PRIORITIES FOR PUBLIC UTILITIES AND HOUSING IMPROVEMENTS IN KUMASI, GHANA : AN EMPIRICAL ASSESSMENT BASED ON SIX VARIABLES

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INTRODUCTION

Access to piped water and sanitation,like the condition under which they are housed,have considerable ramification for the health of city dwellers.This paper is an attempt to use data collected in a housing survey,as part of a larger research programme on housing policy, to indicate areas in Kumasi, a Ghanaian city of 600,000 inhabitants,in which utilities and housing conditions may be particulary inimical to health.

Much research has been undertaken into relationships between environment and health in the tropics,with particular emphasis upon those natural environmental or geo-ecological factors of importance in tropical medicine and tropical hygiene, but no short review of literature would do justice to their full range or substance .This paper presents only a small part of the expanding area in the ecology of disease, which concerns the urban habitat specifically , and points up the utility of a unified field of study embracing architecture , town planning and medical geography which might present scope for collaboration with those working directly in health planning or medecine itself.

It can be argued that the approach to human health and disease has over very recent years undergone marked changes of emphasis where environmental and behaviour (ie. «life-style») factors are concerned . Perhaps the most interesting of these have originated with bodies like the W.H.O. and the World Bank, which have signalled the need for a fundamental rethiking of orthodox Western approaches to the health sector's as part of more general social and economic development in the developing countries . These have found their expression in the World Bank's adoption of formal health policy in 1974, and the publication of its «Health Sector Policy Paper « in 1975, which gave prominence to «insanitary conditions and housing « as causes of poor health . Even more decisive has been the formulation of policy and agreement upon priorities within the W.H.O., culminating in the «Alma Ata Declaration « of 1978 under the slogan «Health for All

by the Year 2000 « which commited the organisation to a changed global emphasis upon prevention and primary health care as distinct from what might be described as high-cost , high-technology, hospital-based curative medecine. To a remarkable degree, there has been a revival of interest in the environmental approach to disease complexes which characterised the medical science before the discoveries of Koch, Pasteur and others a century ago, and there is a growing recognition that diseases are not isolated cycles of cause and cure but part of complex ecosystems, some «natural», some»man-made».The environmental approach is no longer dependent upon the limited analytical tools available to the 19th Century «medical topographer», but can draw on modern ecology and geo-ecology;systems theory, spatial epidemiology, and a range of cartographic techniques which exploit the possibilities of geo-code data and the statistical analysis of health related phenomena clustering in time and/or space . Perhaps most importantly, this interest in the spatial distribution of actual diseases, or the spatial patterning of more generalised health status measurements, points up the scope and possibilities for environmental interventions, modification or change which would achieve particular health goals more cheaply and effectively than conventional medical services .

A particularly valuable set of models is available in the more recent literature of medical geography and geomedecine, much of which has appeared in German-Language sources . Dating back to the writing of Finke in the 1790s, the medical interest in the geography and ecology of disease has most recently found its expression in the work of the Geomedical Research Centre at the Heidelberg Academy of Sciences ; building on the works of the Wehrmacht's wartime « World Atlas of Epidemic Disease,»(Rodenwaldt and Jusatz 1952-1961) comprising 120 sheets between 1952 and 1961, but is responsible for a series of regional studies in geographical medecine (the Geomedical Monograph Series) on countries such as Ethiopia (Schaller and Kuls 1972) and Kenya (Diesfeld and Hecklau 1978) and disease-specific studies such as those on dengue haemorrhagic fever in Thailande (Wellmer 1983) or human helminthiases in the Philippines (Hinz 1985) .

Amongst the most important conceptual and methodological advances from this quarter have been those relating to the identification of «nosochores»(ie.disease areas) and nosochoretic types in which mortality and morbidity data are related to natural geographical areas rather than to administrative units (cf.Diesfeld 1974) . The «natural nidality» of infectious diseases is , of course, not new and has been particulary important in the Soviet approaches to «landscapes epidemiology» (Pavlovsky 1966;cf. Klink 1974), but its refinement in statistical-cartographic terms as a tool for assessing or predincting disease-hazards and risk is particulary important for the developing countries (cf Hinz 1983 on the medical geography of West Africa, and Diesfeld's map and monograph on the medical geography of East Africa, in the Afrika-Kartenwerk series, at press) .

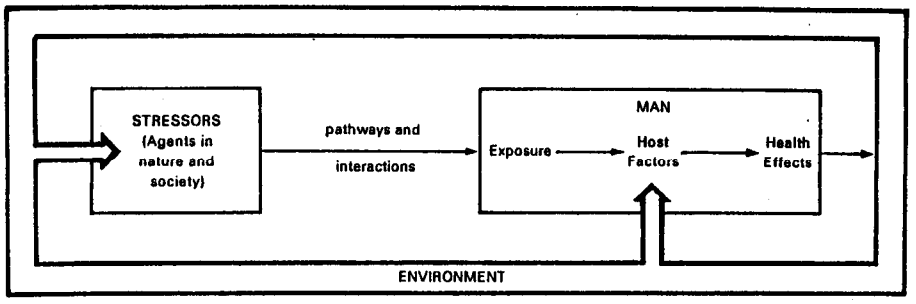
The effect of the man-made environment on human health and behaviour have attracted considerable attention in the developed countries, but remain a relatively unexplored area in many, if not most, developing countries .Subjects covered in Western cities have included not only such obvious ones as general mortality variations within the city (Burnley 1977) or intra-urban variations in singled or grouped diseases like the

cardiovascular (Meade 1983) or psychiatric disorders (Bain 1976), but also links between population density, overcrowding-particulary with regard to room occupancy- and pathology(cf Galle et al.1979, Rose 1976). Particularly suggestive of areas for further research are two reports from the U.S. Department of Health, Education and Welfare, which present comprehensive reviews on human health and the environment, ranging from atmospheric pollutants and water supply to housing , neighbouhood design and segregation of social groups(U.S. Department of Health 1977, Hinkle and Loring 1977).The World Health Organisation has published an annotated bibliography on housing, the housing environment and health (Martin et al.1976) and Akhtar's medical geography bibliography is of interest (Akhtar 1982). By comparison, work on similar topics in the cities of the Third World is, despite the pressing and obvious need for such research and monitoring, sporadic and limited .

Subjects like urbanisation and the epidemiology of mosquito-borne disease (cf Surtees 1971, Wellmer 1983), infant mortality (Mosley and Chen 1984), water supply and disease prevention (cf Bradley 1974) or health care delivery (Iyun 1978) all point up the growing scale of disease problems of cities in the developing countries, yet many of the planning problems associated with them are rendered intractable by the inadequacies and available (usually hospital-based) medical records(cf Iyun 1985)on mortality, morbidity and disability, and the lack of their locational specificity . These urban areas are in general experiencing a disproportionate growth in numbers and expansion in area, with all the concomitant problems of planning implicit in uncontrolled increase(Vining 1985) .

Because it is unlikely that adequate information on health status or disease incidence will be forthcoming in the near future for many such urban core regions, the use of relatively simple environmental indicators in the risk assessment of disease would seem a logical alternative ; in broad terms these are the outward expression of the stessors (ie. biological, chemical, physical and social factors in the total environment) which lead to health effects in man (Schaefer 1974 and figure 1) .

Figure 1



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The use of what have been called «environmental risk containers « or E.R.C.s for rather similar purposes in the urban areas has been more restricted to date, but, in principle at least, their contribution could be considerable . Fox's study of patterns of morbidity and

mortality in Mexico City (Fox 1972) was an important exploration of this area. It placed particular emphasis upon housing patterns, health and disease, starting out from the assumption that certain infectious disease are « more likely to occur in parts of the city with poor housing « and going on to state that « it seems clear that knowledge of the domestic environment could be used to formulate a reasonable view of the likely demand for medical assistance throughout the metropolis «. His results from factors analysis suggest that improved sanitation and hygiene might in particular make a strong impact upon infant and child mortality, though having relatively little effect on adult mortality.

It is the assumption that an understanding of the built environment and of social areas within the city might be a valuable predictor of disease risk (and hence of use in determining priorities in urban upgrading programmes or health care delivery planning) that this study is presented. It is hoped that it might prove a basis not only for a somewhat neglected dimension of environmental risk assessment based on E.R.C.s identified by cartographic and statistical methods, but also suggest areas for any subsequent multi-disciplinary research into changes in mortality and morbidity; specifically the «epidemiological transition « and government responses to them (cf Hellen 1983).

An earlier work of the authors had been concerned with the development of simple methods for analysing housing conditions which could be used inthe difficult working conditions experienced in Third World administration (see Boapeah and Tipple 1983, and Tipple 1985). This paper is presented in the same vein in order to encourage hard-pressed health practitioners in the Third World to identify problems areas quickly and without complex numerical analisys. It demonstrates how data available from a housing survey can be analysed to establish which areas of the city score badly on health related environmental conditions. Then, by combining the scores and rank scores, the overall performance of each area can be assessed and the areas with the highest priority for improvements can be identified . Armed with data such as these and their own specialised knowledge of how they affect health, medical personnel can attempt to shape government priorities in housing and improvement of services.

The case study

Kumasi is the capital of the former Asante Empire and the seat of the paramount chief of the Asante people, the Asantehene. Destroyed by the British in 1901, it was rebuilt as the commercial and administrative centre of the forest areas of Gold Coast, now Ghana. Having experiencied rapid growth during the cocoa boom years before World War II, and in the heady days of self-government and independence in the 1950s and 1960s, Kumasi has suffered badly from the decline in the Ghanaian economy during the 1970s and early 1980s. Always a centre of political opposition, it has received much less government investment than Accra. The environment of the city is now very run-down. The roads are badly pot-holed, drains are blocked and broken, and essential services are scarcely operational.

The following variables were chosen from the data as indicators of housing conditions

which are likely to affect health .

1. Access to water supply ,
2 . Access to sanitation .

These were chosen as measures of the exposure of residents to water related diseases.

3 . Residential density ,
4 . Occupancy rates ,
5 . Households occupying only one room ,

These represent various methods of expressing crowding and the density of contact between residents for the spread of infectious and contagious disease .

6 . Per capita income .

This combines a measure of household size with a measure of the ability of a household to afford adequate nourishment .

The data were collected in 1980 and 1981 in 28 residential areas in the city (the areas are shown in figure 2, major non residential areas are shown on figure 3) . With the exception of the hight cost areas most of the main built up area of the city has been surveyed . Although the former are very extensive, they contain only 10% of the rooms in the city and data for two areas (Asukwa and Bomso) are taken as representative of all. In addition, not all the villages peripheral to the city were surveyed. They were divided into four categories, by size, and one out of earch category is taken ot represent the rest. The villages were divided as follows : large, 500 or more houses ; medium, with 200 or more houses ; and small, with less than 200. The last was further divided into those which are now close to, or within, the city built up area and those which are surrounded by «the bush».

Figure 2 - Location of residential areas

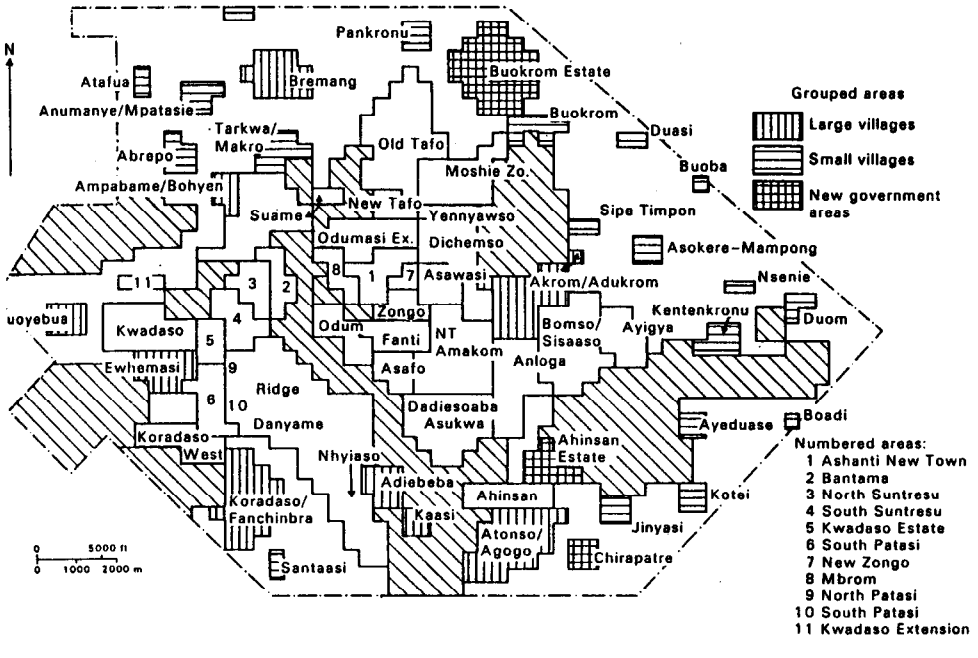
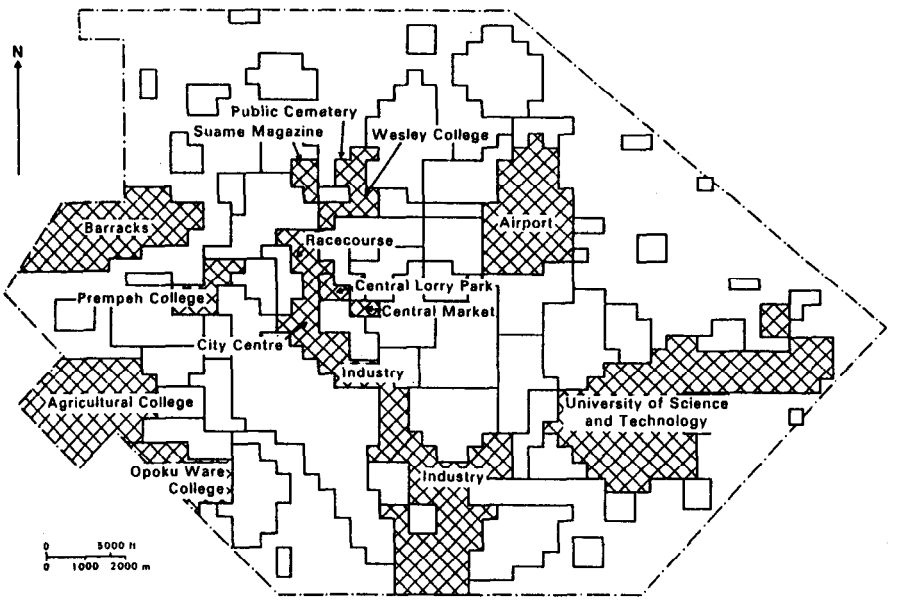


Figure 3 - Location of non-residential areas



In the diagrams, the data are rationalised in the maps to the 330 metres, (1000 feet) grid squares into which the 1960 1 : 2500 Town Sheets are divided.

1. 1. Access to water supply

This refers to whether a household has access to a water supply within the house in which it lives. Most houses in Kumasi are built as rows of rooms around a central courtyard. There may be up to 16 rooms in a single storey house, 30 or more in a two- or three-storey house, each of which may be let to a different household. The Kumasi Building Regulations (K.P.H.B. 1939) state that each new house built must be equipped with at least one tap per storey. If a water tap is present, it will be either in the courtyard or attached to an outside wall of the house. In the latter case, il will be padlocked to prevent ousiders using it without payment. Thus, access to the water supply is shared with all households in the house. In the small percentage of houses built for a single household, the supply is exclusive to that household.

Water supply in Kumasi is in the hands of the Ghana Water and Sewerage Corporation (GWSC) set up in 1965. It is intended to be self-financing but is tied to uneconomic water rates fixed from time to time by government. As a result of economies made by GWSC in its efforts to remain within cost limits set by revenue, the service provided tends to be below standard and subject to frequent breakdowns in equipment and supply.

Indeed, owing to a lack alum at the words during late June 1980 no water flowed to the main residential areas for ten days. Even in some high cost areas water may flow for only two hours a day - often in the early hours of the morning - and rarely above the ground floor.

Damage to mains through impact is common as erosion brings pipes close to the surface. In some areas, the pipework of private connections is visible on the surface of roads and paths.

The standard of supply set by government is 110 litres per capita per day but no urban area in Ghana has achieved this (Amissah 1981). According to GWSC records in 1980, about 9,600 premises in Kumasi had a water supply and 7,000 premises had no connection (Amissah 1981). These data under-estimate the number of houses in the city - by 4,000 (Boapeah and Tipple 1983) - and indicate that well over half have no recorded connection. Despite the regulations, the 1980 survey shows that about 33 % of all households (about 200,000 people) have no access to a house water supply.

Households without access to a supply associated with the house are counted as having none. They must resort to the public standpipes, many of which are no longer in working order. The standard of provision is 1 tapper 300 people within 100 metres of each house.

Although the GWSC denies this, there is evidence that, in order to encourage landlords to have private connections installed, public standpipes are not maintained with any great assiduity. Private connections must be paid for at cost so the further the house is from a main, the more expensive is the water supply. As GWSC only lays mains down roads approved by the planning authority, areas not conforming to town planning maps are further from mains than fully authorised areas.

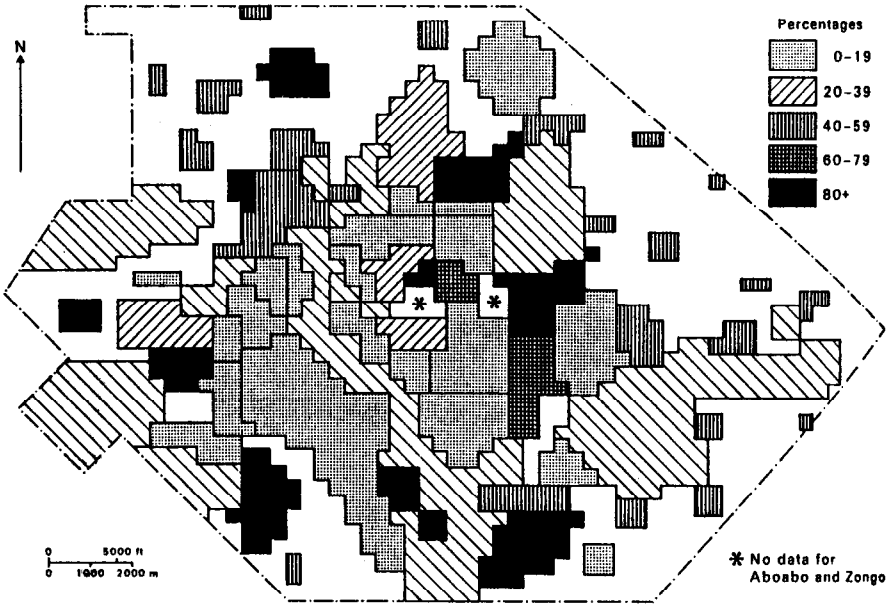
Figure 4 shows the distribution of households who do not have access to a water supply within the house. Owing to survey problems, no reliable data on water supply or sanitation are available for Zongo and Aboabo. It is evident that water supply is poor in the oldest government housing (New Zongo and Asawasi), on the edge of the built up area (such as in Moshie Zongo and Angola), and in many of the peripheral villages. This shows that water supplies have not kept pace with the areal growth of the city and extensions in mains reticulation in the periphery and between main roads are required, to achieve more adequate supplies across the city. As a piped supply of potable water is one of the most basic requirements for health in urban areas, priority should be given to increasing the accessibility of house supplies. A project aimed at ensuring that no area has more than, say, 40 % of households without access to a house water supply would require major extensions to the mains reticulation, especially to the large peripheral villages where population is expanding rapidly. Such an extension is unlikely while current GWSC supply policy remains. Changes in policy are necessary as follows :

a. It would be necessary either to allow GWSC to set its own tariffs related to supply costs or, if this proves politically impossible, to remove its obligation to make a profit.

b. GWSC should be allowed to lay pipes along any established road not just those on approved plans.

c. Connection charges should be standardised each year at the mean cost of all supplies rather than each connection being charged at cost. This would encourage GWSC to establish an even coverage of mains.

Figure 4 - Households without access to water in the house



1. 2. Access to sanitation

As with water supply, access to sanitation implies that households have access to a toilet in the house, even though it may be shared with many other households. The data allow no distinction between bucket latrines and WC toilets, but it is exceptional for a house outside the high cast areas to have a WC. Indeed there are no sewers in most of the city although they have been planned since the early 1970s.

Efforts have been made to ensure at least one latrine in each dwelling. Section 28 of the Kumasi Building Regulations, 1939 (K.P.H.B. 1939) requires that :

a) every dwelling house shall be provided with approved kitchen, bath and latrine accommodation and,
b) in tenement flats, bathroom, kitchen and latrine must be provided for each floor of the building with an additional latrine for more than four rooms on any floor.

Since 1971, the Regulations (Kumasi City Council 1971) have required that bath and sanitary accommodation should be of a type approved by the City Engineer.

As a qualitative measure, the presence of a latrine is perhaps less useful in the Kumasi context than some of the other variables discussed here. The problems arising from the negligent use of large numbers of bucket latrines in the denser areas of the city centre may be much more serious than the lack of latrines in a peripheral village from which most residents can «go for bush».

The bucket latrine system is still relied upon in most parts of the city outside the High Cost sector. There were 9081 private buckets in use in 1977 (KCC Cleansing Dept. quoted in Mensah, 1978). The standards appear to have developed more from the capacities of the hardware used than from considerations of the users' need or convenience. Private latrines were all originally of the bucket type which utilise containers holding 11.25 litres and can cope with 25 visits per day. Thus one latrine per 25 people became standard.

If properly managed and frequently emptied, the bucket system can provide and economical and hygienic sanitation system where water supply is inadequate for water-borne systems. However, the Kumasi system suffers from inadequate labour supply (only a small group of northerners will accept work as scavengers), gross shortages of vehicles, oil, fuel and spare parts, and management inadequacies. Infrequent emptying of buckets (the supply standards of which rely on daily emptying) results in users being denied access to private latrines between their being filled up and being emptied (and, therefore, increasing the usage of public latrines).

The World Bank (1980) provides a useful discussion of sanitation in Kumasi in recent times, although its data on numbers of facilities appear to be inaccurate. According to its report, the latrine units are inadequately designed and poorly maintained. In addition the vaults, into which the head-loaded latrine buckets are emptied in each sanitary area, tend to be liberally covered in fresh faecal matter both loose and in buckets. As they are emptied too infrequently they constitute a dangerous health hazard to users of the sanitary area and occupants of adjacent areas.

The dirty environment may also have supra-local consequences. It is not uncommon for open spaces near sanitary areas to be used for the preparation of cooked food for sale. Such products as doughnuts are carried through the city streets to be sold. Plantain, cassava and yam are roasted or fried, and various porridges are boiled for sale on site or at a near-by junction to passers-by ; kebabs are prepared for later cooking and sale in the streets. As food preparation in Ghana is a time consuming task, most working people depend on such «small chop» for their mid-day meal ; some for most of their meals. Thus, the hazardous consequences of a badly kept night-soil vault in one area can spread rapidly across the city.

Unauthorised emptying of buckets and tanker-loads of raw faeces into the rivers of Kumasi to save time have further exacerbated health problems, especially where the water is subsequently drunk or used to wash foods such as cassava being prepared for sale.

The use of WC toilets has been encouraged for many years but is only common in the Ridge area and on U.S.T. and other education campuses which have their own pipe-borne treatment systems. The problems accompanying introducing universal use of WCs are very serious and include :

a) Insufficient water supply capacity for flushing ;

b) The cost of WC pan and cistern (about C5, 000 in 1982) and the pipework and treatment plant ;

c) The shortage of toilet paper or other anal cleansing material capable of being flushed away.

Despite the building regulations aimed at providing everyone with access to private latrines, the public latrines in Kumasi remain over-used. At least, 22.3 % of households (about 130,000 people) had no access to private latrines, and an unknown number in addition use inadequately serviced latrines which are out of use for part of the time.

Public latrines are provided at over 400 locations in the city. 86 of these are bucket latrines, 7 use water closets, but the majority (318) are aqua-privy or «bomber» latrines - so named after one became blocked during wartime and exploded (Mensah 1978). Since their introduction in the 1930s, the standard of public aqua-privy provision has been 1 «hole» per 30 people, with latrines being within 400 m of every house.

They tend to be used incorrectly and, therefore, become less hygienic than they should be. Originally, each aqua-privy was sited close to a public stand-pipe and the water level could be restored when the tank was emptied. Over the years the stand-pipes have been badly maintained (by GWSC) leaving the crew of the suction tankers (employed by KCC) no means of restoring the water seal in the tank. Thus the aqua-privy quickly becomes a vault full and overflowing with potentially pathogenic excrement.

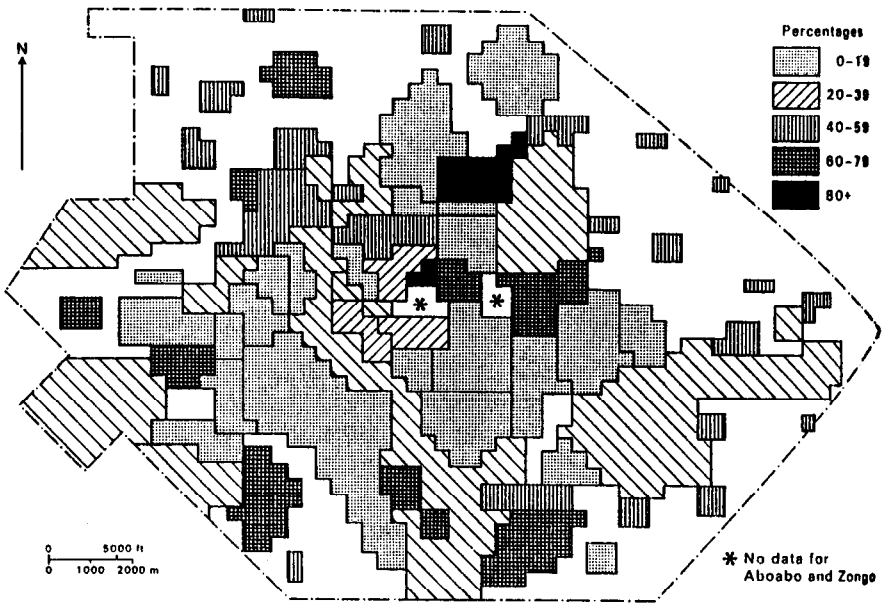
Perhaps surprisingly to planners unused to West Africa, sites for public latrines still form part of policy for residential areas for low-income groups. Most planning students at U.S.T. in Kumasi in recent years regarded them as acceptable sanitary installations though few had regular personal experience of their use. This is in marked contrast to Central and Southern Africa where, in 1943, the Eccles Commission found septic tank (WC) public latrines on the Copperbelt entirely inadequate and unhygienic (Northern Rhodesia 1944) despite a level of provision only just under the South African standard of 1 «hole» to 12 people.

As it is cheaper for landlords to provide a latrine of some sort than a water supply, fewer areas score badly on this variable (figure 5) than on water supply. The peripheral areas are not as badly off as for water although some areas (notably Moshie Zongo, Suame, Kwadaso, and the large villages) have large numbers of households without access to sanitation. Furthermore, the public latrines in these areas tend to be particulary poorly maintained.

As the city bucket conservancy system is inefficient at present, and would become increasingly so if it were extended to more outlying areas, a simple extension of current sanitation cannot be proposed. Indeed, before the general level of sanitation can improve, major changes will be required in the whole system.

The manhandling of raw faecal matter must give way to more effective systems of

Figure 5 - Households without access to toilet in the house



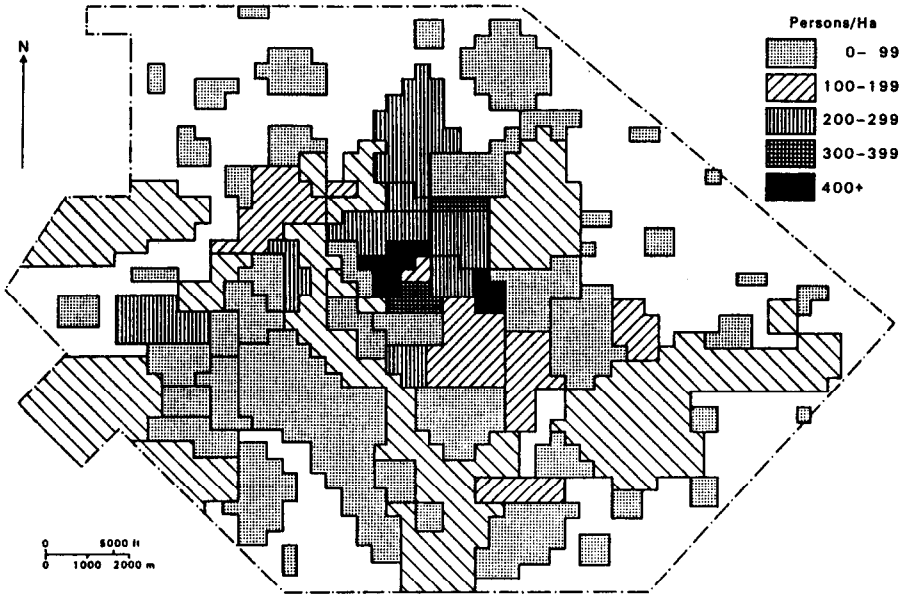
disposal. Furthermore, reliance on public latrines has proved to be unpleasant in the extreme for users. Any proposal for full sewerage falters on cost and also on an inadequate water treatment capacity to cope with universal WC usage. Some compromise is needed between fully private sanitation and the current major reliance on public latrines; and between the technical simplicity of buckets and the sophistication of WCs.

Adoption of sullage aqua-privies, with later upgrading with small-bore sewers appears to present the most cost effective system applicable to a culture in which handling of even composted excrement is taboo for the majority of the people. In the peripherical areas, which score badly at present, improved versions of the pit latrine may prove adequate especially as residential densities are low (figure 6). In both cases, latrines should be private to occupants of one house, even if they must be grouped in a public place for technical reasons.

1. 3. Residential density

This is calculated by dividing the arae of the squares covered by residential uses by the number of people living therein. It is expressed in persons per hectare. Within the city, only non-residential uses larger than half of one grid square have been separated from the residential area. Thus, for the most part, the areas of primary and secondary schools, markets, open spaces along the rivers, and parks are included in the residential density calculations. The large non-residential uses - the new barracks, airport, the main industrial areas, the government office area, the University of Science and Technology, and the agricultural college - are excluded. Thus densities expressed are higher than gross, but lower than net, densities in strict planning terms. As the area occupied by the

Figure 6 - Residential density



peripheral villages rarely fills the squares on the map assigned to them in this exercice, actual densities within the settled areas are probably much higher than reported here. However, as surrounding farm and forest land can be employed for semi-urban uses (especially, in this context, informal sanitary uses), the inclusion of such areas in density calculations is probably as valid as including the river valleys and school sites within Kumasi.

The citywide residential density obtained by this method is approximately 90 persons per hectare. This is very low, especially when compared with the planned density of 180 to 200 persons per hectare for Nigeria's new capital Abuja (Jibir 1985). However, there are areas of very high density within the city. As can be seen on figure 6, Aboabo (in excess of 500 p.p.Ha.) Ashanti New Town and Zongo, which are all close to the city centre, and Yennyawso to the north, are the only areas which exceed 300 persons per hectare. Together they constitute the only areas in the city which could be regarded as having high residential densities.

On the other hand, there are remarkably extensive areas of low densities (less than 100 persons per hectare), either because development is not complete or because of planned low density development. The latter can be seen to the south and west of the city centre. As they are well served with roads, water supply, and sanitation (part having its own water borne sewerage system), these areas can be viewed as a resource for increasing the amount of accomodation close to the city centre without the dangers consequent on very high densities. They could, therefore, accommodate households dispersed from very densely populated areas during improvement programmes where reductions in density are required.

1. 4. Occupancy rates

This variable refers to the area means of the number of persons in each room used for habitation. In some calculations of occupancy, children under one year are not counted and those between one and ten or twelve years old are counted as half. This has not been done in this exercice for the following reasons :

a. There was an under-enumeration of children aged under five in the data. This appeared to have arisen either from a reluctance to admit the presence of babies in case this supernaturally threatened their safety, or because the baby rode on its mother's back so much that it was hardly credited with a separate existence. The former seems most likely, but in either case the result is a slight under-estimation of the mean number of persons per room.

b. Children may be only half as big as adults but each individual has a similar effect on privacy and disease transmission which, in the crowded conditions of Kumasi, are likely to be as important as any space advantage gained because of the smaller size of children.

As available data, eg. census tables, are rarely detailed enough to define the age of members of each household, such differentiation may be impossible in most cities, even if it were desirable.

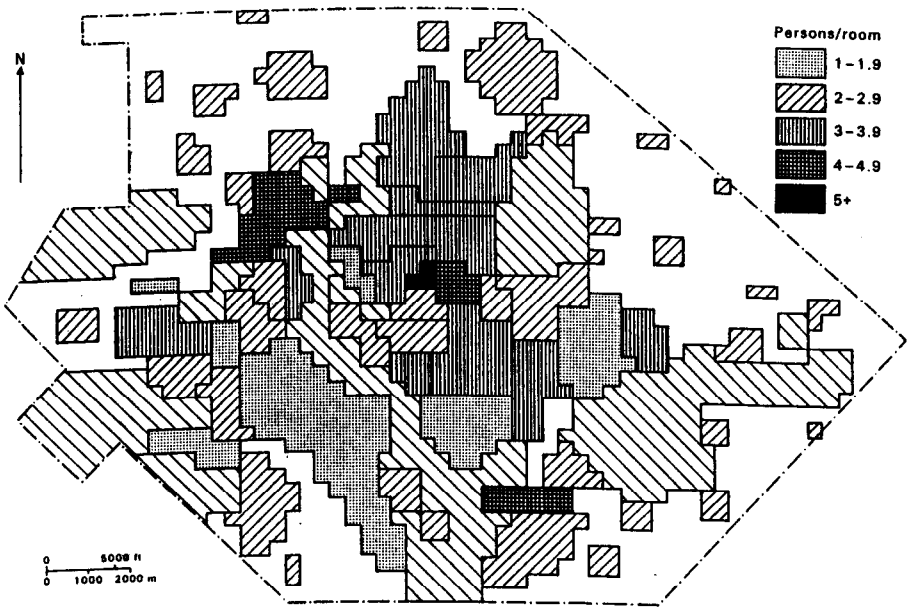
Occupancy rates are very high in Kumasi with a city-wide mean of 3.6 persons per room. As might be expected in a city with such high occupancy rates, the shortage of housing means that households with more than 5 persons have mean occupancy rates in excess of 4 persons per room. In the areas close to the city centre it is so difficult to get accommodation that even very large households may occupy only one room.

Figure 7 shows how widespread are areas where mean occupancy is in excess of a notional overcrowding threshold of 3 p.p.r. The distribution of overcrowding across the city can clearly be seen stretching from Old Tafo in the north, through the main residential areas to the west of the city centre and south to Ahinsan. Where large villages are close to centres of employment - industry (Suame, Kwadaso and Ahinsan), city centre (Bantama), or the University (Ayigya), overcrowding is evident.

The government sector shows and interesting duality between areas close to the city centre (New Zongo and Asawasi) and those which are further away, which is repeated in the variables which follow. In this case, New Zongo and Asawasi are badly overcrowded while the others are not. In the crowded areas, single roomed dwellings are predominant whereas elsewhere two and three roomed dwellings are more common. The survey data showed that households in one room anywhere in the city are more than three times as likely to have occupancy rates of over 3 p.p.r. (45 %) than those with two or more rooms (13 %).

The high occupancy rates can be attributed largely to a hiatus in private house building since the early 1970s. As inflation has been high in relation to controlled rental levels,

Figure 7 - Occupancy rate



the profitability of building for rent has disappeared. Thus, not only has building virtually ceased, but maintenance has also been seriously neglected.

It is interesting to note how many of the areas with high levels of overcrowding (figure 7) have relatively low residential densities (figure 6). Thus, even though the land is committed to residential use, it is being inefficiently used for accommodation. Policies to encourage house extensions in such areas could contribute to increasing the accommodation available in the city without causing any expansion of the built-up area.

1.5. Households occupying only one room

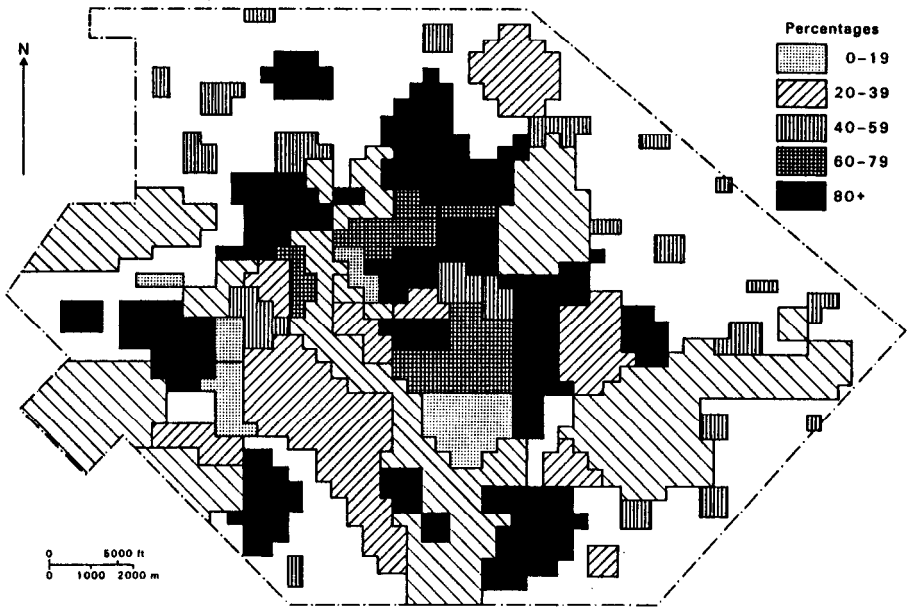
The availability of only one room to a household was regarded as a serious enough constraint on the health and convenience fo those affected to be included in this exercice. Not only is disease easily spread and more difficult to shake off within a household occupying a single room, but social problems are likely to be more acute when there is only one room available for settling young children, doing homework, relaxing in the rainy season, and consumating the marital relationship.

About 70 % of all households in Kumasi have only one room. Those having more than one room tend to be house-owners rather than tenants, or people wealthy enough to live in the high cost sector. These two groups constitute 11.5 % and 9.5 % of households respectively (with some overlap).

Areas with high percentages of households occupying one room are very widespread (figure 8) and show no tendency to decline with distance from the city centre. Apart from

the high cost areas and some government housing areas, only the outlying villages, and Zongo, Aboabo and Odum near the centre display less than 60 % of households in one room. In the case of Zongo and Aboabo, where all the signs of crowding might be expected, their comparatively low scores reflect the fact that the houses tend to be divided into many small rooms in order to allow the segregation needed by the predominantly moslem residents. In Odum so many rooms are used for commercial purposes as well as living that accommodation is spread through several rooms.

Figure 8 - Households occupying one room



1.6. Per capita income

This is included as a measure of household size as well as income. Household size, in itself, may not be an effective indicator of welfare especially in societies where extended families may provide many wage earners. The goodness of fit between a household and its accommodation is tested above in the occupancy rate parameter. The goodness of fit between income - and, therefore, access to food and other necessities - and household size is tested by per capita income.

There can be little doubt that, among low income households, per capita income is strongly related to adequacy of nutrition. Inadequate nourishment reduces immune responses to fight infection, prolongs recovery times, and interacts with the infective episodes to the detriment of growth and development in children , and productivity in adults (Amonoo-Lartson et al., 1984). Thus, where low per capita incomes coincide with poor water supply and sanitation, or with high levels of crowding, infection can flourish.

Data on income are notoriously difficult to collect. Experience in Kumasi provided yet

another example of failure to collect data on income with any accuracy or even at all. However, data on expenditure on food were successfully collected and these were used as a basis for estimating income. From earlier work in Ghana (Lawson 1962, Davey 1963, Adyanthaya and Tweneboa-Kodua 1964), factors were calculated by which the expenditure on food of each household could be multiplied to produce an estimate of income. The factor varied from 1.33 in the lowest quintile of the population to 2.5 in the highest. The estimated household income obtained in this way was then divided by the number of persons in the house to produce a per capita estimate.

While, in general, the estimates seem reasonable, those for the two areas near the centre of town occupied by northerners (Zongo and Aboabo) appear to be very low. This arises from two likely sources :

a. The northern diet includes large proportions of the cheaper starchy staples, especially millet, while Akans tend to use yam, cassava, cocoyam and plantain which are more expensive.

b. Many women in these areas cook food for sale and may feed their families from this without accounting for it in their spending on food.

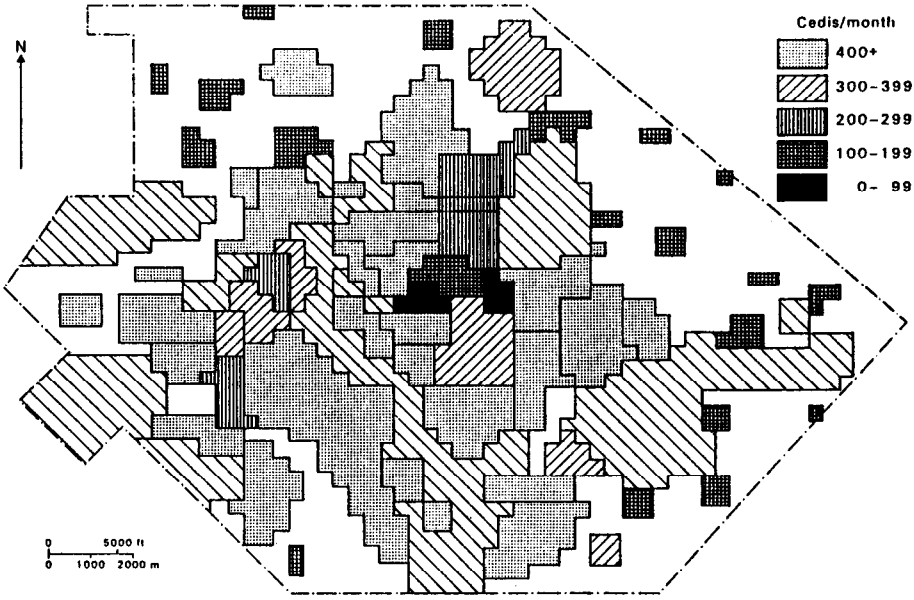
Apart from the above caveats, it can be assumed that the lower the mean per capita income, the poorer are the households in the area.

Mean per capita income in the city in 1980 was estimated to be C431.00 per month. However, the median of C330 and inter-quartile range of C170 to C620 shows a concentration of very low incomes. Although there are no up-to-date estimates of subsistence in urban Ghana, the impression gained from living in Kumasi for four years (1978-82) is that C330 is very close to a minimum required for food only.

Figure 9 shows that there are concentrations of very low per capita incomes to the north east of the city centre, extending from the northerner dominated Zongo and Aboabo and Asawasi, through the relatively new tenement areas of Dichemso and Yennyawso, through to Moshie Zongo. Elsewhere, peripheral villages and some government housing also display low per capita incomes.

For ease of comparison, data from individual maps are collated in the form of numerical scores in table 1 and in table 2 the rank scores of each area according to each of the six variables are presented. Clearly some areas may score well in some variables and badly in others. In order to measure the strength of correlation of performance between variables, Spearmans rank correlation tests have been carried out on the area data. The results are shown in table 3. There is a reasonably high positive correlation between areas with poor water supply and those with poor toilets (59 %), and between areas with high occupancy rates and those with large numbers of households in one room (70 %). However, interestingly low correlations were found between estimated per capita incomes and all the other variables. Although it is true that the high cost areas, represented by Asukwa and Bomso score well overall, and the worst scoring areas have

Figure 9 - Per capita income



low per capita incomes, some areas with relatively high per capita incomes (Suame, Ashanti New Town) score badly overall.

There are relatively low correlations between the measures of occupancy (people per room and households in one room) and density (people per hectare) where high coefficients might havec been expected.

Only 42 % correlation could be found between areas with high means of people per room and those with large numbers of people per hectare. Similary, only a 24 % correlation exists between the latter and areas with high percentages of households in one room.

Figure 10 illustrates the areas with high mean scores over the six variables and, together with table 1 and 2, serves to indicate the priority areas for improvement of utilities and housing conditions. Il seems likely that the areas which have received most government investment in the past - the newer government and high cost areas - require the least spending on improvement in the future, at least on grounds related to health.

Priority for improvement must be given to New Zongo (500 households) which, somewhat confusingly, is the oldest government housing in the city. When it was completed in 1929, it was undoubtedly regarded as an improvement on prevailing housing conditions. Built as a public health measure, following an outbreak of plague in Zongo, the area is now in such a poor state that it needs a complete overhaul or, even, rebuilding.

Selection of the next areas in order of priority must depend on the choice of table 1 or

Table 1 - Scores on six variables, by area

Sector/Area	Access to Water	Access to Toilet	Est'ed Per capita Income	House-holds in one room	Persons per Hectare	Persons per Room	Aggre-gate Score	Mean Score
Tenement.								
Asafo	1	1	1	4	3	3	13	2.2
Amakom	1	1	2	4	2	3	13	2.2
Ashanti NT.	2	2	1	5	5	3	18	3.0
Bantama	1	1	2	4	3	3	14	2.3
Odumasi Ex.	1	3	1	4	3	3	15	2.5
Dichemso	1	1	3	5	3	3	16	2.7
Yennyawso	2	1	3	4	4	2	16	2.7
New Tafo	1	1	1	4	3	3	13	2.2
Indigenous.								
Odum	1	2	1	2	1	2	9	1.5
Fanti NT.	2	2	1	5	1	2	13	2.2
Zongo	nd.	nd.	5	2	4	2	19(8)	3.3(8)
Aboabo	nd.	nd.	5	3	5	2	23(8)	3.8(8)
Anloga	4	1	1	5	2	3	16	2.7
Kwadaso (1)	2	1	1	5	3	3	15	2.5
Suame (2)	3	3	1	5	2	4	18	3.0
Bremang (3)	5	4	1	5	1	2	18	3.0
Kotei (4)	3	3	4	3	1	2	16	2.7
Moshie Zo.	5	5	3	5	1	3	22	3.7
Ayigya	3	1	1	5	2	3	15	2.5
Government.								
N.Suntresu	1	1	3	2	1	2	10	1.7
S.Suntresu	1	1	2	3	1	2	10	1.7
Kwadaso Est.	1	1	2	1	1	1	7	1.2
W.Patasi	1	1	3	1	1	2	9	1.5
New Zongo	5	5	4	5	2	5	27	4.5
Chirapatre(5)	1	1	2	2	1	2	9	1.5
Asawasi	4	4	4	3	3	4	22	3.7
High Cost.								
Asukwa (6)	1	1	1	1	1	1	6	1.0
Bomso (7)	1	1	1	2	1	1	7	1.2

Notes :

1. Represents Kwadaso and Old Tafo
2. Represents Suame and Ahinsan
3. Represents large peripheral villages
4. Represents small peripheral villages
5. Represents never government estates of Chirapatre, Ahinsan and Buokrom
6. Represents Mbrom, Asukwa and Dadiesoaba
7. Represents Ridge, Nhyiaso, Danyame, North and South Patasi, Bomso, Sisaaso and Koradaso West
8. Calculated from four criteria
nd = no data
In the scoring, 1 represents the best category recorded on the maps while 5 represents the worst.

Table 2 - Rank scores on six variables, by area

Sector/Area	Access to Water	Access to Toilet	Est'ed Per capita Income	House-holds in one room	Persons per Hectare	Persons per Room	Aggre-gate Rank.
Tenement.							
Asafo	1	9	7	15	22	17	10
Amakom	13	11	14	16	16	15	13
Ashanti NT.	15	17	9	23	27	24	25
Bantama	1	1	16	17	23	22	12
Odumasi Ex.	8	22	3	14	19	21	15
Dichemso	12	15	19	22	20	17	23
Yennyawso	18	1	22	13	25	14	16
New Tafo	9	1	5	17	21	17	8
Indigenous.							
Odum	1	18	2	9	9	4	6
Fanti NT.	16	19	10	25	11	13	18
Zongo	nd.	nd.	28	4	26	4	16(8)
Aboabo	nd.	nd.	27	7	28	7	22(8)
Anloga	23	9	12	27	17	15	21
Kwadaso (1)	17	16	8	21	18	22	20
Suame (2)	21	20	13	20	13	26	24
Bremang (3)	26	24	4	19	5	7	13
Kotei (4)	19	21	24	10	1	4	11
Moshie Zo.	25	26	23	28	8	24	27
Ayigya	20	14	11	23	12	17	19
Government.							
N.Suntresu	11	10	20	6	10	9	7
S.Suntresu	10	13	18	11	6	12	8
Kwadaso Est.	1	1	15	1	7	1	2
W.Patasi	1	1	21	1	4	11	5
New Zongo	24	25	26	26	15	28	28
Chirapatre(5)	1	1	17	4	2	9	4
Asawasi	22	23	25	12	24	27	25
High Cost.							
Asukwa (6)	1	1	6	1	14	2	1
Bomso (7)	14	1	1	8	3	2	3

Notes :

1. Represents Kwadaso and Old Tafo
2. Represents Suame and Ahinsan
3. Represents large peripheral villages
4. Represents small peripheral villages
5. Represents never government estates of Chirapatre, Ahinsan and Buokrom
6. Represents Mbrom, Asukwa and Dadiesoaba
7. Represents Ridge, Nhyiaso, Danyame, North and South Patasi, Bomso, Sisaaso and Koradaso West
8. Calculated from four criteria
nd = no data

Table 3 - Spearman's rank correlation coefficients

	Access to toilet.	Est'd per capita income.	Households occupying one room.	Persons per hectare.	Persons per room.
Access to water	0.5941	0.1634	0.5771	-0.0773	0.2962
Access to toilet		-0.0360	0.4230	-0.2872	0.2820
Est'd per capita income			-0.1267	0.1593	0.1108
Households occupying one room				0.2386	0.7020
Persons per hectare					0.4206

Figure 10 - High mean scores over the six vriables

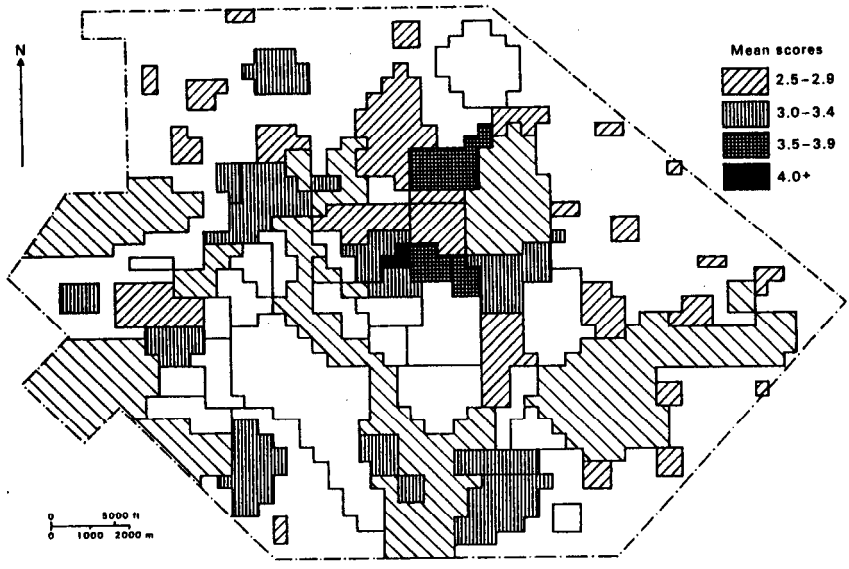
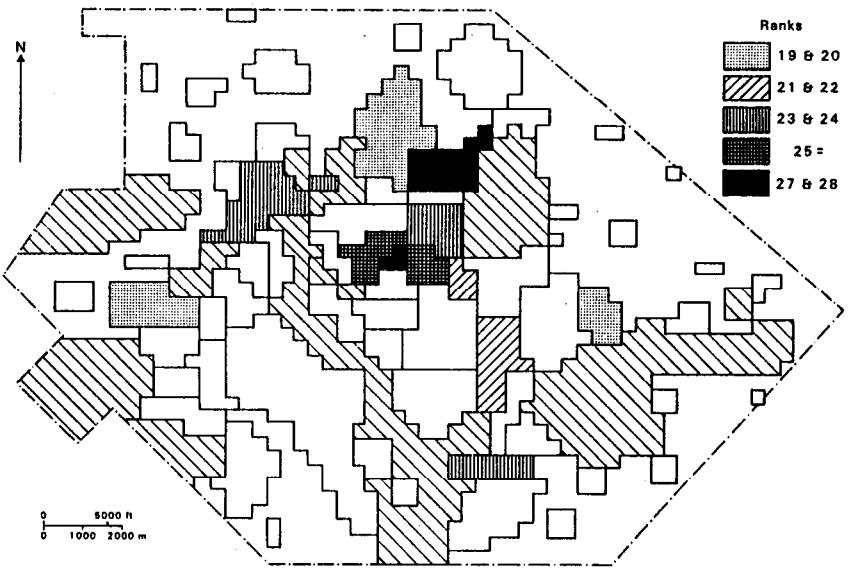


Figure 11 - Low ranking areas over six variables



2 for provision of indicators, although - being substantially in agreement - little conflict is likely. The second oldest government housing area - Asawasi (2400 households) - must be given high priority. Although it was built as a model settlement in the late 1940s, major increases above the planned occupancy rates have rendered services totally inadequate. As New Zongo and Asawasi are adjacent to each other they could be dealt with together in any upgrading strategy. Moshie Zongo (1900 households), Aboabo (6100 households), Suame (also representing Ahinsan - 8000 households) and Zongo (2800 households) score badly (though Zongo has the 13th lowest rank score ; table 2). Aboabo and Zongo are also close together and not far from New Zongo and Asawasi. Investment in environmental improvements in these areas, therefore, could be done together and have a considerable effect on the centre of the city.

Ashanti New Town (10600 households) scores badly on both tables and should feature in any major improvement strategy. It is centrally located (indeed it is adjacent to Zongo), very large, and dominated by the local Akan people who hold traditional power in the city. In contrast to the other areas above (except Aboabo and Zongo for which data are incomple), its high mean score and ranking are mainly due to the density at which it is occupied. As with Zongo, this area is heavily influenced by the concentration of trading functions in near-by Kejetia Market and the general gross shortage of housing in the city. While extension and improvement of public utilities would probably make a significant improvement in the other high priority areas, only a major increase in the number of rooms available to low income households, especially those close to the city centre commercial activities, is likely to improve conditions in Ashanti New Town.

Approximately 26 % of the households in the city would be affected by improvements

to these areas. However, many of them are dominated by northerners who have little political power in the city (see Schildkrout 1970 and 1978). Because some 39 % of the households of all the above areas, 52 % of those outside Ashanti New Town, are classified as northerners, the task of steering improvement funds towards these areas may be complicated by ethnic considerations.

2. Health care and health expenditure

Although the literature on health delivery in Ghana is substantial both in terms of Ministry of Health publications and those from other quarters, the more strictly medical research is readily accessible in periodicals such as the Ghana Medical Journal, any attempt to integrate it with the issues discussed here must await further multidisciplinary contribution. Amongst recent published work, that by the Institute of Development Studies at Sussex University on health in the rural areas is of considerable interest (IDS 1978 and 1981), and may be linked with that on the urban sector in cases like Patterson's study of Accra (Patterson 1979).

It would, nonetheless, seem useful to include here tables to indicate the present scale and the crisis in funding adequate health services. The difficulties which increasingly beset the Government have been highlighted by the decision to increase hospital fees by a factor of 8 or 10 from July, 1985, and the Secretary for Health has been reported as describing this as the only way to stop further deterioration of the country's health services (Ephson 1985). Where health expenditures between 1972 and 1979 had consistently accounted for between 6 and 8 per cent of government expenditure, since 1979/80 there has been a downturn (Table 4). The national population had risen substantially from an estimated 8.3 million in 1969/70 to 11.5 million in 1980/81, and with it the health expenditure per caput and the number of physicians. However, inflation has eroded the value of this expenditure to the extent that by 1980/81, it was less than one third of the 1969/70 level, and on a per caput basis had fallen to less than a quater. Added to this, the increase in the number of physicians in the country has been accompanied by an eight-fold cut in government spending per physician over the same period. The only increase in real terms took place over the period between 1973/74 and 1975/76 when the Acheampong SMC regime increased government activity and expenditure in many sectors, including housing (Tipple 1984). What followed is accounted for by the general inflation and the major recession in the Ghanaian economy from the late 1970s. This is charted in the movements in the consumer price index for the period 1969/70 to 1980/81 (table 5), and the consequential effects registered by adjusted health expenditure figures for the total budget, per person and per physician.

Even in the situation of declining allocations to health in real terms, government and public policy necessarily hinges on the choice of priorities. Richard Doll has recently commented that «curative medicine may be increasingly subject to the law of diminishing returns» (Doll 1983). Although he was writing on the limits of curative medicine in the developed countries and was arguing the case for preventitive medicine, the same lessons apply to the different physical and social environment of housing and infrastructure and, along with primary health care programmes, may hold out some hope for

Table 4 - Health expenditure, 1969/70 to 1980/81

Date	Health Expend. (C mills) (1)	Health Exp. as % of Total Govt. Expend.(1)	Est. (2) National Population (millions)	Health Expend. /person (Cedis)	No. of Physicians (3)	Health Exp. per Physician. (C thous.)
1969/70	31.2	7.1	8.3	3.76	667	46.7
1970/71	n.d.	n.d.	8.6	n.d.	n.d.	n.d.
1971/72	31.4	6.3	8.8	3.57	789	39.8
1972/73	38.8	7.4	9.1	4.26	951	40.8
1973/74	66.6	9.2	9.4	7.09	856	77.8
1974/75	95.4	8.8	9.6	9.94	939	101.6
1975/76	118.0	8.2	9.9	11.92	1011	116.7
1976/77	159.0	8.2	10.2	15.59	1071	148.5
1977/78	257.1	8.5	10.5	24.49	1388	185.2
1978/79	352.5	8.6	10.8	32.64	1482	237.9
1979/80	325.3	6.9	11.2	29.04	1553	209.5
1980/81	492.5	6.4	11.5	42.83	1665	295.8

Notes :

nd = no data
1. Capital and recurrent expenditures from Worl Bank (1984, tables 5.8 & 5.9)
2. Calculated from 1970 population of 8,559,000 (Ghana 1970 Census) and 1980 estimate of 11,500,000 (World Bank 1984, table 8?1)
3. Number of physicians in the second part of each period, from World Bank (1984, table 8.9)

Table 5 - Health expenditures, 1969/70 to 1980/81, adjusted for changes in the Consumer Price Index (1977 = 100)

Date	National C.P.I. (1977=100) (1)	Health Expenditure (C millions) (2)	Health expenditures adjusted for Consumer Price Index numbers. Total (C millions)	Per person (Cedis)	Per physician (C thousands)
1969/70	13.2	31.2	236.4	28.5	353.8
1970/71	13.9	n.d.	n.d.	n.d.	n.d.
1971/72	15.0	31.4	209.3	23.8	265.3
1972/73	17.6	38.8	220.5	24.2	231.8
1973/74	21.1	66.6	315.6	33.6	368.7
1974/75	26.2	95.4	364.1	37.9	387.8
1975/76	37.9	118.0	311.3	31.5	307.9
1976/77	73.1	159.0	217.5	21.3	203.1
1977/78	136.6	257.1	188.2	17.9	135.6
1978/79	220.2	352.5	160.1	14.8	108.0
1979/80	334.3	325.3	97.3	8.7	62.7
1980/81	634.9	492.5	77.6	6.7	46.6

Notes :

1. Capital and recurrent expenditures from Worl Bank (1984, tables 5.8 & 5.9)
2. Two year averages extrapolated from World Bank (1984, table 7.3), 1969/72 data are based on urban numbers from Central Bureau of Statistics Newsletter, 30/76, Sept. 1976.

actually increasing the returns from expenditure aimed at raising health status. The observation by the IDS team (1981, p.399) that «we did not start with the presumption that health needs are solely, or even predominantly, served by conventional health care services,» has contemporary and continuing relevance.

Conclusions

It is obvious to any resident of Kumasi that the housing environment displays many features which are «a priori» inimical to health. Improvements to individual utilities which can help increase the standards of hygiene for households have been discussed, Furthermore, by relating selected social and sanitary variables to social areas within the city, areas of potential concern have been indentified. It has been shown that areas which have been neglected by the public sector, especially those dominated by northern minorities, require priority attention. As some of the worst of these areas are close to the city centre, and are noted for the cooking of food for sale in the streets, their improvement could have a great influence on the general health of the city's population. Furthermore, as the city spreads outwards, the lack of public utilities in the peripherical villages is likely to assume increasing importance in any policy aimed at ensuring that gross variations in health status and disease potential at area level are neither perpetuated nor extended.

There is need for further multi-disciplinary collaborative work into the link between environment and health in which spatial distribution of environmental risks from basic housing data has an important predictive and policy generating role.

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The health problems caused by an inadequate supply of water to most low-income households have been compounded in recent years by a severe shortage of all kinds of soap. Although standards of personal cleanliness remain very high, environmental cleaning and the washing of cooking and eating utensils have undoubtedly suffered. The sight of a chop-bar keeper washing the residue of palm-oil soup off plates and cooking pots with plain cold water serves to underline the problems of hygiene in an economy of shortage.

Owing to problems of data collection, Zongo and Aboabo households are excluded from this analysis. However, an interesting practice to accommodate the sanitation problem came to light while discussing the circumstances of data collection with the Zongo and Aboabo enumerator. As he is a long-term resident in the area, the information is likely to be reliable. It appears that, as the bucket latrines are not emptied more than twice a week, the actual capacity of the toilet provision in each house is grossly inadequate. The moslems, who predominate in the area, find it unacceptable for their womenfolk to be seen entering the public latrine. Therefore, the men and children tend to use the public latrine rather than the house latrine, leaving the latter solely for the women. This reduces the use of the bucket. The problem of infrequent emptying of house bucket latrines affects most areas, except newer government areas. It means that many of the households who report having the use of a toilet in the house, may often have to resort to the public latrine.

Official exchange rate in 1980 valued the Cedi at 2.75 per US$. However, the black market rate, which more accurately reflects the real purchasing power was about C30 per US$. By February, 1986, the Cedi had been officially devalued to C90 per US$.