

# **URBANIZATION AND ENVIRONMENTAL QUALITY: INSIGHTS FROM GHANA ON SUSTAINABLE POLICIES**

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## ***Abstract***

*This paper examines the relationships among population dynamics, environment and economic development. We focus particularly on urbanization, whose impact is often characterized as strongly negative. We first examine the broad conceptual issues of population, urbanization, and environment, providing demographic insight to the understanding of the*

*role of urban growth and urbanization in developing countries today (juxtaposed with the historical experience of industrialized countries). Then, drawing on results using primary data collected in coastal Ghana between 2002 and 2004, we introduce findings from several components of our interdisciplinary population-environment research. These include the influence of urbanization on coastal lagoon nutrient content; the role of urbanization in fertility change; and the determinants of environmental attitudes. We conclude with a discussion of the implications of our findings for both a more nuanced understanding of population-environment links, as well as shifts in public policies and programs, particularly policies aimed at migration, urban growth and urbanization.*

**Key words:** *Urbanization; Environmental quality; Population and migration; Sustainable policies; Ghana.*

## 1. Introduction

Despite the evident and continuing interest in population-environment links, the direct interplay of human population dynamics and environmental change is difficult to identify and even more difficult to quantify. On one hand, the argument is frequently voiced that “population” – usually aggregate human population growth – has a substantial (and adverse) effect on environmental quality. On the other hand, some dispute overall claims of the degree of anthropogenic impacts on the environment.

In this paper, we attempt to offer some thoughts about demographic and social dynamics and environmental outcomes. We first provide some general observations about population-environment relationships and then turn to more focused sociological and demographic insights from our own field research in coastal Ghana. While our argument is general, it is underpinned by our empirical research in coastal Ghana, where, in collaboration with an interdisciplinary set of colleagues, we have been examining water quality conditions in selected coastal lagoons, household drinking water quality, and surveying human socio-demographic behavior.

In this paper, we pay particular attention to the role of urbanization in demographic and environmental change. We present empirical findings on the relationship between urbanization and fertility in Ghana, the human impact on nutrient contents of coastal lagoons in Ghana, as well as Ghanaians’ environmental awareness and attitudes.

We augment the discussion with a concern for measuring and understanding the determinants of human behavior, in this case, behavior that has consequences for the natural environment.

As the pace of *urban growth* accelerates in developing countries, including African countries, so too does concern about the impact of urbanization on the environment, including urban consumption patterns and the environmental footprint of cities (UNCHS, 2001; Rakodi, 1997). Still, it is not quite clear how strong the role of urbanization is (White, 1996) or how strong the relationship is between land use patterns and environmental impact (Entwisle and Stern, 2005). (Strictly speaking, *urbanization* refers to the increasing *share* of a country's entire population residing in urban areas.) At the present time about half of the world's population lives in urban areas (Bloom *et al.*, 2008). For the foreseeable future, urbanization will increase and urban growth in developing countries will outpace that in industrialized countries. Yet it is also important to recognize that while rates of urban growth are high relative to historical experience, the pace of urbanization "falls well within the historical bounds" (Montgomery, 2008: 762). Martine (1996) argues persuasively that concerns for the negative impact of urbanization may be misplaced:

"Nevertheless, it is fundamental to recognize that curbing urban growth is not the solution to either environmental or urban problems."

All this compels us to better understand the role of cities in demographic and environmental change.

Many see urban growth as coincident with positive trends in economic development, even as city growth brings some negative consequences for urban residents and for society at large (Bloom *et al.*, 2008; World Bank, 2000a; Williamson, 1998; White, 1996). Few argue anymore for an optimal city size (Speare and White, 1992) or draconian growth controls. Nevertheless, many observers raise concern about managing urban growth and its environmental impact (Bloom *et al.*, 2008; Montgomery, 1988). More worrisome is the view that African urbanization may in fact be decoupled from economic growth:

"Cities in Africa are not serving as engines of growth and structural transformation." (World Bank, 2000a)

There is a further twist. Many policy makers, government officials, and the like have a negative view of urbanization (Montgomery, 2008).

In a recent UN report, the majority of developing country national policymakers advocated policies to decelerate or reverse migration to metropolitan areas, and 80 percent of African country respondents felt the same way (United Nations, 2003). Another UN report argued that development agencies maintained an anti-urban stance in their programs (UNCHS, 2001). While one may not want to draw too many conclusions from these reports, they do suggest the rather negative light in which urban growth is often viewed. Additionally, urbanization is commonly thought to be linked to air and water pollution, sprawl, and the like (Cincotta and Engelman, 2000), with megacities even more problematically affected (*The New York Times*, 2002; Rakodi, 1997). In a preparatory paper for the Johannesburg summit, a Swedish group noted:

“Urbanization and many aspects of globalization tend to distance people from their relation to ecosystem support... People become alienated from their dependence on access to resources and ecosystem functions outside the boundaries of their own jurisdiction.”  
(Folke *et al.*, 2002)

How this perception is borne out in actual behavior remains to be seen. This is not to deny that urbanization is accompanied by a host of challenges; rather it is to argue that the connection between urban growth and other outcomes needs to be better understood.

A country's population distribution (beyond urbanization itself) matters as well. Coastal areas are gaining in population, bringing more population into the vicinity of sensitive ecosystems (Hunter, 2000). Internal rural-urban migration is implicated in these changes, and there is need to better understand its determinants (Bilsborrow and DeLargy, 1991). In particular, a better comprehension of the sociological determinants of migration, and the behavioral patterns that characterize life in these coastal regions, is needed (Curran *et al.*, 2002).

The debate continues about the connections between population growth, urbanization, and the environment, and it is far beyond our space to review (for example, see recent contributions by Curran *et al.*, 2002; Dasgupta *et al.*, 2002; United Nations, 2001; Demeny and McNicoll, 1999; Arizpe *et al.*, 1994; National Research Council, 1993; Davis and Bernstam, 1991; and National Academy of Sciences, 1986). At the same time, attention has turned to issues of how environmental management is linked to development and economic policy in lower-

income settings, and these issues have become the subject of policy analysis (Hardoy *et al.*, 2001; Bartone *et al.*, 1994; Repetto and Gillis, 1988). In the African setting, concerns are now heard about the pace of urbanization itself, the environmental impact of population growth and urbanization, and the ability of the public sector to address environmental and urban service issues (Rakodi, 1997; Stren and White, 1989; Lewis and Miller, 1987; National Academy of Sciences, 1986).

In this paper we explore the issue of urbanization, population growth and environmental quality. First, we examine the broad conceptual issue of population, urbanization, and environment, drawing on the well-worn and well-known IPAT framework to pose the issue, and argue that we need to reframe the issue. Whether for better or worse, the IPAT framework continues to orient much contemporary thinking on environmental issues (Martine, 1996). Second, we turn to a comparison of Ghana and the UK as a thinking exercise to help orient this reframing. Third, we turn to several research results from our own demographic research that we hope help to inform and recast the discussion of population-environment links. These research results introduce (a) demographic modeling of urban population dynamics; (b) the role of urbanization on demographic change, most notably the demographic transition; and (c) the micro-foundations of environmental change. We conclude the paper with some discussion of the implications of all of this for public policy.

### **1.1. *The I=PAT framework***

The IPAT framework, namely that environmental impact (I) equals the product of population (P), affluence (A) and technology (T), continues to lurk in the background of much of the discussion about environmental threats.

“A sizable segment of the literature on population and environment during the past 25 years has taken the ubiquitous I=PAT equation as the starting point.” (Martine, 1996: 7)

While the IPAT equation (or identity) orients much thinking, there is far less empirical evidence to show how much impact a population increment (or urban population increment) has on environmental quality. At one level it seems obvious, and so explicit or implicit that IPAT notions spill into policy.

“Despite its inadequacies, the IPAT formulation continues to be frequently cited by policy-making institutions.” (Martine, 1996: 9)

At the same time, demographers may be faulted for not engaging the issue with their techniques and expertise as thoroughly as they might. In particular, despite the continued concern for population and urbanization impacts on the environment, recent AAAS and UN publications have made the case quite explicitly that empirical evidence is needed. In part, our paper is a response to this need.

### ***1.2. Comparing Ghana and the United Kingdom***

To help frame the issue of population-development-environment interactions, consider a simple (albeit simplistic) comparison. Table 1 compares Ghana and the United Kingdom on some key demographic, economic and environmental statistics. Remarkably, both have roughly the same land area. Consider a point, sometime in the future, of matching population density and income level for the UK and Ghana. To reach this point Ghana’s population would grow over 2 ½ times (from its current level of about 23 million to the UK level of 60 million) and its income would have to grow over seventy-five fold (from its current level \$520 per capita to the UK level of over \$40,000, under World Bank income estimates and methodology. (Ghana’s population is currently growing at 1.9 percent and its economy at 6.2 percent [World Bank, World Development Indicators database, 2007; Atlas method for making per capita income comparison.] What would happen to the physical environment in Ghana? As shown in Table 1, Ghana is now experiencing deforestation (vs. reforestation in the UK) and the country has set aside a relatively small portion of its land for conservation. Where would the trends lead? We offer these estimates and projections to illustrate some of the trends and choices in economic development, demographic dynamics, and health that are linked to current actions.

Such a discussion also touches on the debate about the existence and shape of an environmental Kuznets curve (EKC), the increase and subsequent decrease of environmental insult with national income. Even as contemporary scholars regularly make use of the EKC concept, some challenge it or its empirical manifestation (Dasgupta *et al.*, 2002; Harbaugh *et al.*, 2002; Hill and Magnani, 2002; Gangadharan and Valenzuela, 2001). Yet the connections are anything but obvious. The

Table 1 – Demographic, economic and environmental comparisons, Ghana and United Kingdom

	Ghana	UK	Source
Total Population (million)	22,5	60,4	WB, 2006 <sup>1</sup>
Total Fertility Rate (births per woman)	4,1	1,8	WB, 2005 <sup>1</sup>
Population Growth (annual %)	1,9	0,2	WB, 2006 <sup>1</sup>
Population Urban (%)	49,3	89,9	UN, 2007 <sup>2</sup>
Urban Annual Growth Rate, 2005-2010 (%)	3,48	0,51	UN, 2007 <sup>2</sup>
Life Expectancy at Birth (years)	57,5	78,9	WB, 2005 <sup>1</sup>
Total Area (1000 sq. km.)	238,5	243,6	WB, 2006 <sup>1</sup>
Forest Area (1000 sq. km.)	55,2	28,5	WB, 2005 <sup>1</sup>
Change in Total Forest Area, 1990-2000 (%)	-16	6	WRI, 2003 <sup>3</sup>
Gross National Income per Capita (US dollars)	\$520	\$40.180	WB, 2006 <sup>1</sup>
GDP Growth (annual %)	6,2	2,8	WB, 2006 <sup>1</sup>
Energy Use (kg. of oil equivalent per capita)	397,0	3.898,9	WB, 2000 <sup>1</sup>

<sup>1</sup> World Bank, *World Development Indicators database*, April 2007 ([www.worldbank.org](http://www.worldbank.org)).

<sup>2</sup> Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2006 Revision* and *World Urbanization Prospects: The 2007 Revision* (<http://esa.un.org/unup>).

<sup>3</sup> World Resources Institute, *EarthTrends Country Profiles* (<http://earthtrends.wri.org>).

World Bank (1994) cited one study arguing that structural adjustment policies promoted deforestation; yet a more recent study claims that the market liberalization of structural adjustment helped slow deforestation in Ghana, due to shifting relative prices for raw materials and finished products (Benhin and Barbier, 2001). In another example, Hettige and coauthors find evidence that industrial water pollution increases with increases in national per capita income and then levels off (Hettige *et al.*, 1997; World Bank, 2000b). There is some argument that environmental regulation does increase with economic development, even at low ends of the development scale (Dasgupta *et al.*, 1995). Furthermore, authors such as Dasgupta have raised issues about the prevalence and persistence of poverty traps in low-income tropical settings, interweaving concerns about development, environment and health (Dasgupta, 2001; Bloom and Canning, 2001).

Even as long ago as the Rio Summit, the conflict between wealthy and poorer nations on issues of environmental redress was observed:

“In Rio the poor countries have spotted that what they do with their environments matters to the richer countries, which are there-

fore prepared to pay for third-world adherence to some green treaties and agreements...But for many it will make better economic sense to clear land and plant crops. That, after all, is what the rich countries – notably unbiodiversified America – have done.” (*Economist*, 1992)

At the more recent Johannesburg environmental conference this conflict arose again with regard to the UN report:

“Officials from the United States and the United Nations praised the document, but it was sharply assailed by environmentalists and advocates for the poor, who complained that wealthy countries had weakened the language.” (*The New York Times*, 2002)

Indeed, much of the discussion placed issues of sustainable development within a context of poverty alleviation, the impact of global climate change on low income societies, and a perceived widening gap between rich and poor nations (United Nations, 2002; see also the statement of the Deputy Director of the UNFPA for the summit [Waki, 2002]). Rather than detour to discuss the merits of Johannesburg or the reporting of the conference, we refer to this discussion to reinforce our case for the need to study more precisely the interrelationships among social processes and environmental outcomes. Even the broad natural science literature has recognized the difficult political trade-off between economic development and environmental preservation:

“Developing countries cannot reasonably be expected to restrict their future emissions without being assured of a fair allocation scheme that will not impair their ability to develop.” (Baer *et al.*, 2000)

Recent writings on issues of natural resource management often stress behavioral and institutional factors (Ostrom *et al.*, 2002; Liu *et al.*, 2001; Ostrom *et al.*, 1999; Arrow *et al.*, 1995; Cohen, 1995); and indeed, reconciling policy objectives and local human behavior can be a challenge (Liu *et al.*, 2001). At the same time there is evidence that a more micro-level approach to studying the impact of human population on the environment may reveal significant variability over the human life cycle (Moran *et al.*, 2005). And there is certainly recognition of the need to integrate social and natural science in understanding the ecology of cities (Grimm *et al.*, 2008).

To return to the stylized Ghana-UK comparison discussed above (and shown in Table 1), we can ask a number of questions. What are



the perceived environmental issues in a developing country setting such as Ghana? What environmental path will Ghana travel as it moves toward Britain? What path of demographic dynamics – births, deaths, migration, and urbanization – will Ghana take? What will be the connection in Ghana between these demographic dynamics and environmental quality? What role will social, economic and institutional factors play in marking the demographic and environmental changes of the coming decades? Our argument is that understanding the micro- and meso-level foundations of demographic behavior may be particularly informative for concerns about population-development-environment paths to be traced in the 21<sup>st</sup> century.

## **2. Data and methods**

In this section we present some of our own research from our demographic and environmental fieldwork in coastal Ghana. We hope that, by linking our own empirical work with the more theoretical discussion presented above, we can help inform the discussion of population-environment links.

Our population and environment research in coastal Ghana includes interdisciplinary work involving both natural and social scientists (e.g., estuarine biologists, demographers, land use planners) from several collaborating institutions, including the Population Studies and Training Center, Brown University, USA; the School of Oceanography, University of Rhode Island, USA; the University of Science and Technology, Ghana; and the University of Cape Coast, Ghana.

### ***2.1. The population-environment research setting***

Coastal Ghana offers a useful setting for population-environment research. The Atlantic coastline of Ghana has long been an area of settlement, and it has witnessed increasing economic activity and human impact in recent years. These activities span traditional farming and fishing, large scale industrial activities, and newer sources of economic development, such as historical and ecological tourism. The southern coast itself stretches for over 500 km, and contains a range of ecological settings (Benneh and Dickson, 1988). It is also this coastal zone which has received a disproportionate amount of population redistri-

bution and economic development in Ghana. Several rivers feed into the coast, and lagoons punctuate the coastline.

Economic development in this area has included growth in the service sector, decline in the public sector, and some growth in small manufacturing. Of particular interest for its cross-competing influences on the local marine environment is the growth of the tourism industry (both historical and ecological) in Ghana. On one hand, the tourism market will place development pressure on the narrow strip of land beside the sea (including the beach itself). On the other hand, tourism presumably creates economic pressure for an attractive and “cleaner” environment. The response to the recent discovery of oil along the western coast represents another potential challenge.

This area of Ghana is primarily inhabited by the Fante ethnic group (an Akan sub-group linguistically related to the Ashanti), as well as other smaller groups (e.g., Ewe, Ga-Dangme, etc.). Nationally, the Fante comprise about 10 percent of Ghana’s total population.

Population growth along the coast has exceeded that of other portions of Ghana, but growth varies by region along the coast. The Central Region, one of ten administrative regions in Ghana and the region within which our study is located, has grown by an average of 2.0 percent per annum between 1984 and 2000 (the dates of the two most recent censuses), a bit below the national growth rate of 2.5 percent. The growth of neighboring Greater Accra Region (the capital region) has outpaced other regions, averaging 4.4 percent annually, about doubling between 1984 and 2000. Ghana is more urbanized than the continent as a whole, but at 44 percent urban, it is still low by European, North American, or Latin American standards. The urban fraction has increased from 32 percent in 1984 (Ghana Statistical Service, 2002: 2). Urbanization brings with it, of course, attendant land consumption at the periphery, demands for fresh water supply and waste water treatment, and other public infrastructure. A great deal of debate swirls around whether developing countries’ policies manifest an “urban bias” or generate an “urban crisis” (Stren and White, 1989; Becker and Morrison, 1998). Ghana’s cities, notably Accra, have been subject to the same criticism. By extension, similar issues arise in more modest-sized urban settlements, such as Cape Coast in the Central Region.

## ***2.2. The demographic component: The population-based household survey***

The demographic component of our project, a 2002 population-based household survey, was limited to the coastal area of Central Region. This area was chosen because of our concern for urbanization in ecologically sensitive coastal zones in developing countries. Our survey is representative of the six coastal districts in the Central Region: Komenda-Edina-Eguafo-Abirem (KEEA), Cape Coast, Abura-Asebu-Kwamankese, Mfantiman, Gomoa, and Awutu-Efutu-Senya. The “2002 Population & Environment Survey” is a representative, household-based survey of the local population in these six districts.

Our two-stage stratified sampling design made use of the 2000 Ghana census. We randomly selected primary sampling units (PSU) from the set of 1156 Enumeration Areas (EA) in the census for the six coastal districts in Central Region. These EAs hold about 750 persons each, and they provide an efficient means for household sampling using geographic clusters. The EAs have three strata defined by the Ghana Statistical Service – urban, semi-urban, and rural – and we sampled three EAs from each of the three strata and in each of the six districts, totaling 54 EAs. Within each sampled EA, we randomly sampled households and interviewed all adults (ages 15 and above). Our sample size consisted of 1197 households (with a response rate of 92 percent) and 2506 adult men and women (with a response rate of 93 percent).

Our survey included community, household, men’s and women’s questionnaires. These survey instruments were modeled after the widely used Demographic and Health Surveys (DHS), and they contained a conventional household roster, a series of questions on demographic behavior, a module on health knowledge, a section on environmental awareness and attitudes (modeled after such questions used in other international environmental surveys), and a life history calendar. The household roster and demographic module provide information on the age, sex, educational, and occupational composition of the household. These data allow us to precisely examine the interrelation of key elements of demographic dynamics.

### ***2.3. The environmental component: The lagoon water quality research***

The environmental component of our interdisciplinary project included the collection and analysis of water samples from several lagoons that cross a number of areas (by initial perception) of human impact along coastal Central Region and nearby Greater Accra Region. (One of the lagoons is a protected Ramsar site.) The objective of this portion of the project was to examine the impact of human settlement in the area on lagoon water quality. Coastal lagoons offer an appropriate source of environmental data reflective of anthropogenic influences. The inclusion of particular lagoons was determined by the range of potential anthropogenic conditions, access by the research team, and particular hydrologic conditions.

After an initial reconnaissance we selected six lagoons in the Central Region for repeated measurement. We also selected two lagoons in the populous capital region of Greater Accra. While all the lagoons are small (0.7 to 7.9 sq. km.), shallow (0.5-1 m. deep), and at least somewhat open to the sea throughout the year, they varied widely in watershed area relative to lagoon area and in the drainage density of their watershed. All of the systems have very large drainage areas relative to the area of open water. With the exception of Oyibi and Sakumo lagoons, salinities in the inner portions of all the lagoons exceeded 30 for most of the year. This reflects the strongly seasonal distribution of rainfall in Ghana and the fact that evapotranspiration exceeds rainfall for all but about two months of the year.

Our research protocol included monthly visits to each lagoon, with water samples drawn from two points in each location. Laboratory measurements involved several parameters of both organic (and ultimately inorganic) contents in the lagoons. These included measures of turbidity and solids, and three nutrient measures ( $\text{PO}_4$ ,  $\text{NH}_4$ ,  $\text{NO}_3$ ). The lagoons were sampled from July 2001 to June 2002. (See Nixon *et al.* (2007) for more details about the environmental component of the project.)

### 3. Results

#### 3.1. Urban growth and urbanization

As mentioned previously, the growth of cities (*urban growth*) and share of the total population residing in urban areas (*urbanization*) are frequently implicated in concerns about environmental deterioration. Almost half of the world's population currently lives in urban areas, and for the foreseeable future, urbanization will increase (United Nations, 2001). What is more, urban growth – and population growth generally – in developing countries will outpace that in industrialized countries. These urban areas, whether small towns or megacities, each develop an environmental footprint. Although there are important regional differences in the level and trend of urbanization, city growth has proceeded steadily throughout the developing world (Montgomery, 2008; Chen *et al.*, 1998).

As we recounted at the outset, many policy makers, government officials, and the like have a negative view of urbanization, such as the 80 percent of African policymakers who see urban growth as problematic (United Nations, 2003). Environmental concerns reinforce these overall urban growth concerns. Yet, there is also a positive association between urbanization and urban economic development and overall economic growth (Bloom *et al.*, 2008; Montgomery *et al.*, 2003).

Urbanization is particularly important in this regard, and for several reasons: (1) Cities are at the forefront of the “demographic transition,” or the shift from a regime of high birth and death rates to a regime of low birth and death rates. (2) Cities expand and grow with economic development. (3) Cities have an environmental imprint that is distinct, and because they are involved in international and internal trade, the specific links between urban settlement and its environmental impact may be hard to trace. At the same time, because of the proximity of persons and the associated economic and social changes that accompany urban growth, cities may be at the forefront of the environmental transition. These realities raise the issue of whether urbanization can provide feedback that might slow population growth and advance initiatives for environmental amelioration. Lowry, for example, argues that cities can indeed be allies in the movement to maintain a cleaner environment (1990).

In the following section we provide further insight into the process of urbanization and the consequences of urbanization for other demographic behavior, most notably human fertility. We draw from work by the recent NAS Panel on Urban Population Change, whose results appear in the 2003 consensus volume, *Cities Transformed* (Montgomery *et al.*, 2003), and on our own demographic research in coastal Ghana.

### ***3.2. Urban population dynamics***

Patterns of urban growth are often misunderstood or misinterpreted for their longer term demographic context. Large rates of growth for particular cities – say 6 or 7 percent per annum – are often seen as newsworthy, but are less often viewed in their historical and demographic context. The first point to make is that high rates of urban growth – the change in the total urban population per annum – may be expected in a developing country context, particularly in a setting of higher overall population growth rates and a relatively large share of an initially rural population. Details of the argument and some of the formal derivation are given in the NAS report (Montgomery *et al.*, 2003). Results include such findings as:

- A realistic, *fixed* regime of fertility, mortality, and rural-urban migration rates will lead to a declining urban growth rate (UGR).
- Urban growth rates are expected to be very high at the onset of the urban transition, as large pools of rural origin persons move to cities at the prevailing rural-urban migration rate.
- The urban growth rate (UGR) is sensitive to rates of natural increase, and differential rates of natural increase across urban and rural territories.

The upshot is that some of the things that we now see in world-wide urban trends are exactly to be expected, suggesting that we should reorient our thinking. Note that urban population growth rates in Asia, Latin America, and Africa have declined in recent years (Montgomery, 2008). And to reiterate the distinction made earlier, one should not confuse the urban growth rate (UGR – the change in the urban population per annum) with urbanization (the change in the *share* of the population that lives in urban areas).

In developing countries nowadays the pace of urbanization is not much higher than that of today's high-income countries at their time of industrialization and urban transition. What is different is the way in which the demographic transition has proceeded in the two regions and historical eras. To oversimplify a bit, contemporary Less Developed Countries (LDCs), especially those in Africa, are urbanizing in a regime of higher overall population growth rates, which fuel higher overall urban growth rates (see Montgomery, 2008, for a more comprehensive discussion). Many of these developing countries – including China, Mexico, and Indonesia – have experienced what we term a “compressed demographic transition,” moving from one regime to another in a shorter period of time. Some implications of this compressed transition for age structure and economic growth have been pursued elsewhere (Bloom and Canning, 2001; Population Reference Bureau, 2004).

### ***3.3. Urbanization and the fertility transition***

The growth of cities and their share of the national population are also associated with the demographic transition, but not in lock-step. In this section we present results from our own research on the independent influence of city residence on birth rates. While it has long been understood in the demographic literature that urban birth rates were lower than rural rates, less has been known about the specific mechanisms that give rise to the differential. On the one hand simple aspects of population composition – more highly educated persons, younger cohorts living in cities – may be the reason. On the other hand, there might be a specific effect of city residence over and above these other factors. In addition, demographers have often puzzled about the specific rate of change, namely did a downward adjustment in fertility take place within the childbearing span of a particular migrant to the city, or did it occur across generations? Rarely has data been available to answer the latter question, but our coastal Ghana household survey allows us to do so.

While detailed results of our analysis of the migration and fertility relationship in Ghana are available in White *et al.* (2005) and White *et al.* (2008, under review), in this paper we sketch over some of our most salient findings. In our demographic analysis of event history data collected in our 2002 representative survey, we used a discrete time hazard

model to predict the probability of a birth in a given year, conditional on the probability of one not yet having occurred to that point. We analyzed the reproductive person-years of a sample of 1,436 women, aged 15 and above. Our statistical analysis controlled for other influential factors, including children ever born, age, birth cohort of the woman, educational attainment, employment (or being in school), union status and residence.

First, our results give an overall picture of the traits that predict childbearing behavior, and some of these results echo what appears elsewhere in the demographic literature. The rate of childbearing rises through the young adult years and then declines, as is well-known. We also find, quite importantly, that younger cohorts of women are bearing children at significantly lower rates than older women, even if we control for other influences. We also confirm the well-established result that more education, particularly secondary education, and current school enrollment are associated with lower rates of childbearing.

Finally, we find that, even after controlling for these other important traits, urban residence itself is associated with declines in childbearing. In other words, even after controlling for age, union status, education, and cohort, urban residence in the prior year predicts about 11 percent lower probability of childbearing in any given year. This is a fairly substantial impact, and it is noteworthy that this urban residence effect persists in the face of other influential traits known to be correlated with urbanization, particularly age, cohort and education. More detailed, parity-specific analysis (described in White *et al.*, 2005, and White *et al.*, 2008, under review) indicates that the urban residence effect is more pronounced in delaying the first birth; for parity 0, urban residence predicts about 22 percent lower probability of giving birth in a given year.

To summarize, our demographic analysis of our representative household-based survey data from coastal Ghana demonstrates that in this population, urbanization is clearly associated with a decline in fertility rates, and hence a slowing in the overall population growth rate. Our results suggest that for those who view the demographic transition and lower population growth rates favorably, urbanization will have an indirect but positive influence on that outcome.



### 3.4. Lagoon water quality

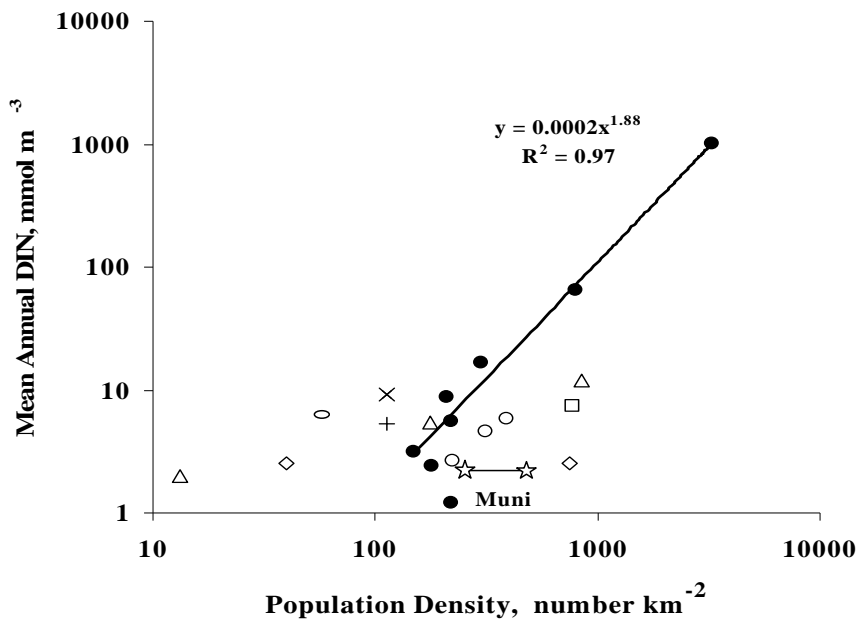
The results of the environmental (e.g., lagoon water quality) component of our population-environment project in coastal Ghana show a wide range in nutrient levels and other water quality measures across the sampled lagoons. All indications are that this range is not only linked to anthropogenic impact, but also influenced by other hydrogeographic factors for each lagoon. In order to account for the few very high concentrations in nutrients, we calculated median concentrations over the annual cycle for each lagoon. Oyibi and Sakumo were found to be fresher than the other systems; they are also higher in nitrite plus nitrate that was probably carried in with the river or ground water. The lack of oxidized nitrogen in the lagoon waters may reduce the amount of the nitrogen load that is denitrified in the systems since most nitrogen removal will have to be supported by coupled nitrification-denitrification in the sediments.

The median annual concentrations of total dissolved inorganic nitrogen varied much more dramatically, with a range of over 1000. This finding confirms our impression that the selection of lagoons captures a wide range of anthropogenic fertilization, with an isotope analysis implicating human sewage as a significant contributor. Overall, in this study, population density is correlated to nutrient concentration (see Nixon *et al.*, 2007, for more details).

While there appears to be a relationship between population density and lagoon nutrient impact in our coastal Ghana study, the connection may not be uniform or universal. Figure 1 shows selected results graphically. The plot shows mean annual concentrations of dissolved inorganic nitrogen (ammonia + nitrite + nitrate = DIN) in each of our eight sampled lagoons (the solid circles) as well as other selected coastal lagoons on the Atlantic coast of the US (all other symbols) as a function of population density in the watershed. The fitted line shows that clearly the relationship between density and DIN is more evident in Ghana than the US Atlantic coast. While this latter set of lagoons is found in a temperate environment and with different hydrogeographic features, it is also likely that levels of economic development may be responsible for the observed differences. It is also noteworthy that we count that one lagoon protected under the Ramsar (wetlands) international convention had lower nutrient rates than would be predicted by its watershed's population density. All told, public sector intervention

to control runoff and human waste discharge appear to play a significant role (Nixon *et al.*, 2007).

Figure 1 – Mean annual concentrations of dissolved inorganic nitrogen (ammonia + nitrite + nitrate = DIN) in each of the eight coastal lagoons of Ghana (solid circles) and some coastal lagoons on the Atlantic coast of the US (all other symbols) as a function of population density in the watershed (log-log plot)



Source: Nixon *et al.* (2007), Figure 16, p. S161.

### 3.5. Environmental awareness and attitudes

In this final empirical section of the paper, we return to additional findings – regarding environmental awareness and attitudes – from the demographic component of our population-environment project in coastal Ghana. In its most general form, we would argue that a far more informed policy for environmental amelioration – the “What path Ghana?” question posed previously – is possible if we have a better understanding of the micro foundations of environmental change.

In other words, what is the extent of knowledge and behavior at the level of the individual and household that impinges on environmental activities and policies?

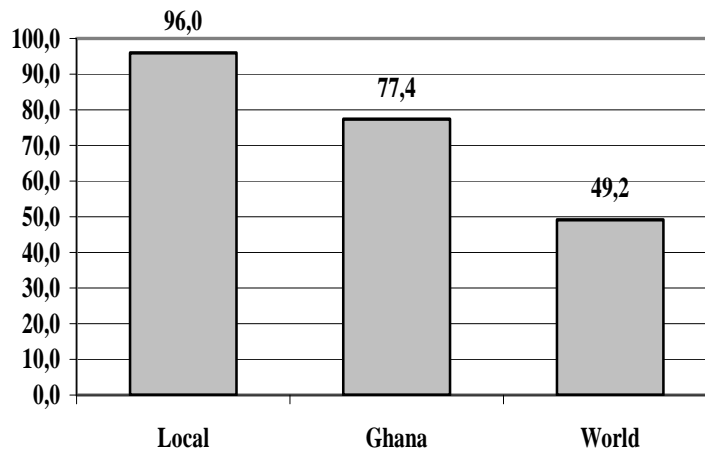
The current discussion of national and international environmental policy assumes MDCs and LDCs to be adversaries. Some of the discussion arising post-Rio and some of the recasting of Johannesburg rests on a tension between economic growth versus environmental preservation, further mapped onto national development groupings. Arguably missing from that discussion is information about how local residents in affected regions behave and what perceptions they have about these issues. This aspect of local residents' actions and views is all the more important as we consider problems of "social aggregation". Since so many environmental problems involve externalities, it is unlikely to be the case that individual human behavior will accurately reflect aggregate environmental costs and benefits. Institutions greatly matter when dealing with this asymmetry – including political structures, informal social controls, property rights and rules for dealing with free-rider problems (Ostrom *et al.*, 1999; Harrison and Matson, 2001). It is also quite clear that there are some very important challenges of generating suitable information flows, maintaining compliance, and identifying an appropriate institutional arrangement (Dietz *et al.*, 2003).

Our research on environmental attitudes examined two issues among others (White and Hunter, 2005). First, we sought to understand the level of environmental awareness that exists in our low income research setting. Second, we sought to determine what individual or household traits are associated with particular environmental attitudes or concerns. In a developing country setting such as Ghana, where nearly half (46 percent) of the population is illiterate (Ghana Statistical Service, 2002), but in which democratic and market transitions are well underway, this question is crucial. Below we provide a brief introduction and example for some of our preliminary findings on Ghanaians' environmental attitudes and awareness.

Figure 2 presents results on environmental awareness for the adult population of our study region. We show a simple tabulation of the percentage of the adult population able to voice an opinion about environmental quality for a locale, by scale. In successive questions in our survey we varied the locale from the immediate vicinity (one's own village or urban community), to Ghana as a whole, to the world. While

admittedly simplistic, these measures do give us a window on the relationship of geographic scale to awareness.

Figure 2 – Percentage of adults expressing environmental awareness, Coastal Central Region, Ghana (N=2,506)



The results are telling. Almost all of our respondents (96 percent) could voice a view about the quality of the natural environment in their local area. Clearly they have views – other work suggests well-formed views in many cases – about the state of the natural environment nearby. These views are based on a variety of conditions and considerations, everything from sanitary disposal of human waste, to deforestation, to depletion of fish stocks. As the geographic scale increases, however, the ability to voice an opinion declines. Over three-quarters (77 percent) could express a view (did not answer “don’t know”) regarding environmental quality in Ghana overall. When it came to world environmental conditions, the percentage able to voice an opinion declined to about half (49 percent). This decline in environmental awareness with increasing scale is substantial.

Using multivariate regression techniques, White and Hunter also investigated what individual traits predicted environmental awareness. Literacy (or educational attainment) is the overwhelming strongest predictor of environmental awareness (White and Hunter, 2005). That some measure of education would move people out of the “don’t

know” category is no surprise. But the role of other traits may be interesting as well. Awareness was higher for men and slightly higher for the young. Notably, those listening to the radio regularly were more likely to express an opinion. How and why mass media exposure matters, even after adjusting for other traits such as education, would be an interesting follow-up. Finally, those voting in the most recent (2000) national election, a measure of civic participation, were also more likely to express a view.

The Ghana Population and Environment survey asked a direct question about whether protecting the environment should take priority over economic growth. (This question is exactly parallel to one used in developed country settings and we used it for that reason.) Literacy is strongly related to expressing an environmental priority, as is socio-economic status (White and Hunter, 2005). Striking, perhaps, is the relationship with voting. Those who voted in the previous election were 50-70 percent more likely to express environmental concern than others, even after controlling for the several other personal traits. These results are strongly suggestive of a view that social change and economic development (increased education and income) will bring with them demands for environmental protection and amelioration.

Some researchers have expressed concern that migrants to an area, given that they do not have a long history of ties to a locality, may have less concern for maintaining the integrity of natural resources in the vicinity (see Curran, 2001). The Ghana data do not support this view (White and Hunter, 2005). Most differences between lifetime residents, recent migrants, and others were negligible and not statistically significant, with one exception: lifetime residents were about 35 percent *less* likely to express the view that environment is a priority over economic growth. While we have not yet had a chance to analyze this relationship in further detail, one possibility is that lifetime residents are more likely to be found in some of the traditional occupations of the area. The concern for their livelihood may be what we are seeing in the statistical results.

Taken together, such findings from a random sample household-based survey in coastal Ghana can provoke some further thinking about human behavior and the environment. Specifically these results encourage us to consider the micro-foundations of environmental change. The results point quite strongly to the finding that low income country residents do have demonstrable and differentiated views about

the environment, and moreover, that their views are better formed and more readily voiced regarding the environment close to home. The statistical results also indicate some relationships that would be expected – that education and literacy are related to environmental awareness and concern. Less obviously, the results also point to a finding in which voting (perhaps a proxy for a sense of political engagement, an ability to act on collective issues) taps a key trait in environmental awareness and concern. Local health concerns linked to the environment (water and air pollution, local sanitation) may be particularly salient point in the feedback loop between human behavior and environmental quality. Finally, these results give little or no support to the notion that recent migrants in a community, being less tied to the local social fabric, are less environmentally concerned than other local residents.

#### 4. Discussion and conclusions

In this paper, we have attempted to address some key aspects of the relationship between human population dynamics and environmental change. This final section discusses implications for sustainable policy issues.

First, the discussion of population-environment connections needs to move beyond thinking about population as an undifferentiated aggregate. To be sure, much writing about human impact on the environment has already done so, or at least, it has begun to question the magnitude of the influence of population growth on environmental outcomes. At the same time, composition and context matter. Our discussion about urbanization demonstrated first that urban dynamics are often misunderstood and hence run the risk of being misinterpreted for policy. One should expect initial urbanization in developing countries, e.g., contemporary sub-Saharan African countries, to occur with high rates of urban growth. At the same time, one should expect these growth rates to decline with the evolution of systems of population redistribution. In fact, this has indeed been the case in all developing regions (Asia, Latin America and Africa), where urban growth rates (UGR) have indeed begun to decline (Montgomery, 2008).

Second, we demonstrated that in our coastal Ghana study site, urbanization is associated with higher levels of lagoon water nutrient

content, an indicator of anthropogenic impact. Yet this association between population density in the watershed and lagoon pollution (nutrient loading) in Ghana was not found among the US lagoons. The difference between the Ghana and US results points the possibility of some pattern akin to an environmental Kuznets curve.

In addition to these empirical results from the environmental component of our Ghana project, our paper also presented results from the household-based survey. We showed that urbanization also brings with it lower levels of childbearing: city residence itself is associated with lower childbearing, even after adjusting for other traits of the women. This finding also parallels results with less refined data from other sources. The implication is that in most settings urbanization will operate to slow childbearing, both through housing a population whose composition demonstrates lower fertility and through the effects of urban residence itself. Therefore, urbanization plays a role in expediting the demographic transition. Policy hostility to urbanization (as we have seen is often the case) may be better replaced by targeted programs to accommodate and manage rural-urban migration, as urbanization accompanies demographic and economic transitions.

Third, we examined the extent of environmental awareness at the local level. Representative household survey data show that the vast majority of the adult population expressed environmental awareness of issues close to the locality in which they lived. Among personal traits, education, literacy, gender, and participation in the electoral process all matter in environmental awareness. Conversely there is no evidence that newer residents to an area are less prone to holding environmental concerns. Thus, the preconditions for environmental change may be present. These findings suggest that micro-level, locally-oriented work on environmental issues, communication, education and mobilization, may pay significant dividends. Indeed, the local should not be overlooked in our concern for the global.

So, in summary, can one put demographic dynamics, urbanization, and environmental attitudes all together? Yes. Our argument in this paper is that we should worry less about population growth overall and the growth of cities and more about the detailed manifestations of growth patterns. More important still, we should be concerned about the social processes that underlie environmental change. The growing literature on economic development and the environment strongly suggests that with rising income we wish to consume a higher quality

environment. This, we argue, is also the case in Ghana. Economic development is the ally of environmental quality, and so might be urbanization, since it is associated both with economic development and slower rates of population growth. Rapid economic development in low-income countries may, ironically, pay environmental dividends. In the face of inevitable population growth and increasing consumption in these countries, how one finds a path becomes the challenge. Theory and empirical evidence both suggest that a more optimistic path for population, development, and environment is possible.

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