1

The Environmental Question in Africa: A General Statement

Anta Sané

Introduction

All works dealing with climate change in Africa agree that the continent stands to suffer the most from global warming. They also show that past history provides us with poignant lessons on the likely effects of future climate change, the greatest concern being the large infrequent disturbances to the climate as these will have the most devastating effects. In a sobering study from the Kenyan Tsavo National Park, Lindsey Gillson (2006) reveals evidence for a drought that coincided with the harrowing period of Maasai history at the end of the nineteenth century termed *Emutai*, meaning 'wipe out'. Ecological shocks such as that experienced by the Maasai are predicted to be a feature of global warming. Gillson explains that her work involved analysing sediments from the famous Tsavo National Park. The age of the sediments was obtained by using radiocarbon dating. Ananalysis of the pollen and charcoal fragments provided a picture of accumulated environmental change. John Lovett, who has been researching the impacts of climate change on Africa, says that we must learn from history and be prepared (Lovett 2006).

Prepared or not, the perils of climate change are already being felt across Africa. Andrew Simms of the New Economics Foundation has reported that although climates across Africa have always been erratic, scientific research and the experience of groups monitoring the situation indicate new and dangerous extremes. Arid and semi-arid areas in eastern, western, northern and parts of southern Africa are becoming drier, while equatorial Africa and other parts of southern Africa are getting wetter. The continent is, on average, 0.5 degrees centigrade warmer than it was 100 years ago; in some areas, the temperatures

have risen by much more. In a part of Kenya, for instance, the temperature has become 3.5 degrees hotter in the past twenty years. As a result, in the past few years alone, 25 million people in sub-Saharan Africa have faced a food crisis because subsistence farming has become very difficult. The great tragedy is that Africa had played virtually no role in global warming, a problem that was caused by the economic activity of the rich, industrial countries. The rest of this chapter provides a comprehensive picture of the problem and offers feasible suggestions on how to deal with it. The chapter begins with a discussion of the 'law of change', the theoretical postulate upon which the analysis in this paper is grounded.

Issues of Change

Humans, like all other animals, and all plants, influence their environment, and are, in turn influenced by it. Mutual influence is part of life itself; a fundamental force behind the development, for centuries, of the many living things on our planet. We can envision this force as a law of nature: the law of change.

The concept *ecological balance* is often employed to simplify matters. The term implies a situation where the law of change works in various directions in a system of animals and plants, and that the various forces countervail in order to stabilise the system as a whole. But in a broader perspective, and in the long run, it makes no sense to speak about equilibrium, as the law of change is omnipresent. It works sometimes incrementally, with course corrections, sometimes by leaps and bounds, as ancient species and ways of life give way to the new.

Industrialisation, so far incomparably the greatest intervention by the law of change in our existence and environment, is due to accumulated knowledge, inventiveness and organisational talent. But we now see the limits of what this new make-up provides: pollution of air and water, noise, acidity of lake water, maltreatment of nature, the health hazards of many products and production processes, overcrowding, and the breakdown of traditional groups and values. All these are consequences of industrialisation or, at least, of a too rapid and, in part, obviously unpremeditated process of industrial growth. These consequences are the price we have paid for our un-paralleled per capita supply of goods and services and our un-paralleled population growth. Most of us only became genuinely aware of these consequences very late on.

It is imperative to keep in mind the link between material well-being and interest in environmental improvement when we consider the problems which African countries face with regard to soil, vegetation and water. The existence and increasingly critical nature of these problems are generally recognised and eloquently described. That the rich world's donors of development assistance should try to help towards their mitigation is undisputable. Indeed, it is not industrialisation which constitutes the main environmental dilemma for African countries. Industrialisation has not developed very far in Africa. Agriculture and

animal husbandry, generally at a subsistent level, constitute the dominant pattern of the African economy. In their pursuit of survival, peasants exploit ever more marginal soil, ever poorer grazing grounds.

The problem of Africa, when it comes to the natural environment, as well as in most other respects, is not an over-hasty development, but a too sluggish one, or none at all.

Environmental Crises in Africa and the Developed Countries: A Brief Comparison

The environmental crises in Africa and the developed nations are Janus-faced: i.e. whereas the environmental crisis in Africa is one of under-consumption and inadequate technology, the environmental crisis in the developed countries is one of mass consumption and advanced technology. That patterns of production and consumption in the developed nations have had a severe impact on those nations' environments is now becoming apparent to citizens in those countries.

Today, about 20 per cent of Americans, for example, refuse to drink water from their taps, at least partly because they doubt its safety; there are dangers of floods (increased by the clearing of forests for farms and timber), the leaching of rubbish buried in landfills, and pesticide runoff in irrigation waters from agriculture. Many Americans are worried about the ways society generates energy and the resulting global warming, air pollution (as much of the 2,500 gallons of air inhaled in the US each day contains exhaust fumes, lead and asbestos), and ozone depletion and its relationship to skin cancer (Blatt 2004).

The relationship between poverty and environmental abuse is not as widely understood. Even so, on closer examination, it, too, seems inevitable. This relationship is painfully apparent in Africa. Affluent societies' appetites for exotic hardwoods do, of course, contribute to rampant devastation. American, European and Japanese corporations, constrained by severe restrictions at home, have been able to operate quite uninhibited in Africa. The royalties developed countries have paid for laying waste to African lands have been welcomed by African governments as much-needed nest-eggs for their countries' 'development'. Now, albeit late in the day, a few African leaders are beginning to take appropriate action.

Nonetheless, native slash-and-burn farmers are also contributing to the problem, as they cover ever wider territories to eke out food for the day from temporary croplands. In addition to the farmers, there are hosts of landless peasants who wage a desperate struggle to ward off hunger and malnutrition. Yet more still – millions – are in desperate need of firewood, especially for cooking. The scarcity of firewood is the real energy crisis for a majority of Africa's people. Anything and everything that can be burned is being torn out of the soil; barren circles around villages are widening. Gathering food for cooking is beginning to take all day for many.

Where the forest is gone, wells dry up, rivers alternate between flooding and running dry, topsoil is leached and washed away, and dams clog with silt. In this way, the poorest people are literally destroying their own future, as the very basis of future generations' existence goes up in smoke.

Poverty

Are problems of pollution and environmental degradation really the sole headache of the industrialised countries? Problems of conservation are mounting in African and other developing countries as well, but they are generally of a different kind compared to those in the industrialised countries: desertification (i.e. the process whereby vegetation and soil are debased to the extent that more or less permanent areas of desert-like barrenness materialise in arid tracts outside actual deserts), the wholesale razing of tropical rain forests, the pollution of highly productive coastal waters, etc.

In the last three decades, increasing attention has been paid to environmental questions in the debate on foreign aid and development. The reason is obvious. In many African and other developing countries, there is now ruthless exploitation of scarce natural resources and a dramatic degradation of the environment, which is threatening the basis of human existence. Thus, the customary view that environmental degradation is only a problem for the industrialised countries, and that environmental protection is a luxury which the developing countries cannot afford, appears increasingly obsolete. There should be no conflict between environmental protection and development in African nations. In many places, environmental degradation constitutes a direct threat to development. This is especially true of the efforts to improve the living conditions of the numerous poor in the rural areas. Active environmental protection is in many cases a prerequisite for development.

Environmental degradation in African countries is principally a result of over-exploitation of natural resources. This is, for instance, true of arable land, pasture, groundwater and forests. There is in addition profit-motivated devastation, especially in the case of the felling of forests. To subsist, people are forced to use natural resources in a way that drastically reduces the capacity of those resources to provide yield in the long term. The energy and food crises have created a vicious circle of poverty which has led to ecological disaster in many areas.

The decisive importance of environmental aspects has been better documented at the international level, and it has also been recognised more widely in recent years. A World Conservation Strategy was initiated in 1980 by a number of international organisations both within and outside the United Nations system. This strategy emphasises the connection between social and economic development and the natural environment, and suggests alternative approaches to development that take this connection into consideration. Environmental development is a major

component of the work of the United Nations Environmental Program (UNEP). The aim is to achieve an integration of environmental and resource aspects in all of the United Nations' development efforts and to work out methods of integrating them into the development work of individual countries.

All development and development assistance cooperation must hinge upon the wishes of the recipient countries. Consequently, the frequently discussed question of choosing a suitable technology for a development project should be, first of all, a matter for the recipient country. The task for development assistance should be to help the recipient country to develop its own capacity to assess, receive and adapt the technology that is exported.

African countries and the developed countries must markedly increase their commitments in the sphere of land management, principally in village forestry, and the combating of desertification. The problems of soil erosion and desertification are especially acute in the Sahel area, where the advance of the desert constitutes an ecological disaster of enormous proportions. The very basis of human existence is being rapidly eroded over large areas by the desperate search by the poor for shrinking grazing land for their livestock and for fuel and water. Bilateral projects, which must be brought to the fore, should include planting of trees and village forestry, providing more efficient stoves which use less wood, and the restoration of areas around water-holes, which have been over-grazed in countries like Burkina Faso.

A corollary to poverty, inevitably, is hunger. The reasons for hunger in Africa are many; environmental degradation is one. Another is that African countries today produce raw materials for which the industrialised countries pay very little. In order to feed their own peoples, African countries are then forced to increase their production of raw materials at the expense of the environment. Signs of stress on the world's bio-productive resources are already apparent. If the production of major commodities of biological origin is viewed in per capita terms, it is evident that many of them have already exceeded their peaks. And as population and per capita consumption continue to increase, it is likely that more commodities will reach their peaks in the near future.

The earth's physical resources and expanding technology can sustain an average growth rate in food production of about 5 per cent. Even a humble population growth of 2.1 per cent per year, however, would lead to increased pressure on resources, higher real costs and environmental deterioration, factors which would further undermine global food prospects. Humankind has entered an era of scarcity as far as arable land is concerned. The declining availability of arable land suggests that expanding food production will depend on a wide range of resource-augmenting inputs like fertilisers, pesticides and high-yielding varieties.

But this leads to another problem. Not only is the production of fertilisers and pesticides energy-intensive, it is also expensive and dependent on global

petroleum prospects. Producing one ton of nitrogen requires about 1.8 tons of oil-equivalent. Much of the fertiliser applied to farms is not utilised by crops and leaches into water systems where it poses environmental health risks through nitrate contamination. The presence of nitrates in drinking water may induce a disease called methaemoglobinaemia, through which the capacity of the blood to carry oxygen from the lungs to the rest of the body is reduced. Infants are most vulnerable to this disease. Moreover, the leaching of nitrogen fertiliser may lead to the problem of eutrophication. It has been estimated that more than 70 per cent of the nitrogen entering surface water comes from agricultural activities. If eutrophication is modest, it may be a source of food for numerous herbivorous animals, which in turn are fed upon by fish. But if the bloom becomes excessive, it may choke waterways and hinder navigation. And when the bloom decomposes, it depletes oxygen and may affect the fish population.

Most of the pesticides used in Africa and other developing countries include persistent organochlorines like DDT, aldrin, dieldrin, and heptachlor – all of which have already been banned or are heavily restricted in developed countries. Pesticides poison at least one person every five minutes in the third world, making a total of 250,000 people a year, of whom about 10 per cent die. This estimate, however, does not include the thousands who suffer from cancer, miscarriages and still-births, bear deformed children or suffer from the effects of pesticide contamination. The world produces about 1.8 tons of pesticides each year, an equivalent of 14 ounces per person on earth. Approximately 360,000 tons are exported to the developing countries. Despite this massive production of pesticides, the problem of pests is far from being solved; the bugs are fighting back by developing resistance against pesticides.

Future growth in agricultural resources will depend on the provision of more water and better water management in the arid and semi-arid areas. It will also depend on the drainage and management of surplus water in the humid and wet areas that account for well over 50 per cent of the world's remaining reserves of arable or potentially arable land. Water will continue to be a major limiting factor to food production. Producing one kilogramme of dry wheat grains needs at least 0.75 tons of water, and irrigating a hectare of rice requires up to 787,400 cubic inches of water in a season.

Food production faces the challenges of soil deterioration, despite the fact that some previously unutilised land is being brought under the plough. Soil deterioration is mainly a result of desertification, waterlogging, salinisation, alkanisation, deforestation, loss of farmland to other uses and general soil erosion. The problem is compounded by the lack of effective technology for reclaiming salinised and waterlogged farmland. And irrigating more land may reduce the availability of pastureland and intensify pressure on the remaining pastures.

Forests and Trees

The threat to tropical forests is a threat to many people's chances to survive on agriculture. The devastation of tropical forests in Africa has created an energy crisis that is of concern to most people. The ravaging of rainforests is radically changing our climate and life conditions, in spite of denial by some policy makers and observers. The threat comes from transnational forest companies pursuing maximum profit and slash-and-burn farmers struggling to eke out a living; though signs of resistance are beginning to emerge.

The rainforest is a 60 million year-old ecological system that is unique in its stability but, currently, about a quarter of a million square kilometres of rainforest disappear each year. At this rate, this would mean that within a span of a generation, there would be no such forests left on this earth. What happens when a rainforest disappears? One outcome is certain: the rainforest will never reappear. It is even questionable whether an ordinary forest would ever grow out of this devastation. In addition, modern climatic research points out that the clear-cutting of rainforests can heavily add to the increase of carbon dioxide content in the atmosphere created by the burning of fossil fuels.

The future of Africa is intimately bound up with the future of its trees. Wood and charcoal are African households' most important fuels. Furthermore, trees provide shade and protect crops from the scorching sun. They help retain moisture in the soil, thereby combating erosion. But more trees are felled than are being planted. Turning the tide to avert catastrophe requires planting millions of trees each year. Fuel, too, must be used more efficiently. With an average population growth of about 3.2 per cent per year, Africa's problem is acute, requiring mass mobilisation and firm political will to solve the deforestation problem.

Despite the abundant oil reserves in Africa, most of which has not even been tapped, the continent is facing two energy crises at once: an oil crisis in the modern sector and a wood fuel crisis in the traditional sector. The crisis in the traditional sector has to do with the fact that more trees are felled than are planted. Moreover, waste (plant mortality) is substantial: roughly three out of every five seedling trees are destroyed, with only two surviving ten years after planting.

Desertification

In 1973, two words became prominent in newspapers and television news around the world: Sahel and desertification. Sahel is an Arabic word denoting the belt of steppe and arid savannah south of the Sahara – from Senegal on the Atlantic Ocean to the west, to Sudan and Ethiopia on the Red Sea to the east. This roughly 310–496 mile-wide belt normally receives 2.5-15 inches of precipitation per year; but several years between 1968 and 1973 brought far below normal amounts of rain. Grass and other fodder disappeared, and millions of head of

livestock perished. Deaths due to starvation among the nomadic herdsmen and small farmers of the Sahel were estimated at 200,000. The disastrous cycle of crop failure, famine, devastated pasturelands and cultivated fields has gone down in history as 'the Sahel catastrophe'. It also resulted in a considerable degree of desertification – defined earlier in this chapter as the process whereby vegetation and soil are debased to the extent that more or less permanent areas of desert-like barrenness materialise in arid tracts outside actual deserts.

Several types of land abuse can result in desertification. Two cases of the devastation of arable land in the arid regions of Africa are considered here: (1) Tunisia, an example of the situation on the northern fringes of the Sahara; and (2) Sudan, an example of sub-Saharan Sahel conditions.

The Mediterranean climate is characterised by long, dry summers and intensive periods of rain during the winter – a pattern that can lead to significant soil erosion if natural ground cover is weakened through farming, over-grazing, or the clearing of bushes and trees. The same practices denuded the mountains bordering the Mediterranean to the north and east some 2,000 years ago. Greece, Italy, Lebanon, Spain, Turkey, among other countries, offer numerous examples. As the population of Tunisia has grown rapidly (about eightfold) over the past 100 years, the pressure on land, water and wood resources in that country has intensified. Consequently, the following five ecological effects have been noted:

- Over-grazing occurs because too many animals are allowed to graze freely on steppe land for long periods. Grazing and the trampling of hooves of goats, sheep and, to some extent, camels weaken natural ground cover. As a result, topsoil is pulverised and is easily blown away by the wind or rinsed away by heavy rains.
- Wood derived from the cutting of trees and brush for household fuel, fencing or building material bares the soil, paving the way for ensuing erosion. Each family of farmers cuts approximately one hectare of marquis each year to meet fuel needs. The areas are cleared and then planted, making them extremely vulnerable to erosion.
- Salinisation of irrigated land results because the bedrock of southern Tunisia contains salt that in many places contaminates groundwater as well as soil water. Deposits of gypsum have caused the formation of alkaline crusts in the soil and salinisation with gypsum in irrigated fields. Salinisation due to insufficient drainage is believed to have ruined vast irrigated tracts in ancient Babylon, contributing to the fall of the empire more than 2,000 years ago.
- Water erosion and siltation in reservoirs are the outcome of the many fluvial reservoirs that have been built in Tunisia. Most of them lie in the mountainous and less arid northern reaches of the country. Dams have been constructed to supply the cities with drinking water, to irrigate

various agricultural districts, and to control flooding. All of the reservoirs, however, are filling rather quickly with sediment.

- Wind erosion is symptomatic of the effects of the tremendous dust storms that carry soil particles from North Africa across the Mediterranean to southern Europe. Soil leaves Tunisia in other directions as well – e.g., eastward and southward. Clouds of red dust from Africa have descended from time to time on the Alpine glaciers – where the snow is coloured red – and on European coasts and cities. Precipitation occurs in the form of dry dust or as clumps of mud in rainstorm. Each of these storms represents the loss of millions of tons of African soil. The loss of wind-borne sand and soil particles from the Sahara and the Sahel over the Atlantic is even greater.

Sudan, the largest country in Africa, with an area of 967,247 square miles, contains a variety of climatic zones, ranging from Saharan desert along its northern borders to mountainous rain forests along the Uganda-Congo frontier to the south. Sudan probably has more territory affected by desertification than any other country in Africa.

A 1944 report by a Sudanese government commission on soil conservation revealed that the problem was known even at that time. The commission's conclusion was that soil degradation and erosion were more a consequence of human beings and their domesticated animals than of a change in climate. Its recommendation mainly concerned the region's surrounding towns, where it advised planting green windbreaks of trees and bushes around some centres. As we know today, the commission was only partly correct in both its diagnosis and suggested medicine.

Between 1968 and 1973, the arid and semi-arid reaches of Sudan suffered as severe a drought hit the countries of the West African Sahel, from Senegal to Chad. Three factors helped to lessen the impact on Sudan, compared to its neighbours, Chad to the west and Ethiopia to the east: (1) Sudanese herdsmen and their animals moved south, (2) domestic relief supplies were available from the surplus of Nile Valley agriculture, and (3) there was a certain degree of awareness and preparedness among policy makers of the necessity of combating desertification.

A detailed and well-thought out plan was drawn up under the sponsorship of the Sudanese Research Council and presented to the United Nations Conference on Desertification (UNCOD) convened in Nairobi from 29 August to 9 September 1977. The plan entailed (a) an inventory of the forms and extent of soil degradation and erosion, and (b) a pilot programme for soil conservation and desert control. Unfortunately, Sudanese efforts to engage the industrialised countries and oil-rich neighbours in a common cause against desertification fell on deaf ears. Even the conference planned to be held in Sudan in 1978 had to be cancelled due to lack of interest among the invited countries. Nevertheless, Sudan

started, with its own funds and probably support from United Nations organs and bilateral assistance, several successful pilot projects that have shown that soil conservation is possible even in areas of extreme aridity. These projects include windbreak plantations along the western fringes of the Nile Valley bordering on the Sahara. Sweden also supported plantations near the town of Atbara.

In essence, the need to conserve basic resources like water, productive soil and vegetation in Africa cannot be overstated and is greater now than ever. Soil erosion is one of the most serious threats to the health and welfare of Africans today, especially marginalised groups, who are forced to live on the fringes of arable land. Traditional forms of land use can no longer support them. There is no place left for them to move should their present land be debased or destroyed. Soil conservation for long-term productivity must become a more central concern in the US's development assistance programmes than has been the case to date.

Global Warming

In June 2006, the government of Niger requested that its citizens pray and fast so that it would rain. The country had had three consecutive years of drought and the situation was getting desperate. Could anyone in the US imagine three years without a drop of rain? This is commonplace in parts of east and southern Africa.

The major reason for this and other deleterious effects that have resulted from global climate change, according to Dr Sama Banya, Honorary President of the Conservation Society of Sierra Leone, is the reckless manner in which some developed countries are misusing the earth's natural resources and polluting the atmosphere with greenhouse gases. He suggests that while Africans have no control over the way the industrialised countries are causing climate change leading to global warming, Africans can minimise the effects of those changes by the way they treat their local environment.

That the effects of global warming are being felt on the continent of Africa is hardly disputable. As Godwin Obasi (in Ramsay and Edge 2004:241) points out, global meteorological observational records show that Africa is now warmer than it was 100 years ago. Warming through the 20th century was at the rate of about 0.05 degrees centigrade per decade, with slightly greater warming from June to August and from September to November than at other times. The five warmest years in Africa have all occurred since 1988, with 1988 and 1995 being the two warmest years. Africa's rate of warming has mimicked that of the rest of the world. Obasi adds that a comprehensive characterisation of regional climate change projection for Africa in the 21st century is that future annual warming will be from 0.2 to more than 0.5 degrees centigrade per decade – i.e. ten times the rate during the 20th century. Warming is expected to be greatest over the interior semi-arid margins of the Sahara and central and southern Africa.

According to Science base Section News (2006), researchers from University College London found that the fabled equatorial icecaps in the Rwenzori Mountains will disappear within two decades because of global warming. The Rwenzori Mountains, also known as the 'Mountains of the Moon', are on the border between the Democratic Republic of Congo and Uganda. The mountains are home to one of the four remaining tropical icecaps outside of the Andes and are well known for their spectacular and rare Afro alpine flora and fauna. The legendary status of these mountains can be traced back to the 2nd century when Greek geographer Ptolemy proclaimed that the River Nile was supplied by snow-capped mountains at the equator of Africa. In his words, they were 'The Mountains of the Moon whose snows feed the lakes, sources of the Nile' (Science base Section News 2006).

The glaciers were first surveyed a century ago, and glacial cover over the entire range was estimated at the time to be 4.3 square miles. Recent field surveys and satellite mapping of the glaciers conducted by University College London, Makerere University and the Ugandan Water Resources Management Department reveal that some glaciers are receding tens of yards each year and that the area covered by glaciers halved between 1987 and 2003. The researchers also found that since the 1960s, there have been clear trends toward increased air temperature around the Rwenzori Mountains without significant changes in precipitation.

If present trends continue, then less than one square mile of the remaining glaciers will disappear within the next twenty years. It is not clear, however, how the projected loss of the glaciers will affect tourism and the traditional belief systems of the BaKonzo people. Nzururu, the BaKonzo word for snow and ice, is the father of the spirits who are responsible for human life, its continuity and welfare. The irony of global warming as it pertains to Africa is best stated by Richard Taylor, the lead researcher from University College London, as follows: 'Considering the continent's negligible contribution to global greenhouse-gas emissions, it is a terrible irony that Africa, according to current predictions, will be most affected by climate change. Furthermore, the rise in air temperature is consistent with other regional studies that show how dramatic increase in malaria in the East African Highlands may rise, in part, from warmer temperatures as mosquitoes are able to colonise previously inhospitable highland areas' (Science base Section News 2006).

Conclusion

Planting trees is one of the most important tasks facing Africans today and will require considerable efforts. A continent-wide reforestation programme would cost billions of dollars, but no other course of action offers the same advantages at that price. The value of trees cannot be overestimated: as mentioned earlier, trees

shade the soil and crops against the scorching heat of the sun; they help retain moisture in the soil and mitigate the effects of seasonal drought; they inhibit erosion, a severe problem in Africa; they pump up nutrients from deeper layers of soil; they provide fodder for livestock and food, fuel and timber for people.

In order to stimulate such a reforestation programme, more money should be channelled directly to planting groups, so that more people can be activated in the projects. The problem is so serious that governments alone cannot solve it without mobilising the people. Bottlenecks in reforestation projects usually involve the supply of seeds and seedlings, shortages of cars for transport and implements and watering cans for use in planting. Seed collection and founding nurseries must get under way promptly.

The International Center for Research in Agroforestry (ICRAF) studies the co-cultivation of trees and crops to see what systems are best suited to different types of soil. It has found that over the years, Western agricultural practices, with large-scale monocultures that leave the earth bare from time to time, are poorly suited to African soils and climatic conditions. Combining agriculture and silviculture produces better yields, while combating erosion. This leads to better harvests and more trees, which is important inasmuch as food production is vital and should not be in competition with energy sources.

Energy must be used effectively in every phase, and there is a lot of room for improvement. Simple wood stoves, built with local materials, might increase the efficiency of wood use. It is vital, however, that the stoves be inexpensive, so that many people can afford them. An expenditure of any magnitude will not attract many users, even though households in many areas spend as much on wood as they do on food each year. A conceivable solution might be to introduce portable, effective kilns of the type developed by the Food and Agricultural Organization (FAO), the Cusab kiln. The kiln could be transported, making local purchases of wood. In the long run, alternative energy sources such as solar, wind and water will contribute to Africa's energy supply. But for the present, most people on the continent rely on wood. Hydro-power can be further exploited to provide more electricity for the modern sector. One problem with this energy source is that dams and reservoirs tend to clog with sift as a consequence of soil erosion. Therefore, hydroelectric power, too, is dependent on the success of reforestation and soil conservation efforts.

Geothermal energy has begun to be exploited in some areas of Africa. For example, in Olkaria, some 62 miles north of Nairobi, a hole was drilled 353 feet into the earth. Steam is produced and harnessed to drive the turbines of a generator to produce electricity. Drilling was done at several other sites, so that geothermal electricity can contribute approximately 11 percent of Kenya's electricity.

Bio-gas (methane), derived from the manure of livestock, can be produced and utilised on large farms, although it is unlikely to contribute on a large scale,

as cattle are grazed sparsely scattered over vast areas. Ethanol, or ethyl alcohol, can be produced from molasses, a by-product of sugar refinery. Ten per cent ethanol can be mixed with gasoline to reduce Africa's need for imported gasoline. But efforts to increase ethanol production further will be at the expense of foodstuffs. Producing methanol (methyl or wood alcohol) offers greater promise.

Solar cells are used for telecommunications, to drive pumps in isolated places, and to electrify fences to keep animals out of cultivated fields. They are too expensive, however, to have a major impact on the total energy strategy. Solar radiation is used to heat water and to dry various crops. The prospects for expanding this type of energy are vast. The sun can heat water for schools, hospitals, institutions of various kinds, hotels and homes. It can also be used to dry coffee and tobacco. The drying of tobacco leaves today consumes vast quantities of wood – approximately thirty trees per hectare of tobacco. Thus, in the short term, only mass mobilisation to plant trees, coupled with more efficient use of wood fuels, can solve the energy crisis in the traditional sector.

References

Banya, Sama, 2006, 'Apart from Climate Change What Else?', Freetown, Sierra Leone: Concord Times, 6 July.

Blatt, Harvey, 2004, *America's Environmental Card*, Boston, MA: MIT Press.

Lapham, Nicholas P., 2004, 'A Natural Resource Conservation Initiative for Africa', in Walter H. Kansteiner III and J. Stephen Morrison, eds, *Rising U.S. Stakes in Africa: Seven Proposals to Strengthen U.S.-Africa Policy*, Washington, DC: Center for Strategic and International Studies Press.

Obasi, Godwin O. P., 2004, 'Embracing Sustainability Science: The Challenge for Africa', in F. J. Ramsay and W. Edge, eds, *Africa* (Global Studies, 10th ed.), Guilford, CT: McGraw-Hill/Dushkin Company.

Sciencebase Section News, 2006, 'Disappearing Equatorial Icecaps', 15 May, posted by <Africans_Without_Borders@yahoogroups.com>

Lovett, John, 2006, 'Impact of Climate Change in Africa', *Science Daily*, 27 November <http://www.sciencedaily.com/releases/2006/11/061126115458.htm>, accessed 7 May 2010.

Swedish International Development Authority, 1981/82, *Report, Theme: The Environment*, Stockholm: SIDA Information Division.

Vig, Norman J. and Michael G. Faure, 2004, *Green Giants? Environmental Policies of the United States and the European Union*, Boston, MA: MIT Press.