

## Views on Environmental Problems—in East Africa

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Environment is the ambience that surrounds us. Environmental problems are those of men, posed to us by a variegated and variable world of nature, created by us through our interaction with the natural world, intensified for us by our growth in numbers, our desire to live together and our quest for technological ease and excellence.

### AN OVERVIEW

Environmental problems are nowhere more important than in Africa, but they little resemble the problems that served to initiate the 1972 United Nations Conference on the Human Environment. For in Africa, as in much of the developing world, and despite the inroads of technology, environmental problems for most men are those of the world of nature. In an era in which even the woes of mankind are bedecked in a certain glamour, it seems quaintly old-fashioned to remind our readers that the problems of Africa are still those of the rains that fail or wash the soil away, of the wildlife that destroys the harvest or of disease so endemic as to mock the very concept of being healthy.

To illustrate this we have compiled Table 1, a listing of environmental problems focusing on the resources to which they are related.

The perspective we adopt is that of professionals who are sympathetic with the national aspirations of the East African peoples. We interpret these aspirations as including: (a) an attitude for development broader than a desire for economic growth and one that considers that the ways in which development takes place may be as important as the ends it serves; (b) an emphasis on the overwhelming majority of the people of East Africa who live in rural areas, while recognizing the particular problems of the urban sector and the inevitable increasing significance of these problems; and (c) a strong tradition of ties to the land that emphasize the pragmatic use of land for human betterment but with close affinity and respect for the natural world.

Thus, the personal views that we espouse in this paper are our attempt to combine our best professional judgement with our perception of national aspirations. To this judgement, we bring a combined Eastern Africa experience and knowledge encompassing work in the Sudan, Uganda, Kenya,

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Tanzania and Zambia. For each problem listed in the table, we have provided qualitative estimates of various parameters: the importance of the problem, change in its direction and intensity, concern with it, and man's potential to affect or alter the problem.

In the table we suggest that the importance of a problem can be estimated as a function of the severity of its impact, the frequency of its recurrence and the extent to which the population is involved in effects of the problem. These estimates are crude but, nevertheless, revealing. One major problem, population growth appears to be a moderately severe, increasingly widespread problem, but in predominantly rural Eastern Africa, affects at most, but 5 per cent of the total population.<sup>1</sup> In contrast, endemic diseases such as chronic malnutrition, intestinal infections or malaria are severe, particularly to children, occur frequently, and the population at risk is most of the area's inhabitants.<sup>2</sup> Automobile accidents which average 50 times greater than American rates affect few, with a pernicious severity and selectivity of victims: mainly from the leaders, the educated and the skilled.<sup>3</sup> In further contrast, bird and insect damage, while widespread and frequent, is relatively light in the severity of individual losses.<sup>4</sup>

The direction and rate of change in the intensity of the problem is shown symbolically in the table. Certain problems grow rapidly (10 to 15 per cent per annum), natural hazards are periodic and relatively stable, and some land use changes are slow, but steadily worsen. Somewhat surprisingly, we conclude that a technological hazard such as auto accidents may show little or no change. While the frequency and severity continue at a high rate, improvements in roads and vehicles offset the increase in traffic and vehicle ownership.

Concern is expressed from several points of view. The form of concern external to Africa is reflected in both popular and scientific publications and this concern is often the highest as those who bother to write about African problems from a European or North American perspective are by definition<sup>5</sup> generally concerned. For evidence of internal concern we draw heavily on governmental actions and pronouncements. In these, African nations, pressed by the exigencies of development problems, evidence concern publicly mainly over the dramatic effects of nature or the growing edges of modern life which often personally involve the policy-maker.

In our evaluation we share the vision or myopia of official Africa in devaluing many world-view problems in the light of more pressing needs. At

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- 1 I. D. Thomas and C. J. Thomas, "Comparative Population Data for the Divisions of Tanzania", BRALUP Research Notes No. 10 (University of Dar es Salaam, 1971).
  - 2 H. Page, "Health Services and the Incidence of Disease", in *Tanzania in Maps*, edited by L. Berry (University of London Press, 1970), p. 118.
  - 3 Local newspapers in Kampala, Nairobi and Dar es Salaam, almost monthly report the death or severe injury of senior government personnel in car accidents.
  - 4 A. C. Mascarenhas, personal communication; also see note 34
  - 5 We also have available one of the few studies existing in East Africa of farmer perception of various environmental crop hazards, a comparative evaluation by 219 Sukumaland farmers of 13 potential crop hazards. See L. Berry *et al.*, "Pilot studies in Human Adjustment to Agricultural Drought in Tanzania", BRALUP Research Paper No. 13 (University of Dar es Salaam, 1971).

the same time our own experiences and those of colleagues lead us to serious concern with the soil erosion problem, but concern more related to over-grazing than erosion from cultivation of steep slopes.<sup>6</sup> Our preoccupation with rural development is manifest in a high concern for more co-ordinated rural land use. Such a concern arises from our applied research, where we have found failure to achieve expected benefit from water supply and/or irrigation schemes because they were designed and built as alien intrusions on existing land use with no attention to soils, farmer interests, or markets.<sup>7</sup> But we would disagree with the emphasis on urban land use that so frequently embodies physical planning in the European sense, which in Africa leads to urban districts segregated by class or colour, with workers often isolated from their places of work, and all manner of *bidonvilles* tolerated if mostly out of sight to all but their inhabitants.

On the wildlife issue, international concern is often expressed about the need for preservation of wildlife ecosystems, coming often from countries which have destroyed much of their own wildlife.<sup>8</sup> While recognizing the global need we also recognize that the world as a whole should take on the cost of this exercise. We would rate the preservation of wildlife as a *national* objective fairly low in priority unless means can be found of benefiting local people much more than at present.

Finally, some problems attract our interest not because of their urgency but because of the relative ease by which they can be changed. Thus urban land use may be more easily controlled than rural land use, or agricultural chemicals regulated far more easily than ubiquitous bird or insect pests. Conversely our reading of the work of Bradley<sup>9</sup> or Kreysler<sup>10</sup> makes us pessimistic on the prospect of radical reduction in endemic and water related diseases.

The table serves to set in overview what we think are the more distinctive Eastern African environmental problems, but it oversimplifies them as well. Indeed its tabular classification does an injustice to the major theme of this paper; that environmental problems are in a major way the result of interaction of man and the natural world. Each major ecological zone has its particular set of problems and in the area studied we pick out the desert, the semi-arid lands, the wet and dry savannah and the tropical highlands as having distinctive sub-sets of important man-land problems. To these we add

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- 6 R. Wilson, forthcoming publication, *The Soils of Tanzania* (FAO, Rome).  
A. Kasseba and L. Berry, eds., *Land Use in Tanzania*. Proc. Conference, OUP. (in Press).
  - 7 L. Berry and R. W. Kates, "Planned Irrigated Settlement: A study of four villages in Dodoma and Singida Regions Tanzania", BRALUP Research Paper No. 110 (University of Dar es Salaam, 1970).
  - 8 Considerable international pressure has been brought to bear on East African governments when quite small decisions on land use changes affecting game parks have been announced. The general East African record on preservation of game ecosystems and development of game parks is good.
  - 9 D. Bradley, in G. F. White, D. J. Bradley and A. U. White, "Drawers of Water; Domestic Water Use in East Africa" (Draft).
  - 10 J. Kreysler, "Uhuru na Maji: Health, Water Supply and Self-Reliance in Mayo Village", BRALUP Research Paper No. 3 (University of Dar es Salaam, 1968).

Table 1—SOME PARAMETERS OF RESOURCES AND RELATED ENVIRONMENTAL PROBLEMS IN EAST AFRICA

Resources and Related Environmental Problems	Importance			Rate of Change	Potential to Affect or Alter the Problem	Concern	
	Severity	Frequency	Population at Risk			External	Internal
<i>Human Resources</i>							
Population Growth:							
Urban Congestion	+ -	+ -	- +	↑	+ +	+ +	+ +
Rural Involvement	+ +	+ +	+ +	↔	+ +	+ +	+ +
<i>Quasi-Natural Hazards:</i>							
Drought	+ +	+ +	+ +	↔	+ +	+ +	+ +
Flood	+ +	+ +	+ +	↔	+ +	+ +	+ +
Endemic Disease	+ +	+ +	+ +	↔	+ +	+ +	+ +
Fire	+ +	+ +	+ +	↔	+ +	+ +	+ +
<i>Technical Hazards:</i>							
Auto and Related Transport	+ +	+ +	- -	↔	+ +	+ +	+ +
Industrial Accidents	+ +	+ +	- -	↔	+ +	+ +	+ +
Occupational Diseases	+ +	+ +	- -	↔	+ +	+ +	+ +
<i>Land Resources:</i>							
Soil Erosion From Cultivated Land	- +	- +	+ +	↔	+ +	+ +	+ +
Rangeland Deterioration	+ +	+ +	- -	↔	+ +	+ +	+ +
Forest Destruction	- -	- -	- -	↔	+ +	+ +	+ +
Unplanned Urban Land Use	- -	- -	- -	↔	+ +	+ +	+ +
Uncoordinated Rural Land Use	- -	- -	- -	↔	+ +	+ +	+ +
<i>Water Resources:</i>							
Industrial	- +	- +	+ +	↔	+ +	+ +	+ +
Sewage and Human Waste	+ +	+ +	+ +	↔	+ +	+ +	+ +
Water Related Diseases	+ +	+ +	+ +	↔	+ +	+ +	+ +
<i>Air:</i>							
Pollution	- -	- -	- -	↔	+ +	+ +	+ +
<i>Other Risks:</i>							
Conservation of Wildlife	+ +	+ +	- -	↔	+ +	+ +	+ +
Marine Pollution	- -	- -	- -	↔	+ +	+ +	+ +
Agricultural Chemicals	- -	- -	- -	↔	+ +	+ +	+ +
Biological Crop Hazards	+ +	+ +	+ +	↔	+ +	+ +	+ +
Birds, Insects, Vermin	- +	- +	+ +	↔	+ +	+ +	+ +
Wildlife and Livestock	+ +	+ +	+ +	↔	+ +	+ +	+ +
Micro-parasites	+ +	+ +	+ +	↔	+ +	+ +	+ +
<b>Key</b>							
Not Significant	-	-	-	-	-	-	-
Low	+ -	+ -	+ -	↔	↔	↔	↔
Moderate	+ +	+ +	+ +	↔	↔	↔	↔
High	+ +	+ +	+ +	↔	↔	↔	↔
Very High	+ +	+ +	+ +	↔	↔	↔	↔
Rapidly Increasing	↑	↑	↑	↔	↔	↔	↔
Stable	↔	↔	↔	↔	↔	↔	↔
Increasing	↔	↔	↔	↔	↔	↔	↔
Decreasing	↔	↔	↔	↔	↔	↔	↔
Rapidly Decreasing	↓	↓	↓	↔	↔	↔	↔

two distinctive urban environments; the concrete, European-type colonial city and the traditional African urban complex.

The zoned complexity is matched by dynamic changes partly induced by population-based growth and partly by the disruptive impact of development inputs. Recent studies of population pressure, soil erosion, natural hazards, water development and international trade illuminate these changes, confounding some conventional expectations while confirming others.

#### A ZONAL VIEW

##### *The Traditional City*

The traditional city in Africa is difficult to define; it may be epitomized by Omdurman or Ibadan or by the fringes of many modern African cities like Nairobi or Dar es Salaam. Among its characteristics are: closely spaced single, rarely double, storied buildings, largely of traditional materials, using traditional kinds of services for the large part; the Arab *suk* or the African market place as the focus of retail activity, small workshops and trading firms as the industrial backing and standpipes and latrines as the major water and drainage services.<sup>11</sup>

These cities fulfil many functions very well. Their very lack of services means that they absorb a less disproportionate amount of the nation's wealth than the Western modern city; the intermixture of small industry and dwelling cuts down the needs for transport and inter-city communication may be a limited problem. However, rapid growth brings a whole set of environmental and social hazards unless accompanied by a thoughtful adjustment of living styles to the new scale.

Even in the tropics fuel is a major requirement and most traditional cities use charcoal as the cheapest cooking fuel. A city of 20,000 to 30,000 may in the right ecological setting obtain enough charcoal for its daily purposes from the surrounding areas without endangering the habitat; 250,000 or over 1,000,000 people present a new hazard to environment in most ecological zones. It is difficult to compute the total needs but whatever the detailed figures the results are evident. The almost complete deforestation of the Nile Valley from Khartoum to Malakal well documented from historical records, the totally bare zone around Omdurman and the growing range reached by charcoal buyers around Dar es Salaam, all highlight the ecological effects of urban growth.<sup>12</sup> In the same way the mixture of animals and agriculture within the traditional city is a rational adaptation of rural life. But when the city is large, grazing for goats and space for agriculture disappears leaving a nutritional gap to be filled.

11 See R. J. Horvath, "Von Thünen's Isolated State and the area around Addis Ababa, Ethiopia", *Association of American Geographers*, Vol. 59, No. 2 (1969), p. 308, for a discussion of the role of forests in an African city.

12 J. H. G. Lebon, "Land Use in Sudan", *World Land Use Survey, Regional Memoir* 4 (1965).

In many ways the traditional city may be important for Africa in the future, one important function being the preservation of many elements of local life within an urban setting. But in order for it to fulfil its functions, a careful look needs to be taken at the problems of growth. The dangers are of major economic, ecological and social deterioration. How can we have single story homes with plots for cultivation and yet prevent impossible strains on the transport and service network?<sup>13</sup> How can fuel needs be met cheaply without ecological danger? And as the city presses even closer together the disposal of waste and sewage becomes a more pressing problem: can it be solved cheaply and wisely?<sup>14</sup>

### *The Modern City*

The modern city in Africa began as an administrative structure—typically with well separated (segregated) areas—the administration block and the widely spaced suburban-type dwellings, the local town, etc. Later, planned additions learning European lessons provided industrial areas and the varying grades of residential areas. This city now shows the splendour and misery of its European counterpart, together with, for most of the poorer sections of the community the problems of poverty and lack of public facilities. The journey to work on foot or in infrequent and overcrowded buses adds greatly to the working day. Improved services exist but are strongly differentiated; the urban poor of Nairobi pay as much as \$1.23 per cubic metre for water compared to \$0.10 per cubic metre for the rich, without the convenience of taps.<sup>15</sup> A recent urban plan for Dar es Salaam, forecasting a modest, constrained growth rate of 6 per cent per annum, would, nevertheless, absorb a high percentage of the local development funds of the country in order to carry out the recommended “needed” projects.<sup>16</sup> Planning the European way is in our view not the answer. Rather than repeat the errors of current urban development, should not the aim for a planned city be one which will have a good public transport system in a comparatively classless society; that has integrated district, integrated in function as well as in race and income, so that communication problems are reduced but with industry well controlled in its environmental effects?

### *The Desert*

Of all ecological zones perhaps only the semi-desert can be more affected by man than the desert and of all ecological zones the desert is perhaps the most apt to spring surprises. Deserts in Africa are usually so because of lack

13 The document “Arusha Master Plan Tanzania” contains a discussion of these problems (Tanzanian Government, 1971).

14 Some interesting possibilities of cheap self-igniting waste disposal units are currently under experiment by Swedish scientists.

15 G. F. White, D. J. Bradley and A. U. White. “Drawers of Water, Domestic Water Use in East Africa” (Draft)

16 Dar es Salaam Master Plan.

of water and one of man's dreams has been of "making the desert bloom". The recipe seemed to be "add water for instant success". One ambitious attempt at desert transformation has been in the Aswan High Dam, the formation of Lake Nasser and the vast consequent increase in the irrigable land and electric power supply of Egypt. It is too early to trace the full costs and benefits of this achievement but the project is beginning to reveal once more the hazards of such large modifications of any environment.<sup>17</sup> Despite the popular statements to the contrary, some anticipation had been made of problems such as the loss of natural fertilizer from the Nile silt in the irrigation waters, the problems of silting and evaporation in the reservoirs, the effects on fisheries off the delta, the erosion of the delta shoreline and increased erosion downstream of the dam. But these were not thought through and the needed research undertaken and their extent will only be apparent in the future. The greatest hazard from competitive plant and animal life may yet be to come. Provide water in a hot desert environment and ecological conditions are perfect for the rapid multiplication of a host of plants and animals. The development of whole new ecosystems may appear catastrophic, with rapidly multiplying plant and animal life. The intrusion of the water hyacinth into the Nile south of Khartoum in the fifties was one such major event. Lake Nasser is very vulnerable to such events. The modification of environment has also had wide ranging social effects. Some of these like the evacuation of Nubians from the area were foreseen and to some extent planned. Less clear are the effects on the south Egyptian peasant. How has he reacted to the new siltless waters? How is fertilizer distributed to replace the silt? We do not have data to follow up these questions, but it seems clear that the social and political ramifications, good and bad, will continue to unfold for some time to come.

#### *The Dry Savannah*

Most of Africa is semi-arid, and dry seasonal vegetation covers perhaps 40 per cent of the continent. Past fluctuations of climates have meant that this zone has at various times been both drier and wetter than it is at present. For this reason its soils have been formed at least in part in different climates and are vulnerable.

A wide zone exists south of the Sahara which contains large areas of loosely compacted sandy soils and the North Central Sudan may be typical. In this area where present cultivation is hampered by the irregular and uncertain

<sup>17</sup> The degree to which the *Saad El Aali* (Aswan High Dam) is cited as a prime example of environmental problems appears almost inversely related to the literature available on the actual environmental effects. For the problem of evaluating costs and benefits see C. S. Russell and H. A. Landsberg, "International Environmental Problems—A Taxonomy", *Science*, 172, pp. 1309-1310. See also, C. S. George, "The Role of the Saad El Aali (Aswan High Dam) in the Fisheries of the Southeastern Mediterranean", in *The Careless Technology; Ecology and International Development*, M. T. Fravar and J. M. Milton (eds.) (New York: The Natural History Press, 1971).

rainfall, grazing has traditionally been the means of livelihood. Cattle, goats and camels are the main source of income. Growth and development have produced a steady rise in the stock numbers and major government and private programmes for provision of water points have been in operation for 25 years. The Dixey/Aubert FAO team in 1959 emphasized the scale of the resulting problem—a major deterioration of a whole ecological zone.<sup>18</sup> Thus, in this zone, provision of water must be linked with its uses. Water for irrigation and gardens and water for human consumption may be encouraged but water for stock must be mainly related to the potentiality of environment and coupled with central land use planning.

Environmental problems here relate to the whole planning of rural land use and the future economy of the area. Grazing is an effective use of this zone but if future generations are also to use it, major national and possibly international steps, including the setting up of proper standards of land use, optimum stocking rates and long-term education and organization on environmental problems, will need to be taken.

#### *Wet Savannah*

Much of East Africa falls into the wet Savannah climo-vegetational zone. It is the zone of seasonal drought but good vegetation cover, of small-holder agriculture with maize and millet the staples. Here problems of growth and change tend generally to be less traumatic than elsewhere but have grave potential for the future. Peasant cultivation in many areas has not been such as to make for any major deterioration, overgrazing is locally a problem but land pressure is not yet high.<sup>19</sup> Environmental problems are related to the natural environment, with birds and other pests,<sup>20</sup> including tsetse and wild game figuring high. A major need is to match people and crops to markets and land capability so as to increase rural incomes.

#### *Highlands*

Tropical uplands with their unique range of temperature and insolation conditions and their generally adequate rainfall make attractive and productive environments. They have been preferentially sought out by the East African peoples and some of the densest populations occur on the uplands of Kenya, Uganda and Tanzania. Also, some of the most intensive land use systems have developed in these areas often accompanied by well organized water control and use. But such systems have been confronted with problems

18 For detailed investigation of the area and the problems see *Doxiades, Associates 1963-1966*, and UN Special Fund, *Land and Water Use Survey in Kordofan Province of the Republic of the Sudan*, 60 Reports and Final Report 1966. J. H. G. Lebon, "The Land and Water Use Survey of North Central Kordofan (1961-66)", *Geog. Journal*, Vol. 134 (1968), pp. 546-549.

19 I. D. Thomas and C. J. Thomas, 1971, *op. cit.*

20 A. C. Mascarenhas, in S. Ominde (ed.), *Essays in Honour of Professor Baker* (Oxford: OUP, 1970).



of steady population growth and low rates of increase of prices and yields in the cash crops. Population growth and resultant land pressure may in some areas be endangering the whole viability of these favoured ecological niches.<sup>21</sup> Yet few data are available on this process and its effects. The studies by Thomas<sup>22</sup> (Uluguru and Pares) provide some beginning to the co-ordinated study of the land use and population in mountain areas, and work by Dattoo<sup>23</sup> underway looks at the whole response, or lack of response to traditional systems under steady pressure through changing population parameters. The thesis of Boserup<sup>24</sup> that the steady pressure serves to stimulate re-adjustment strikes us as an optimistic view of a serious problem. To avoid rural involution, new and much more productive combinations of resource use will have to be found in these areas.

#### AN HISTORIC VIEW

##### *Soil Erosion: A Chronic Environmental Problem*

Soil in any part of the world is a vulnerable resource, in the tropics with high rainfall intensities, particularly so. Since the 1920s the misuse of the land has concerned the governments in East Africa.<sup>25</sup> Such fears were based on concrete evidence in some areas but in others on imported ideas of what was good and not good agricultural practice.

A number of schemes in Tanzania were initiated in the 40s and 50s mostly to deal with conservation problems in the mountain areas, but some others in lowland and plateau areas. They all raised peasant resistance, were poorly thought out, in some cases did not improve the agricultural conditions and were in the final analysis failures.<sup>26</sup> As some of the land conservation schemes were firmly associated with colonial government and with some of the more repressive aspects of their agricultural policy it is not surprising that such ideas dropped out of general discussion after independence.

Recently in East Africa a number of studies of mountain areas, by

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- 21 S. H. Ominde, *Land and Population Movements in Kenya* (London: Heinemann, 1968).  
R. S. Ondingo, "Land Settlement in the Kenya Highlands" in *Education, Employment and Rural Development* (Nairobi: East African Publishing House, 1967).  
J. N. S. Carey, "The Decolonization of the 'White Highlands' of Kenya", *Geog. Journal*, 131 (1965), pp. 186-207.
- 22 I. D. Thomas, "Some Notes on Population and Land Use in the North Pare Mountains", BRALUP Research Notes No. 9 (University of Dar es Salaam, 1970).
- 23 B. Dattoo, personal communication.
- 24 E. Boserup, *The Conditions of Agricultural Growth, the Economics of Agricultural Change Under Population Pressure* (Chicago: Aldine, 1966).
- 25 Somewhat to our surprise we found that soil erosion became a serious concern in East Africa before it was a worldwide issue. (G. Gillman's personal papers, Tanzania National Archives.)
- 26 L. R. Cliffe, "Nationalism and the Reaction to Forced, Agricultural Change in Tanganyika During the Colonial Period", *Taamuli*, Vol. I, No. 1 (July, 1970), pp. 3-15.

EAAFRO<sup>27</sup> and later by co-operation between Uppsala University and the University of Dar es Salaam<sup>28</sup> point to the conclusion that deforestation and even cultivation of steep mountain slopes in the tropics on particular kinds of soils is less hazardous than was formerly supposed though dangers exist in terms of *bare* ground and in some localities. Continuous cropping on steep slopes in the Ulugurus has certainly been practiced through the last 50 years without catastrophic changes in yields.

Equally there is growing evidence of the soil erosion problem on a variety of soils in East Africa, particularly those under grazing. In grazing areas the social value of cattle is often weighed in numbers, large numbers are also thought of as good drought insurance. With improved veterinary facilities and water supplies, grazing and the availability of palatable grasses become the constraints on stock numbers.<sup>29</sup> With grazing land not controlled by rigid land tenure provisions overgrazing is all too high a probability. Murray-Rust<sup>30</sup>, in a detailed study of one catchment in Arusha region Tanzania, traces the effects of improved water supplies through an increase in stock, in stock movement, a major increase in soil erosion, and a 55 per cent infilling of the reservoir, all in a decade. If one accepts the high economic potential of Africa's grazing areas such processes bode ill for the economic and environmental future of these areas.

#### *The Introduction of Water: An Acute Environmental Problem*

Most environments in Africa are water deficient, at least for part of the year and deficiency in water provides the main barrier to a wide variety of biotic developments when sunshine, suitable temperatures and suitable soils are often available. Water control constitutes an interference in the hydrological cycles, makes major modifications in the soil biotic cycle, and drastically alters inputs into the local ecosystems. All of these systems interact with each other and react on man in several ways. Thus we can regard water control as being, in most cases, an acute disruptive change in the environment often for the real benefit of man but just as often accompanied by a poorly understood, long chain of sequential events sometimes harmful both to man and the environment.<sup>31</sup>

- 27 L. Berry and J. Townshend, "Soil Erosion in Tanzania", in preparation for *Geografiska Annaler* (Special Publ. on Tanzania, 1972). H. C. Pereira *et al.*, *East African Agriculture and Forestry Journal* (1962), special issue. Also M. Dagg and J. R. Blackie, *Bulletin of the I.A.S.H.*, Annee No. 4 (1965), pp. 63-75.
- 28 A. Rapp and L. Berry, "Soil Erosion and Sedimentation Studies in Tanzania", in *Proceedings of Conference on Land Use* (Dar es Salaam: Tanzanian Publishing House, 1971).
- 29 M. N. Harrison, "Report on a grazing survey of the Sudan Khartoum", mimeo. (1955).  
J. R. Peberdy, "Rangeland", in W. T. W. Morgan, *East Africa, its Peoples and its Resources* (Oxford: Oxford University Press, 1969).
- 30 H. Murray-Rust, "Soil Erosion in Kisongo Catchment Area, Arusha", BRALUP Research Paper No. 15 (University of Dar es Salaam, 1971).
- 31 For a detailed explanation of the complexity of events, see the report of the Working Group on Man-Made Lakes of the Special Committee on Problems of the Environment, of the International Council of Scientific Unions, *Man-Made Lakes as Modified Ecosystems* (in Press).

We have studied a small irrigation scheme at Mangoni in Tanzania<sup>32</sup> where the construction of a small dam to regulate flow resulted in there being permanent water in the stream below the dam. Game which used to travel elsewhere for water in the dry season, flocked to the area and elephant and wild pig particularly were a major disruption to the scheme and its crops.

On larger irrigation schemes, including the largest in Africa in the Sudan Gezira, the irrigation water brings with it the bilharzia snail which is a constant scourge to the people of the Gezira, lowering their will to work and their resistance to other diseases and creating major social problems.<sup>33</sup>

*Drought: A Periodic Environmental Problem*

Current research now permits us for the first time to broadly, albeit crudely, sketch the extent and effect of drought hazard.<sup>34</sup> For example, six times in the past thirty-two years over half of the population of Tanzania was affected by a major shortage of rainfall. These major events, occurring on average once in five years, affect national income by about 4 per cent and require a commensurate effort from the labour of smallholders, generate migration movements that increase urban problems, accelerate existing malnutrition, and create widespread, if unmeasurable psychic stress. As governments strain to cope with the hazard and accept increasing responsibility for coping with it, large amounts are expended for famine relief and development effort is sidetracked into what is at best a maintenance effort. The assumption of such responsibility by national governments and their increasing capability to do so has led to a genuine reduction over time in the more terrifying impacts of drought-death and disease from famine. But in line with observations from many other parts of the world, commercialization of agriculture, regional specialization, centralized marketing, and an urban demand independent of production have increased the economic effects of drought losses and the resultant loss of development effort. Thus, a recent drought occurrence in Tanzania, a minor one by its climatological extent, required the import of 43,000 tons of food grains in contrast with minimal imports in the more serious drought year of 1965. The perspective for the future is also depressing as the *Uhuru* decade for Tanzania appears by contrast with previous eras more favoured climatically than that experienced in the past or to be experienced in the future.

32 L. Berry and R. W. Kates, 1970, *op. cit.*

33 W. A. Hance, *African Economic Development* (New York: Praeger, 1967).  
A. T. Sharaf, "The Sudan", in S. P. Chatterjee, *Developing Countries of the World* (Calcutta, 1968).

34 A major manifestation of drought is food shortage and famine. This is now documented in Berry *et al.*, *op. cit.*; C. Brooke, "The Heritage of Famine in Central Tanzania", *Tanzania Notes and Records* No. 67 (1967), pp. 15-22; C. Brooke, "Types of Food Shortage in Tanzania", *Geographical Review*, Vol. 57 (1967), pp. 333-357; A. Mascarenhas, "Aspects of Food Shortages in Tanganyika (1925-46)", Geog. Dept., University College, Dar es Salaam, Research Paper No. 3 (1966), mimeo, M. Patton, "Dodoma Region 1929-1959, A history of famine", BRALUP Research Report No. 44 (University of Dar es Salaam, 1971). More recent work is described in R. W. Kates and B. Wisner, "The Impact of Agricultural Drought in Tanzania and Kenya" (in preparation).

More can be done at the level of farm management to reduce drought vulnerability: planting at optimal times, using short season maize varieties and millet for drought prone areas, and improved local marketing and storage policies. Adoption of these depend in part on general improvement in agricultural practice, on utilizing potential in co-operative activity, on development of improved varieties and methods, and on complex environmental change. For example, the adoption of drought sensitive maize in preference to drought resistant millet has come about in part, because bird depredations, greater in millet, have increased with the concentration of crops and the loss of bird chasers as more small children attend school. But the historic way of coping with food shortages has been to spread the risk and share between places of shortage and places of plenty. In tribal Africa the family and tribe served this purpose. Increasingly national government takes on the task. But the rising costs suggest that both national and regional planning are required for periodic variation in rainfall.

*Pollution: An Exogenous Environmental Problem*

The response of developing countries to the environmental problems of developed countries ranges from hostility to at best, mild sympathy. Considerable fear has been expressed that the environmental preoccupations of developed countries will detract from the already meagre interest and development aid available;<sup>35</sup> that environmental standards based on developed nation standards will be imposed on developing countries already burdened by inappropriate technology transfers and forced purchases of tied aid; that environmental standards will be used to further reduce imports from developing countries;<sup>36</sup> and that overall, environment is just one of the growing list of issues which the rich countries of the world use to evade the true crisis of mankind, the great global inequalities of rich and poor. Hamilton Shirley Amerasinghe, Ambassador of Ceylon to the UN, gave recent voice to these and similar views.<sup>37</sup>

The government of developing countries, their economists, and planners must not and will not allow themselves to be distracted from the imperatives of economic development and growth by the illusory dream of an atmosphere free from smoke or a landscape innocent of chimney stacks. We must not, generally speaking, allow our concern for the environment to develop into a hysteria.

That these fears are well based can be readily understood by East Africans long accustomed to international concern with its wildlife resource, at times bordering on hysteria, and deeply revealing of values that seemed to express

35 See, for example, "African Lands taking first small steps to preserve environment", *New York Times*, December 28, 1971, p. 2. Also, discussions at preparatory conference for UN Conference on the Environment 1972 (at Addis Ababa, September, 1971).

36 C. S. Russell and H. H. Landsberg, "International Environmental Problems—A Taxonomy", *Science* (June, 1971), pp. 1307-1314.

37 Quoted in M. T. Farvar *et al.*, "The Pollution of Asia", *Environment*, 13 (October, 1971), p. 10.

greater concern over poaching than the malnutrition of children.<sup>38</sup> But certain aspects of the environmental crisis might be used to further the needs of developing countries. Some African nations might choose to become "pollution havens". In the words of Amerasinghe:

All developing countries are aware of the risks, but they would be quite prepared to accept from the developed countries even 100 per cent of their gross national pollution if thereby they could diversify their economies through industrialization.

Fortunately such rhetorical choices may not be necessary. Rather, in developing regions where the present levels of pollution are already low, with careful locational and technological planning, natural processes of air, water and soil can be used to dispose of residual waste with minimal environmental disruption. This potential comparative advantage may shift the balance of locational decision as to where to process primary materials that serve as the major exports of so many developing countries.<sup>39</sup>

Another key production decision may shift to the favour of developing countries. Synthetic manufacturers are major polluters. Commoner recently contrasted the disruptive qualities of synthetic fabric production compared to the virtues of natural production of cotton:

Nylon, for example, is produced in a series of from six to ten chemical reactions ranging from 200° F. to 700° F. This means a considerable combustion of fuel—and resulting air pollution. In addition, such chemical reaction may release waste chemicals into the air or water, again polluting. One environmental input not included in the natural production of fibre... (and) because the synthetic fibre is man-made it cannot be disposed of without putting a stress on the environment... every bit of synthetic fibre or polyester that has been produced on the earth is destroyed by burning—and thereby pollutes the air—or accumulates as rubbish.<sup>40</sup>

It makes good ecological sense to buy East African cotton and sisal.

Finally, the more radical environmentalists in developing countries have raised substantial issues as to the rapacious nature of a system, predominantly capitalist, that involves employment in the U.S.A., for example, of 40 to 50 per cent of the world's natural resources for the direct consumption of about 6 per cent of its people. Depending on overviews of the finite nature of the resource base, the problem is more or less serious. But it helps little to note as some have done, that African and other developing countries vie with each other for such exports. Clearly, the international terms of trade for primary production makes a mockery of the notion of comparative advantage unless it means that poor countries will have the comparative advantage of remaining poor.<sup>41</sup> By focusing on the true social costs of production in both developed and developing countries, the environmental crisis can be made to

38 See note 9 and *New York Times*, op. cit. (note 35) on both these points.

39 See Russell and Landsberg, op. cit., for a discussion on trade, aid and environment

40 B. Commoner, "The Closing Circle", *Nature, Man and Technology* (New York: Knopf, 1971).

41 J. F. Rweyemamu, "International Trade and the Developing Countries", *Journal of Modern Africa Studies*, 7, 2 (1969), pp. 203-19.

serve as emphasis to the exploitative nature of the present world market in agricultural and industrial materials.

#### CONCLUSIONS

African environmental problems still relate strongly to the difficulties of the African environment, and are not an exotic import of the anxieties that concern the developed world. Natural hazards, although their effect is being altered with changing technology and parameters of population are still of paramount importance. Maintaining the viability of both town and country in the face of change; permitting radical developmental change while preventing the deterioration of land and other natural resources and doing this in the face of successive accretions of population in fragile ecosystems—these are the problems.

The major remedy both for internal self-reliance and for outside support seems to be encouragement to develop existing knowledge of the unique qualities of major environmental zones and appropriate governmental infrastructures for each. Within countries and between countries in Africa every encouragement should be given to develop co-operative measures to "spread the risk" of natural hazards at any one time. The traditional wisdom of the small farmer needs to be institutionalized into a system of regional complementarities and specialization. Africa-wide co-operation in natural disaster prevention, now mainly in locust control, should be broadened to cover a range of natural hazards, with planning for inter-regional food storage and distribution given a high priority.

The tide of global environmentalism does not necessarily auger well for developing countries. But new opportunities for common cause should be exploited in practical ways. Environmentalists in developed countries should be encouraged to raise demands for tariff-free entry of natural products competitive with synthetics, for greater processing in the country-of-origin, for non-exploitative price and profit remission policies and for redistribution of the world's wealth rather than the continued gluttonous growth of environmentally disruptive consumption in the developed world.

In the East African context, many of the difficult choices facing policy-makers are genuine questions of balancing development and conservation, but none should be made by omission or out of ignorance. Major development projects should routinely provide for environmental impact assessment (see Appendix A). On a regional basis specialized personnel should be available, charged with reviewing imports of industrial and other machinery to encourage pollution control and to prevent the dumping of "dirty" technology. The regional monitoring and quarantine of agricultural plant imports currently carried out in East Africa, should be broadened to include related imports of fertilizer, herbicides and pesticides. Modest amounts of directed research similar to the type described in this paper can serve to identify and focus energies on the most pressing environmental problems, energies which are

now dispersed by the varying perception of external observers, resident scientists, and local policy-makers.

Finally, the legal systems of many countries are still in their early formative years and may be amenable to incorporating environmental quality as a public right. What Africa does not need now is another bureaucracy charged with monitoring or protecting such a right. Rather an assertion of public domain over environmental resources with provision for stand-by controls seems a more appropriate arrangement.

The two strands of thought running through this paper: the concern with the "traditional" environmental problem and the growing awareness of the new set of problems brought on by technology reflect the basic nature of development. While the complexity and multiplicity of the problems seem daunting, our own view is one of optimism. Africa has time, and if that time can be used wisely, an exemplary model may yet be achieved.

## APPENDIX A

An example of the kind of guidelines for environmental assessment that are currently being discussed.

### QUESTIONS ON ENVIRONMENT AND DEVELOPMENT

The following are some queries which might be made when drawing up and reviewing plans or projections either on a project, sector, country, regional or inter-regional scale. Answers to these questions, along with social and economic considerations, could help both governments and assistance agencies in appraising more fully development programmes and projects.

#### 1. *Goals*

- (a) Is there an environmental component of the national development policy and how does the programme relate to it? Are short-term programme objectives consonant with long-term goals?
- (b) Do the objectives include an enhancement of the environment, or of its maintenance?
- (c) Is the implementation of objectives feasible under existing legislation and existing administrative and supervisory machinery? How realistic is it to expect that qualified personnel will be available to administer and supervise?

#### 2. *Preparation*

Have relevant and interested groups (including the scientific community) been consulted on possible environmental effects?

### 3. *Environmental Consequences*

- (a) What kind of environmental changes are foreseen? How far are these irreversible? What alternative choices remain open for the future? Is there a "balance sheet" of estimated environmental costs and benefits?
- (b) Have possible alternative arrangements for achieving comparable goals with more favourable impact on the environment been explored?
- (c) Has adequate provision been made for the recovery of environmental quality and the avoidance of a deleterious effect on society? If so, what will be the difference in
  - (i) direct investment costs; and
  - (ii) maintenance costs?

### 4. *Evaluation*

What arrangements have been made for keeping the programmes under continuing review and—if required—subsequent reassessment of objectives and approaches?

### 5. *International Environmental Implications*

In the interest of the rational use of resources as well as the protection of the environment, how does the programme relate to such environmental standards, global criteria or priorities which may have been generally adopted or recognized?



## A GUIDE FOR CONTRIBUTORS

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