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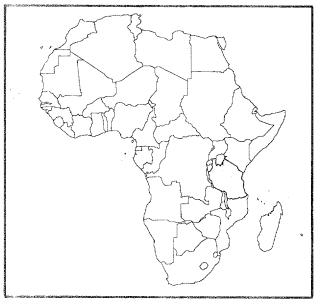
Environment and Urbanization 1991; 3; 147
DOI: 10.1177/095624789100300114



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Michael Yhdego

Michael Yhdego is a senior research fellow at the Technical University of Denmark. He was formerly a lecturer at the Department of Environmental Engineering, Ardhi Institute, Dar es Salaam. He is now carrying out a research project on cleaner production and technology for Tanzanian industries in collaboration with the National Environmental Management Council and the Ministry of Trade and Industry.

Contact address: The Technical University of Denmark, CDC, Building 208 DK-2800 Lyngby, Denmark

I. INTRODUCTION

THIS PAPER DESCRIBES the environmental problems evident in the urban areas of Tanzania, especially in its former capital and largest city, Dar es Salaam. Although Tanzania is one of the world's least urbanized nations, in recent decades it has experienced a rapid rate of urbanization. Today, it has several urban centres with more than 100,000 inhabitants and many of its major centres have populations which have multiplied several-fold between 1967 and 1988 (see Table 1). The consequences of this are visible in squatter settlements, where poverty, poor housing and inadequate infrastructure prevail, and where there are few utilities and little or no public administration. Despite much discussion about environmental problems such as flooding and the loss of green space, the situation in urban areas remains a cause of grave concern. Although the name of Tanzania's largest city, Dar es Salaam, means "haven of peace", it is presently becoming a garbage and mosquitoes city.

Table 1: The Population of Tanzania's Larger Urban Centres

	1967	1978	1988,
Dar es Salaam	272,515	769,445	1,360,850
Mwanza	34,496	110,553	n.a.
Tanga	60,106	103,399	187,155
Mbeya	12,325	76,601	152,844
Arusha	32,012	55,223	134,708
Morogoro	25,097	60,782	117,760
Moshi	26,612	52,046	96,838
Tabora	20,862	67,388	93,506
Sumbuwanga	n.a.	28,586	91,972
Dodoma	23,440	45,807	88,473
Iringa	21,444	57,164	84,860
Singida	9,459	29,258	80,987
Mtwara	21,118	48,491	76,632
Lindi	13,069	27,312	41,587

SOURCES: Population Censuses 1967, 1978 and 1988, Government of Tanzania.

1. Yhdego, M. (1986), "Physical infrastructure improvement for squatter upgrading in Tanzania", Ardhi Institute, Dar es Salaam.

Increasingly intensive urbanization and industrialization has led to a level of environmental degradation unknown 20 years ago. It is estimated that 70-80 percent of the urban population are now living in slums or squatter areas.[1] The urban areas are unable to provide adequate quality housing to keep up with population growth - arising both from natural increase (children born to those already living in urban areas) and migrant population from rural areas. Consequently, there are problems of overcrowding, inadequate water supply and sanitation, inadequate refuse collection, poor drainage and road transport which are now common in Dar es Salaam and in other Tanzanian urban centres such as Arusha, Mbeya,and Mwanza.

There has been little planned urban development in Tanzania. Urban growth was insufficiently checked or controlled, especially during the 1960s and early 1970s when relatively rapid industrial growth was taking place. The decentralization policy of 1972 gave responsibility for urban planning and administration to the district councils and, during the villagization period in the early 1970s, urban planning was given a low priority. By the 1980s when the national economy was in deep crisis, responsibility for town planning was handed back to the town and municipal councils. These councils have neither the funds nor the personnel to manage and maintain urban utilities.

Not surprisingly, there has been no control of polluting industries, small-scale enterprises and residential areas. Poorly located factories which make no provision to treat or reduce polluting emissions and unplanned squatter settlements are therefore major causes of urban environmental problems. The rivers and lakes are now affected by industrial effluent and domestic sewage, open spaces have been replaced by both planned and unplanned urbanization, and the air is polluted by uncontrolled motor vehicles and the poor siting of industry.

II. WATER SUPPLY, SANITATION, SOLID WASTE AND DRAINAGE

TANZANIA HAS MANY water resources in lakes, rivers, ponds and groundwater reservoirs. However, there are problems with both obtaining and providing drinking water in urban areas including: shortage and poor quality of water, lack of investment and maintenance, illegal connections, inefficient collection of revenues, and weak management.

Currently, the population is estimated to be growing at between three and four per cent a year in Tanzania with urban population growing at between seven and ten per cent per year. The number of urban households grows far more rapidly than the piped water supply system. Drinking water is only partially treated due to lack of chemicals and insufficient cleansing of the treatment plants. These factors have a direct bearing on the transmission of water-washed infections and water-based diseases. For example, an estimated eight-ten million people are affected by schistosomiasis in the country. About one-third of the urban population use untreated water for daily consumption, often drawing this from underground water, rainwater, open drains, and stagnant polluted pools.

Urban health is seriously endangered by the lack of sanitation facilities. For example, outbreaks of cholera are common in many

urban areas. In 1980, there were 5,196 cases and 504 deaths in the whole country. In 1985, about 300 people died in one outbreak in Lindi town. Every year, thousands of people suffer from faecal-borne diseases and many die.[2]

Rapid urban growth has led to an increasing problem with the disposal of solid wastes. In 1968, the population of Dar es Salaam (then around 300,000) generated about 175 tons of waste a day. Today, with a population estimated at around 1.5 million, the figure is between 1,200 and 1,500 tons a day. About two-thirds of all waste is left outside residential houses, markets, hotels and offices. For both environmental and health reasons, the collection and disposal of solid wastes is inadequate.[3]

Most urban areas are faced with serious drainage problems. In the past, drainage was through natural channels but this is obviously not adequate for the much increased urban population with large concentrations of people. The problem is especially acute in squatter settlements where there are no drainage systems. Many towns have expanded onto areas which have been avoided by planned developments because of the risk of flooding or because the terrain is swampy. This is particularly the case with industrial areas and squatter settlements. Due to a lack of drainage, many ponds and pools are formed during the rainy season in most towns. Domestic waste water is disposed of into drains near residential areas and this also contributes to storm water pools. The decomposition of food waste may result in bad odours. Ponds and pools are often breeding sites for disease vectors such as mosquitoes, and they create many problems for those living closeby.

III. WATER POLLUTION

THE MSIMBAZI RIVER, often mentioned in ancient histories of Dar es Salaam for its purity, is now badly polluted by untreated effluent from industries and domestic sewage. When the river enters Dar es Salaam in the Kisarawe area, the water is much cleaner than when it leaves the city at Salander Bridge. Effluent from textile companies, such as Urafiki, Kiltex and Sunguratex, includes chemicals such as heavy metals (cadmium, chromium and zinc), dyes, caustic soda, bleaches which are toxic and acids such as sulphuric, hydrochloric and acetic acids. The Ubungo waste stabilization ponds designed to treat waste water from Urafiki textile mill and surrounding residential areas have not been working for many years. The effluent from this mill and the residential areas is discharged through Ubungo stream and joins the Msimbazi river near the upper part of Morogoro Bridge.

Food processing industries such as Tanzania Dairies at Ubungo, Tanzania Breweries at Ilala and Vingunguti abattoirs produce waste water containing fats, blood and organic materials and which has a large biochemical oxygen demand. This water enters the Msimbazi river without any form of treatment. A large quantity of raw sewage containing organic matter, nutrients, bacteria and pathogens from Ilala residential area is also discharged into the Msimbazi river. Bulky refuse from the garbage site at Tabata is used to fill low-lying areas around Luhanga river, a tributary of the Msimbazi river.

All the factors mentioned above contribute to the pollution of the Mzimbazi river. This condition probably arises as a result of the higher dissolved oxygen demand of industrial effluent. For example,

2. Ministry of Health (1986), *Annual Report,* Dar es Salaam and Yhdego, M.(1988),"Epidemiology in squatter settlements in Tanzania.", *Ekistics* (in press).

3. Yhdego, M. (1988), "Urban solid waste management in Tanzania", *Waste Management and Research* Vol.6, No.4.

the effluent from Tanzania Dairies has a very high biochemical oxygen demand: between 1,000 and 1,400 milligrams per litre (a fully treated effluent would have a figure of around five milligrams per litre) while the figure for the effluent of the Tanzania Breweries is some 4,500-8,000 milligrams per litre. The abundance of nitrogen compounds from the industries' effluent also promotes blooms of algae in the water. The blooms spread on the surface of the water depriving all aquatic micro-organisms at the bottom of dissolved oxygen and creating anaerobic conditions. The smell of gases such as hydrogen sulphide, ammonia and methane is evident along the Msimbazi river particularly across the Morogoro Road; however, the worst problem occurs along the coast at Salander Bridge.

The polluted river directly and indirectly affects human health. Many children play in the river and some people use river water for agriculture during the dry season. At present, the Msimbazi river is not even fit to be used for irrigation, let alone for use for washing and drinking. The most commonly used indicator for water quality is the coliform count which is the number of coliform bacteria found in 100 millilitres of the water. The coliform count in the Msimbazi at its entry into Dar es Salaam at Kisarawe is between 75 and 100 per 100 millilitres of water - a relatively low count indicating good quality water. When it leaves Dar at Salander Bridge this figure has risen to between 250,000-400,000 per 100 millilitres of water which is heavily contaminated. This is over 1,000 times the coliform count considered as safe just for swimming - let alone human consumption. In effect, this stretch of the Msimbazi river has become an open sewer.

The Msimbazi river enters the sea at Msimbazi Bay. The marine eco system of the Dar es Salaam coast has several exploitable resources of economic significance and includes several diverse natural communities such as coral reefs, seagrass beds and mangroves, cliffs, sandy beaches and sandy mud. Each habitat has its own characteristics which make each of them very sensitive to ecological stress and pollution. There is a general lack of public awareness about the potential impact of marine pollution. No comprehensive scientific studies have been carried out to assess, for instance, the pollution level and the health effects of marine pollution along urbanized coastal areas except for one small exercise looking at micro-organisms.[4]

Rivers in other urban areas such as Themi (Arusha), Njoro (Moshi) and Ngerengere (Morogoro) also have problems due to the discharge of untreated domestic and industrial effluent. Samples taken have revealed that the water quality of the rivers is affected. In Mwanza, factories like the soap and edible oil refinery, and residential areas discharge untreated wastes into Lake Victoria.

4. Bryceson, I. (1982), "Pollution of Dar es Salaam coastal environments by industrial and domestic effluents", University of Dar es Salaam.

IV. AIR POLLUTION

IN MANY CITIES in Africa, motor vehicle traffic and other users of fossil fuels contribute to high concentrations of air pollutants - including oxides of sulphur and nitrogen and photochemical oxidants.[5] The number of private cars in Tanzania has been increasing rapidly, especially since June 1984 when the government removed a ban on importing private cars from abroad. According to the Central Registry of Motor Vehicles, in 1988, there were about 300,000 motor vehicles in Tanzania, two-thirds of which were in Dar es Salaam.

There is no monitoring of air pollution from traffic but congestion and pollution arising from motor vehicles are the subject of continu-

5. Photochemical oxidants are a group of harmful pollutants produced by a reaction of some of the air pollutants in motor vehicle emissions (hydrocarbons, oxides of nitrogen) and sunlight.

ing public debate in various meetings. Much of the stock of motor vehicles is old with inefficient engines, for example UDA (public buses), *dala dala* (private buses), lorries and taxis. Carbon monoxide emissions may be up to ten or even 20 times greater than those of new vehicles imported from Japan.[6] There are more petrol driven vehicles than diesel vehicles and most petrol still contains lead additives thus resulting in toxic lead salts in the air.

A high percentage of domestic cooking in towns is done using charcoal and wood as the fuel. Cooking takes place squatting over an inefficient and smoky stove with smaller or older children in attendance. Respiratory illness may occur or be exacerbated because of the smoke.

A further source of air pollution in Dar es Salaam is the Tabata solid waste dump site. All refuse at the site is partially treated by uncontrolled burning. During the burning of plastics, papers and vegetable materials, large quantities of toxic gases are emitted, including hydrogen chloride and sulphur dioxide. A north-westerly wind drives the smoke into the neighbouring settlements. The gases are a health hazard to the population of Tabata area and to the people who daily use the Port Access Road. A survey conducted in the area revealed that smoke was one of the biggest problems.[7]

In Dar es Salaam and Tanga, the spraying of DDT and other insecticides to eliminate mosquitoes is still practised by city and town authorities, and by the Ministry of Health in collaboration with the Japanese. This practice stopped years ago in most other parts of the world. Air borne DDT is carried to the soil by rainfall and may pollute agricultural land and ground water.

Other major sources of air pollution in Dar es Salaam and Tanga are the Tanzania and Italian Petroleum (TIPER), the Wazo Hill Cement Factory and the Tanzania Fertilizer Company. TIPER is located about four kilometres to the south-east of Dar and is surrounded by agriculture, residential areas and heavy industry. Hydrocarbons and hydrogen sulphide emitted into the atmosphere are considered to be potential health hazards both within and outside the refinery complex. The petroleum refining process is known to be directly associated with air pollution due to the disposal of by-products from the refining process into the environment. Residents in the area suffer from headaches and stomach upsets which they attribute to the refinery.[8]

The Wazo Hill Cement Factory produces large discharges of dust into the air. Dust pollution is of great concern to the cement industry. Exposure to excessive concentrations of these dusts increases the frequency of mild respiratory ailments such as colds and influenza. The Tanzania Fertilizer Company manufactures different types of fertilizers including aluminium sulphate and triple superphosphate. The factory is located about two kilometres east of Tanga town centre, 200 metres from the Indian Ocean, and is surrounded by residential and commercial areas. Oxides of sulphur, hydrogen fluoride and ammonia gases and dust are discharged into the atmosphere through a 100-metre high chimney stack. Questionnaires conducted in the area revealed that more than 90 per cent of people complain of irritation and coughing.[9] These are most likely due to sulphur dioxide gas.

6. Department of Trade and Industry, (1982), "Air pollution", *Technology and the Environment* No 12, London.

7. See reference 3.

8. Yhdego M. (1989), "Industrialization and environmental pollution in Tanzania; case studies - Wazo Hill cement factory and Tanzania Fertilizer Company", Research Report, Dar es Salaam.

9. See reference 8.

V. CONCLUSION

LACK OF URBAN and environmental planning, and uncontrolled urban development have contributed to the growth of insanitary settlements. Many urban areas in Tanzania now have shortages of water for both domestic and industrial purposes. Most of the squatter settlements only have access to untreated water for their daily needs. These people often rely on underground water, rainwater, open drains and stagnant pools. Public health dangers related to polluted surface and ground water are particularly serious, increasing the risk of contracting and spreading communicable diseases.

Despite many problems in the urban environment, remedial action is being taken very slowly. Urban master plans based on outdated European models of town planning are inappropriate for Tanzanian conditions. Methods of urban planning and environmental monitoring need to be improved. Innovative research on environmental problems and their solutions, on the environmental consequences of residential and industrial development, and on technologies for environmental preventive control need to be undertaken. The focus should be on technology and planning methodology for environmental protection in regard to housing, water, sanitation, refuse management, drainage and road transport, aimed at improving the quality of life for the mass of the urban population.