 5th Substantive Session of the Intergovernmental Negotiating Committee for the Elaboration of an International Convention to Combat Desertification*	1
Draft Resolution on Urgent Action for Africa	15
UN General Assembly Highlights:	
Convention to Combat Desertification	17
Drylands, People and Desertification Control - UNEP Looks Ahead* By Franklin Cardy	18
Population, Environment and Sustainable Development: Desertification in Africa* M.B.K. Darkoh	20
Soil Erosion and Desertification as a Consequence of Farmland Abandonment in Mountain Areas José M. García-Ruiz, Teodoro Lasanta, Purificación Ruiz-Flano, Carlos Martí, Luis Ortigosa & Constanza González	27

Multitemporal Satellite Image Analysis for Monitoring Human Encroachment on Forest Reserves By Patrick Mushove	34
Methods applied for recording desertification and their results from the Sahel region of the Republic of Sudan Mariam Akhtar and Prof. Dr. Horst Georg Mensching and Immelyn Domnick	40

REGIONAL COOPERATION

Land Degradation in East Africa* By Michael Stähl	48
New Evidence of Desertification from Case Studies in Northern Burkina Faso* Sven Lindqvist and Anna Tengberg	54
Survey of Research into Improving Salt Resistance of Acacia species of Djibouti L.Bray and M.N. Di Michele	61
NEWS FROM UNEP	67
NEWS OF INTEREST	72

Cover: Land rehabilitation through the planting of tree seedlings and grasses on contour bunds which are designed to harvest runoff rainwater in Baringo District, Kenya. (Photo: Daniel Stiles)

Population, Environment and Sustainable Development: Desertification in Africa*

Paper presented at the Round Table Conference on Population, Environment and Sustainable Development at the International Academy of the Environment, Geneva, Switzerland, 24 - 26 November 1993

M.B.K. Darkoh,

*Ph.D.
Professor and Chair of Geography,
University of Papua New Guinea*

Concept and definition

Despite the different definitions and contentions about what is desertification as reflected in the works of individuals and international organisations in the past, I think the world development community has now reached a consensus on what is a much more composite or comprehensive definition, which can provide an adequate basis for analysis of the problem and possibly the development of appropriate and effective mitigating policies. I dare, therefore, suggest that the forum accept for operational purposes the latest internationally negotiated definition of desertification adopted by the UN Conference on Environment and Development (UNCED) which says that:

⊕ “Desertification is land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors including climatic variations and human activities.”

The inescapable fact is that desertification is caused by the interactions of climate and human abuse or misuse of the environment. Thus, while focusing our attention at this round table on population or the human side of the problem, it is important that we do not lose sight of the other (the physical). The more so, because the purpose of our meeting is to respond to the many calls in *Agenda 21* for more policy relevant knowledge about the relationship between environment and sustainable development, of which the demographic factor of course, constitutes only one, albeit a very important variable in the equation. It is surprising that the Report before us overlooks this consensual definition.

Emerging from our accepting this definition of desertification as land degradation in drylands for whatever reason, I would like, for operational purposes, to point out that the drylands in Africa face three major environmental predicaments:

(1) unpredictable and at times severe drought. I use the term drought here to refer to short-term (1-2 years) deficits in rainfall which can generally be accommodated by existing ecological, technical and social strategies. (2) desiccation or aridification due to chronic drought. I use the term desiccation here to refer to longer-term (i.e. decadal order) deficits in rainfall which seriously disrupt ecological and social patterns and which require national and global responses. I would like to stress that it does not, however, necessarily follow that drought and desiccation, by themselves, will give rise to desertification in dry-land areas. Much depends on the nature of the resource management in these areas. When human misuse (mismanagement) of land weakens the natural system, drought and desiccation often lead to desertification. (3) dry-land degradation brought about mainly by inappropriate land use. Dry-land degradation manifests itself in the slow secular decline in productivity of the land through such human mismanagement as overcultivation, overgrazing, deforestation and poor irrigation practices.

*This article is this author's commentary on "Issues in Sustainable Development : Population, Poverty, and the Environment" Publication No. R11 of the International Academy of the Environment, Geneva, Switzerland a report prepared by Mary Barberis in October 1993 for the Round table discussion on Population, Environment and Sustainable Development.

Although the three problems overlap on the ground, their discrimination is important for the development of appropriate and effective policies. In assessing the linkages between population, poverty, environment and sustainable development, however, I presume, it is the third aspect of these three environmental predicaments that will be our principal focus.

Extent of the problem of desertification

Even more surprising is the lack of information in the Report before us on the latest data sets on the extent of desertification in Africa. Perhaps, it may not be out of place (and this is only a minor criticism) to point out that the Report limits its documentation to only one principal source i.e. World Bank Reports - occasionally and randomly making mention also of others such as IIED and FAO reports, and almost completely ignoring the tremendous and generally useful work done by UNEP and UNSO on desertification.

However, thanks to the resolute efforts of these two international organisations, we now have what can be regarded as more precise data not only on the extent of the drylands in Africa (and the rest of the world) but also on the status and trends of desertification. In 1990-91, in accordance with the provisions of the UN General Assembly resolution 44/172 of December 1989, UNEP carried out a new assessment of the status of desertification and a new world map of drylands was prepared by the GEMS/GRID Programme Activity Centre of UNEP in 1991. The new data is regarded as more precise because they are based on time-dependent climate data selected by rigorous criteria.

According to these new data, drylands in Africa comprise 1959 million ha or 65 per cent of the continent and 32 per cent of the world's drylands. One third of this area is hyper-arid (762 million ha) and uninhabited (except at oases), where by definition, desertification is ruled out since the area is already a desert. The remaining two thirds or 1,287 million ha com-

prise the arid (504 million ha) semi-arid (514 million ha) and dry sub-humid (269 million ha) areas. These latter three sub-areas are commonly referred to by the acronym ASAL (Arid and Semi-Arid Lands). Nearly 400 million people (two thirds of all Africans) live in this ASAL, currently the most densely peopled part of the continent.

Again, from the 1991 assessment of the status of desertification, we now know that the total area of agriculturally used drylands in Africa is 1432.59 million ha of which 1045.84 million ha or 73 per cent is presently degraded at a moderate or high degree.

The extent of desertification in Africa on the basis of the three principal land use categories of irrigated lands, rainfed croplands and rangelands, according to UNEP, is as follows:

Irrigated Lands			Rainfed Croplands			Rangelands		
Total	Degraded		Total	Degraded		Total	Degraded	
m. ha	m. ha	%	m. ha	m. ha	%	m. ha	m. ha	%
10.42	1.90	18	79.82	48.86	61	1342.35	995.08	74

Source: UNEP (1992) Status of Desertification and Implementations of United Nations Plan of Action to Combat Desertification, Report of the Executive Director, Nairobi, UNEP, p.81.

Human population

The Report also does quite a good job of analysing the relationship between population growth and land degradation, and it quite correctly says that there is a general consensus among development experts that rapidly growing poor rural populations are being increasingly forced by circumstances to degrade the environment. It does not, however, sufficiently bring out the fact, which some have found in the field, that population growth is not itself directly related to degradation, but is an important (albeit very important) component in a mix of factors that include drought, desiccation, poverty, powerlessness, inappropriate agricultural policies and ineffective land laws (UNSO 1992). The same applies to the connection between land degradation and population density. It is seldom direct or clear

cut. And as it correctly documents from studies by Mortimore, there are certain large concentrations of people in the Sudano-Sahelian area, notably around cities like Kano where degradation is not acute. In such instances, perhaps, more people means more labour to till and protect the land. While population density may be one cause of land degradation, it is rarely the primary one and like rapid population growth, is never the only one.

Migration

People in the ASAL lands of Africa have strong traditions of migrations stretching back centuries. Migration often tends to reinforce the effects of natural population growth and population density. These

have important environmental implications.

Migration generally takes three forms:

1. rural-urban migration i.e. migration caused by the urban pull.
2. rural-to-rural flows.
3. emigration - or the steady loss of labour especially of able bodied males, which is keenly felt in rural areas.

All three types are common in the ASAL. They are particularly pronounced in the Sudano-Sahelian countries.

In Kenya, my own work in 1990 in relation to the preparation of the Draft Environmental Action Plan for Sustainable Development in the ASAL for the World Bank and Kenya's Ministry of Land Reclamation and Regional and Water Development reveals three migratory trends in the ASAL: permanent immigration, temporary or seasonal emi-

gration and return migration. The first two are of particular importance to environmental issues in ASAL. Several factors influence these migration trends, including climate, security, tradition, availability of central services, famine relief, gainful employment in towns, irrigation schemes and seasonal labour in high potential districts.

Permanent immigration in the ASAL

With high population densities in the high potential areas, more and more people are moving from these areas into the marginal zones in search of farming land and employment opportunities. Environmentally this is the most important form of migration as it is these immigrants who often cause land pressure and import inappropriate technologies that lead to land degradation. They also disrupt the indigenous management systems which are based on appropriate and locally adapted technologies.

Sometimes, this permanent movement of population into the ASAL is part of a deliberate government policy of solving the population-resource problem by encouraging planned settlement and cultivation in the wetter margins of the arid and semi-arid lands, or irrigation schemes.

Seasonal emigration out of the ASAL

Another important migratory phenomenon in the ASAL is temporary out-migration of men in search of work. The reason for this migration is that most dryland farming and pastoralists households are unable to earn enough cash from herding and farming alone. This type of migration rate is higher in the mixed farming belt than it is in the areas where pastoralism prevails. In the ASAL, temporary out-migration increases sharply during drought years and falls in years of good rainfall. In years of adequate rainfall, many stay away for short periods of time while in drought years they may stay

away for up to six months or possibly more. Such migration is essentially a traditional drought-coping strategy and has positive implications for the environment.

Return migration

This mainly occurs when people return from the city to rural areas, for instance on retirement or when there are better opportunities for jobs or farming in the home district.

Land use conflicts

Permanent and seasonal migrations of populations within the ASAL, especially movement of farmers from the overpopulated adjacent high potential areas (where arable land is in short supply) to the arid and semi-arid lands seems, on the basis of the evidence I have gathered from fieldwork all over Kenya and Tanzania, the main threat to the environment in the ASAL. It is giving rise to land use conflicts. These conflicts arise as a result of intrusion of agriculture into lands traditionally used for domestic stock. Partly because of a lack of coordinated national land use policies for ASALs, there is competition for resource use between the various production sectors. The major contenders are agriculture, livestock, wildlife and settlements. Often the weakest sector - pastoralism bears the brunt of this fierce competition for resource use, consequently becoming increasingly marginalised.

The conflicts are especially intense in the key production areas within the ASAL. These are the riverine forests along the main water courses, the natural forests, swamps and hilly areas. The dynamics of the conflict in these key production areas which are currently some of the most threatened marginal productive lands within the ASAL need to be investigated thoroughly in order to devise policies and strategies for their rehabilitation.

Other conflicts relate to the seasonal movement of wildlife or what has been called wildlife dispersal corridor conflicts. In Kenya, for instance, between 65 and 80 per cent of wildlife live outside the parks.

Many wild animals migrate during the wet season out of the parks and tend to concentrate within them in the dry season, using them as dry season water and range reserves. The major conflict outside the park boundaries by free roaming animals is with agriculture. Major problems relate to the destruction of crops by the trampling of elephants, buffalo and wildebeest. Conflicts also arise because of predations of livestock by wild animals such as hyenas, leopards, lions and jackals as well as the transmission of diseases.

Refugees:

Another special kind of population movement has recently emerged: the large movement of refugees has been triggered by war, drought, desiccation and dryland degradation in the last two decades. The heaviest burdens are felt near the international borders with countries in which there are civil wars - Sudan, Djibouti, Ethiopia, Guinea, Somalia, Kenya, Tanzania, Rwanda, Burundi and Cameroon are particularly heavily burdened. Refugees have had considerable negative impacts on the environment as in parts of the Sudan and Tanzania. In Africa we are still not clear whether the "refugee problem" is simply a manifestation of otherwise underlying conflicts over resource access and use. One of the priority areas for policy relevant research is the refugee-environmental degradation nexus.

Population and degradation

Is the understanding of the interlinkages among population, poverty, environment and sustainable development sufficient for purposes of policy formulation and implementation?

In my view, from the background document and from my own research findings, the following seem pertinent (1) The first and most striking feature of the ASAL's social structure is continued rapid population growth. There is wide agreement, despite the inadequacy of the data

base that the high rates of growth are real and arise principally as a result of the huge gulfs between crude birth rates and death rates and the effects of migration and other factors. It also appears that these high growth rates will continue for some time. Increases in population size have been projected to rise for at least another two decades.

The rapid population growth is a development problem for several reasons. First, it exacerbates the difficult choice between higher standards of living now and the investment needed to bring higher standards of living in the future (Clausen 1984). Second, in many countries, increases in population threaten what is already a precarious balance between natural resources and people. Continuing large increases in population can contribute to overuse of limited natural resources such as land for agriculture, and fuel wood, mortgaging the welfare of future generations.

Third, rapid population growth is creating urban economic and social problems that risk becoming wholly unmanageable. Fourth, with rapid increases in population growth, more and more people are swelling the ranks of the poor in both rural and urban areas. The number of people below the poverty line in sub-Saharan Africa in 1985 was 184 million. This is projected by the World Bank to increase to 304 million in the year 2000, an inexorable expansion of the number of human beings condemned to lives of deprivation and desperation.

The World Bank has further estimated that by the end of the decade about one quarter of the world's poor will live in sub-Saharan Africa. Fifth, growing population means shortening of fallow cycles and the need to deal with more destitution during droughts. More mouths to feed especially after drought and desiccation, and more people to consult, can only bring problems to those who are responsible for welfare (UNSO 1992). Finally, population growth increases the demand for goods and services and if practices remain unchanged, implies increased environmental damage.

The relationship between population density and land degradation as we have already indicated is not that straight forward, and perhaps more research work is

needed to establish the precise relationship. Similarly, although increasingly much is now known about population movement and resulting population pressures on natural resources, further research work is needed in these two areas as well. Research is needed to assess the dynamics and impact of population movement and resettlement on the carrying capacity of arid lands.

An intriguing question related to this issue of population movement and resettlement is why migrants in ASAL cling to imported habits and practices that they themselves know are sometimes harmful and not suited to ASAL environments. Only social science research can provide the answer to this question.

Impact on agriculture (Crop Production)

The relationship between population growth and productivity increase in agriculture has been adequately brought out in the Report. The slow growth in agricultural production in relation to population growth would seem to suggest some Malthusian and Von Thunian scenarios in play: population expanding beyond the capacity of the land to support it; and expanding onto the poorer land, giving lower returns per hectare for labour and other investments and probably more degradation and susceptibility to drought.

An important factor not discussed in the Report is the relationship between cash cropping and food cropping. It would be interesting to note how cash crops combine with population growth to encourage farmers to overcultivate the declining areas reserved for food or to cultivate them poorly and at the wrong time or to neglect them and how these relate to land degradation and hunger. It will also be interesting to see how the land squeeze works on an individual's plot and at national levels.

Rangeland degradation Fuelwood supply

The Report partially portrays the state of our present knowledge on animal population and rangeland degradation. How-

ever, in recent years some significant paradigmatic changes have occurred in the discipline of range science with regard to overgrazing and the carrying capacity of rangeland in arid and semi-arid areas, which have not been sufficiently portrayed.

The new paradigm in range science suggests that the problem is not just one of too many animals relative to available grazing areas but that the state of the rangeland ecosystems in arid and semi-arid areas has more to do with the highly irregular supply of rainfall than anything else.

The new paradigm suggests that "overgrazing" or extensive grazing systems have been greatly overestimated as an environmental problem. Seven reasons are given according to UNSO (1992). First, herds seldom reach carrying capacity between droughts. Second, rarely can enough stock be kept over the dry season to damage wet-season pastures. Third, it is hard to measure "carrying capacity" where pastoralists are constantly moving between many different types of rangeland. Fourth, herds usually recover quickly after droughts, suggesting that there has been little long-term damage to the range. Fifth, herds have continued to increase over many decades despite repeated claims of overgrazing. Sixth, where earlier range scientists saw extreme damage to the grazing lands around watering points, recent studies show that pressure can be improved in these areas as nutrients are brought in by cattle from surrounding rangeland. Seventh, many pastoral communities have been shown to have developed methods for managing the range.

The new paradigm would seem to point towards policy makers looking in other directions such as drought preparedness, early warning systems, insurance schemes and other measures of contingency planning rather than to destocking as a solution to the desertification problem in rangelands.

Fuelwood cutting can have some of the most serious, though localised, effects on dry-land degradation in certain areas, es-

pecially in urban centres where considerable amounts of charcoal is used. Fuelwood and charcoal are a critical resource for the poor. They are the cheapest available fuels per ton and per unit of heat and they are used extensively if not exclusively to provide energy for cooking, heating and light. The poor compete for fuelwood with richer urban users who demand charcoal-grilled meat, baked bread, beer and the like, all dependent on wood. UNSO (1992) has noted that in purely rural macrocosm, with dispersed settlements, fuelwood seldom has been a great problem. My own research in East Africa has revealed that except in some highly localised or highly populated rural areas like the Ethiopian Highlands and some parts of central Tanzania, little evidence exists to suggest that rural household energy consumption is responsible for large scale deforestation. Mounting evidence from all over the ASAL seem to point out that it is rather the urban demand, usually for charcoal, that leads to the wholesale cutting down of forests. The commodity status of charcoal makes it an attractive choice for entrepreneurs who can derive incomes from its production and distribution.

Intense wood cutting causes the severest form of land degradation near urban areas. The effects of wood cutting around cities include fuelwood scarcity and ever longer journeys made and man-hours spent on the quest for wood supplies, often by women and children. The need for woodfuel and land for cultivation, however, poses a real threat to the remaining areas of forest lands, especially the riverine forests within the ASAL.

Need for policy-oriented research and development options

It is quite clear that population is a critical factor in desertification in Africa. While

we must concede that a lot is now known about population trends and dynamics and how these relate to land use pressures, there are still definite gaps in our knowledge of how population interacts with other variables to have a detrimental impact on the environment and natural resources.

The other variables can be classified as both internal and external. Among the internal factors are absence of political stability, civil wars, illiteracy, failure to work out priorities, national policies, growing poverty, landlessness, lack of appropriate technology, natural and man-made disasters such as drought, dessication, disease, and famine; poor rural infrastructure, subsidies and pricing policies; inadequate and ineffective agricultural support services, lack of managerial and financial skills.

Among the external factors are the lack of new credit, mounting national debts, and debt servicing burdens, adverse terms of trade; falling commodity prices; the IMF's conditionalities and the World Bank's structural adjustment policies, depression of prices and quota systems of purchase of primary produce; and the unequal economic relations that the North imposes on these ASAL countries of Africa.

To a certain degree desertification is associated with human population and human activity. Indeed one could argue that one force behind desertification is the social transformation produced by development. Modernisation and population growth in Africa have been putting increasing pressure on available land and other natural resources. The result has been a major transition from traditional to modern patterns of livelihood. We are still not very clear on how change causes deviation from normal mechanisms of resource utilisation and the resulting impacts such changes have on the environment.

An example of needed research initiatives : community management of natural resources ¹

After decades of abortive efforts to develop the ASAL it is being realised today that sustainable natural resource management and utilisation are critically dependent upon the ability of local communities to control the resources from which they derive their livelihood. The local people do not only have the useful local knowledge of their environment but have sound management strategies that enable them to survive in a region with extreme climatic and, at times erratic water supply; they also have a vested interest in conserving their local resources for sustainable use. The recognition of these facts has supported the idea of decentralising authority over natural resource management.

At the same time, some African governments seem to have entered a phase in which their political penchant for highly centralised authority and often autocratic rule, is being eroded. As perceived stability and security needs are diminishing, with independence being consolidated and national identity forming, and as political conditionality (the linking of development assistance to political liberalisation) is taking hold, these countries are moving towards more democratic systems. The building of representative local government, a prerequisite for more decentralised approaches to natural resource management is becoming a priority in this context.

Efforts to devolve authority on natural resources management to local level institutions requires changes and adaptations in policy and practice on national and local levels. There must be in place research programmes that continually monitor and evaluate the new experi-

¹ This section is based on Krugmann (1992)

ments. We need answers to a host of questions in this connection.

For example, how best can local representative institutions be built to encourage effective participation of the local population? How can these institutions' capacity to manage natural resources be strengthened? What are the decision making processes that govern local use and management of natural resources, and how are they changing as a result of decentralisation? What are the roles of customary and statutory laws in regulating access and rights over resources at the local level and what resource tenure regimes are most suitable for facilitating equitable and sustainable resource management? How are they affected by markets and the cash economy? How can local resource management enhance the livelihood and development of communities and contribute to their empowerment (ability to articulate their needs and to influence the ways to satisfy them)?

These and related questions must be addressed in a variety of experiments, across different ecosystems as well as within socio-economic and political contexts.

Towards sustainable development : a personal perspective

Drought and land degradation/desertification have inflicted and continue to inflict tremendous loss of life and livelihoods on the people of Africa's drylands. The nature and scale of the problem facing the populations in these drylands are well known. In some countries oppression and armed conflicts make any efforts towards sustainable development an impossibility; in others the problems are not given priority by international and bilateral agencies because the countries concerned are strategically unimportant.

Climate change is now expected to make things worse for the people in the coming decades. There is probably little that can be done, by governments or anyone else to avert this climatic threat to our ecological and social fabric. With the essential support of the international com-

munity, however, the people of the drylands in Africa must find ways to deal with the problems, as they have done for many centuries with only their own resources.

Local communities cannot undertake the enormous task of resource rehabilitation and conservation without support from their governments and the international development community. External assistance is required to supplement local efforts and initiatives. It is important that such assistance should reinforce local efforts, enhance local capabilities, build upon local knowledge and skills and respect community priorities. Local people possess assets in the form of empirical knowledge of the individual elements of the ecosystem, of their inter-linkages, and of the way in which these relations change through time. The outsiders could do well first to identify and prioritize this local knowledge. Such knowledge can then be applied via farmer's participation in the design, testing and adaptation of appropriate technologies. Finally such knowledge can be efficiently shared via farmer-to-farmer or herder-to-herder technology transfer.

Local agricultural and pastoral production systems are the backbone of African food security. They are best adapted to local soils, resources and ecosystems. Contrary to common belief, many of these production systems have the potential to produce surpluses for market and can under appropriate stimuli feed the ever increasing population and also serve as the basis for environmentally sound development. If they are ignored, it is likely that food security will decrease and environmental degradation will continue. They can best be improved by building upon existing systems rather than trying to replace them and by merging the best aspects of traditional systems with the contributions of modern science. This presents a great challenge for development assistance.

Development assistance to enhance local agricultural and pastoral systems will need to:

- place a high priority on environmental, economic, social and institutional sustainability.
- it will need to accommodate the

diverse and flexible approaches typical of resource-poor agriculturalists and enhance their ability to handle risks.

- local participation, especially of women, would be an integral part of such a strategy and be one way to tap important local resources.
- it would need to account for the interacting ecological, social and economic components of low resource agriculture and improve the links between farms and external systems such as markets, extension systems and transportation networks (Horwith, 1989).

In any effort at improved land use and conservation of natural resources at the community level, one problem area would seem to be land tenure and property rights. The present situation in most ASAL countries in Africa in this respect is unsatisfactory and it is necessary to establish clear rules on the access, ownership and use of resources. Recent studies have shown that in marginally productive ecological zones such as the ASALs, common property regimes have intrinsic social, environmental and hence long-term economic advantages over private property arrangements. What is needed is understanding of all aspects of land use management within a group's territory. In some cases, it may require the formalisation or legislation and enforcement of traditional systems of land tenure and use. In other cases, individual title deeds may be necessary. Under some circumstances, it may even be necessary to evolve new property regimes and build new institutions to ensure their use.

Many environmental problems can easily be solved by adapting and applying existing traditional and customary laws and property rights to environmental protection and sustainable community resource management. Governments with support of international organisations and non-governmental organisations should look into the possibility of modernising, articulating and adapting traditional customary laws and property rights to sustainable resource management in the arid and semi-arid lands.

In conclusion, I personally hold the strong view that the knowledge and technology necessary for self-reliant liveli-

hoods, growth and sustainable development exists in the poverty-ridden rural communities in Africa. Non-utilisation of this potential results from a development bias created by the interaction between Africa and Europe through political, cultural and technological colonisation of the former. A reversal of attitudes by African elites and leaders to enable recognition of the values and potentials of their people and to use these as a focus for sustained development planning is urgently necessary.

References

- Barberis, Mary** 1993 *Issues in Sustainable Development: Population, Poverty and the Environment*, Final Report and Executive Summary, International Academy of the Environment, Geneva, Publication No. R. 11s
- Clausen, A.W.** 1984 *Population Growth and Economic and Social Development*, The World Bank, Washington D.C.
- Darkoh, Michael B.K.** 1993 *Desertification: the Scourge of Africa*, TIEMPO, Issue 8, pp.1-6.
- Darkoh, Michael B.K.** 1993 *Desertification: Its Human Cost in Africa*, Forum for Applied Research and Public Policy, (in press).
- Darkoh, Michael B.K.** 1993 *Towards Sustainable Development and Environmental Protection in African Drylands*, WHYDAH, African Academy of Sciences Newsletter, vol. 3, No. 3, pp 1-7.
- Darkoh, Michael B.K.** 1993 *Towards a Community Management of Natural Resources in the Drylands of Sub-Saharan Africa*, Paper presented at the International Conference on "Human Livelihoods in Drylands-Constraints and Possibilities", Organised by EPOS Environmental Policy and Society, Uppsala University Uppsala, Sweden, November 23-35, 1993.
- Darkoh, Michael B.K.** 1993 *Land degradation and Soil Conservation in Eastern and Southern Africa Sub-Region: A Research Agenda*, Desertification Control Bulletin, UNEP, No. 22, pp. 60-68.
- Darkoh, Michael B.K.** 1992 *Land Degradation and Resource Management in Kenya*, Desertification Control Bulletin, UNEP, No. 19, pp. 61-72.
- Darkoh, Michael B.K. edited** 1992 *African River Basins and Dryland Crises*, Uppsala University, Sweden.
- Darkoh, Michael B.K.** 1992 *Planning Arid Lands Development in Africa: Some Reflections from the Ringside*, in Security in African Drylands edited by Anders Hjort af Ornas, Uppsala University, Sweden, Chapter 3.
- Darkoh, Michael B.K.** 1991 *The Fuelwood Crisis in Kenya's Asal Resources*, A Journal of Sustainable Development in Africa, Vol.2, No. 2, pp.7-14.
- Darkoh, Michael B.K.** 1990 *Trends in Natural Resource Use and Prospects for Sustainable Resource Management in Kenya's Arid and Semi-Arid Lands*, Land Degradation and Rehabilitation, Vol. 2, pp. 177-190.
- Darkoh, Michael B.K.** 1989 *Combating Desertification in the Southern Africa Region*, UNEP, Nairobi and Moscow.
- Darkoh, Michael B.K.** 1987 *Population Expansion and Desertification in Tanzania*, Desertification Control Bulletin, UNEP, No.6, pp.26-63.
- Finkel, Moshe and Darkoh, Michael B.K.** 1991 *Sustaining the Arid and Semi-Arid (ASAL) Environment of Kenya Through Improved Pastoralism and Agriculture*. Journal of Eastern African Research and Development, Vol 21, pp.1-20.
- Finkel, Moshe and Darkoh, Michael B.K.** 1990 *Draft Environmental Action Plan for Sustainable Development of Kenya's Arid and Semi Arid Lands*. (Consultancy Report), The World Bank and Kenya's Ministry of Reclamation and Regional Development (formerly MRDASW).
- Horwith et al, B.J.** 1989 *The Role of Technology in Enhancing Low-Resource Agriculture in Africa*, Agriculture and Human Values, Vol. VI, No. 3, pp 68-84.
- Hartmut Krugmann,** 1992 *Regional Research Initiatives: IDRC's contribution*, Resources Vol.3, No.1, pp31-37.
- UNSO,** 1992 *Assessment of Desertification and Drought in the Sudano-Sahelian Region*, The United Nations Sudano-Sahelian Office, New York.
- UNEP,** 1992 *Status of Desertification and Implementation of the United Nations Plan of Action to Combat Desertification*, Report of the Executive Director, United Nations Environment Programme, UNEP/GCSS.111/3, Nairobi, Kenya.
- World Bank,** 1992 *World Development Report 1992: Development and Environment*, Oxford University Press.