Prepared for PERN Cyberseminar 5-16 September 2005

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# Population Dynamics and Millennium Development Goal 7

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On September 8th, 2000, the 189 nations of the general assembly of the United Nations (UN) adopted the United Nations Millennium Declaration. This declaration reaffirms international commitment to the organization and charter of the UN and establishes shared fundamental values for the twenty-first century. Included among these objectives are a specific group of 8 goals which have been named the Millennium Development Goals[1].

The Millennium Development Goals (MDGs) are meant to provide both a global vision for human development as well as a series of time-bound, quantified targets that governments and the international community should strive to meet. Goal setting is not new for the United Nations. Since the 1960s, ambitious goals for development have often been established, and in the population-environment field two major milestones have been Agenda 21 and the ICPD Programme of Action.[2] What makes the MDGs different is the unprecedented attention they are attracting from developing country governments and the entire UN system. The MDGs provide a framework and an impetus for the world to accelerate the pace of development and improve human welfare. They are the most broadly supported, comprehensive, and specific poverty reduction objectives the world has ever established (UN Millennium Project, 2005). Since the UN Millennium Declaration, global leaders have reaffirmed their commitment to the MDGs at the November 2001 Doha Round on international trade; the 2002 International Conference on Financing for Development in Monterrey, Mexico; and the World Summit on Sustainable Development in Johannesburg, South Africa in 2002. They are expected to do so again at the 2005 World Summit at the UN in New York, September 14-16. The

[1] For a complete list of the United Nations Millennium Development Goals, see http://www.un.org/millenniumgoals/.

[2] At the 1992 UN Conference on Environment and Development, 178 nations agreed to Agenda 21, a set of social and economic development goals resulting from the Rio Declaration on the Environment and Development (UN, 1992). At the 1994 International Conference on Population and Development (ICPD) in Cairo, governments established a Programme of Action that recommended a set of important population and development objectives (UN, 1994), several of which are the same as the MDGs

goals thus represent a landmark partnership in which developing countries – by implementing plans to reduce poverty – and developed countries -– by substantially increasing support for development – agree to undertake joint action for global poverty alleviation (UN Millennium Project, 2005).

While both Agenda 21[3] and the ICPD Programme of Action[4] explicitly discuss the interrelationship between population, sustained economic growth, and the environment, the MDGs do not directly address the relevance of demographic factors for reaching the global objectives. Several of the MDGs do refer to closely related aspects of the 1994 ICPD Programme of Action, such as universal primary education, gender equality, and reducing child and maternal mortality, but the relevance of population dynamics *per se* was not mentioned in any of the goals[5]. In fact, there has even been ambiguity about whether the goals that call for halving by 2015 the number of poor and hungry people refer to *percentages or absolute numbers*, which results in significant differences in the populations affected.

The absence of population dynamics from MDG7, which is on ensuring environmental sustainability, contrasts with a significant body of research that highlights important interrelationships between population, the environment, and economic and social development. Given the importance of the MDGs for the UN system, national governments, and international development organizations, as well as the political significance of the high level plenary at the UN in September (the 2005 World Summit), the Population Environment Research Network (PERN) has deemed it important to offer an opportunity, via a cyberseminar, for PERN members to debate the population-environment dimension of MDG7 and to contribute to the evidence on environmentally sustainable strategies for lifting people out of poverty.

As background material for the PERN seminar, this paper will examine the relationships between population and targets 9, 10, and 11 of MDG7. We will provide evidence on how population change is likely to affect the achievement of these targets, and hence how the absence of population from the MDG7 targets will hinder the achievement of the MDG7 goal. We do not discuss how the achievement of the MDG7 targets might in turn affect population dynamics, since in our estimation, of more interest is how not achieving the MDG7 targets might affect population. This is a topic that we invite participants to discuss at more length in the forum of the cyberseminar.

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[3] Principle 8 of the Rio Declaration on Environment and Development explicitly mentions promotion of appropriate demographic policies. Agenda 21, Chapter 5 is devoted to demographic dynamics and sustainability.

[4] The ICDP Programme of Action discusses relationships between population, economic growth, and sustainable development throughout. Chapter III, section C is devoted to Population-Environment.

[5] Recognizing the absence of population dynamics from the MDGs, the Population Division of the Department of Economic and Social Affairs of the UN Secretariat organized a Seminar on the Relevance of Population Aspects for the Achievement of the Millennium Development Goals in November, 2004. Unfortunately, with the exception of Target 11 on urban slums, little attention was devoted to MDG 7 (UN-DESA, 2005).

In the space available, we also do not pretend to provide a comprehensive review of the growing population-development-environment literature, but rather only aim to stimulate discussion for the cyberseminar and to gather material to develop an improved paper on this topic. Finally, we do not attempt to review the extent of progress towards achieving MDG7[6].

## How do population dynamics affect strategies to achieve the MDG 7 targets?

MDG 7, to ensure environmental sustainability, comprises the following three targets and 6 indicators:

> **Target 9.** Integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources.
>
> *Indicators:*
>
> (25) Proportion of land area covered by forest
>
> (26) Ratio of land area protected to maintain biological diversity
>
> (27) Energy use (kg of oil equivalent) per $1000 GDP
>
> (28) $CO_2$ emissions (per capita) and consumption of ozone depleting CFCs (ODP tons)
>
> (29) Proportion of population using solid fuels[7]
>
> **Target 10.** Halve by 2015 the proportion of people without sustainable access to safe drinking water and Sanitation.
>
> *Indicators:*
>
> (30) Proportion of population with sustainable access to an improved water source, urban and rural.
>
> (31) Proportion of population with access to improved sanitation, urban and rural
>
> **Target 11.** Have achieved, by 2020, a significant improvement in the lives of at least 100 million slum dwellers.
>
> *Indicator:*
>
> (32) Proportion of population with access to secure land tenure

A review of all eight MDG goals reveals that MDG goals 1-6 have targets 1-7[8] which set measurable, quantitative objectives. In contrast, target 9 on reversing the loss of environmental resources has no quantifiable target or time dimension[9]. The indicators related to target 9 cover a range of environmental resources, including forest area, protected areas and biodiversity, energy, and $CO_2$ emissions. Targets 10 and 11 do provide quantifiable targets, though there is concern that these targets are not sufficiently ambitious.

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[6] Data on progress toward achieving the MDGs are available from World Bank Indicators 2005, and online at http://ddp-ext.worldbank.org/ext/MDG/homePages.do.

[7] This indicator has been proposed as an additional indicator for MDG7.

[8] For a complete list of UN Millennium Development Goal, targets, and indicators, see http://millenniumindicators.un.org/unsd/mi/mi_goals.asp

[9] The Task Force on Environmental Sustainability of the Millennium Project (commissioned by the United Nations Secretary-General in 2002 to develop a concrete action plan for the MDGs) discusses the problems and complexities of setting measurable targets for the various aspects of target 9. They call on each country to set individual measurable and time-bound targets related to environmental sustainability. The authors of this paper could find no information reporting on the progress towards establishing such country-level targets.

The initial scholarly debate as well as the popular media's depiction of population-environment relationships focused on one aspect of demography (population growth) and its relationship to the environment and development. More recent research, however, has begun to deal with additional dimensions of demography, including population mobility (in-migration, out-migration, urbanization, temporary migration, and even international migration), age and sex composition, and mortality and morbidity. In addition, there is growing research at multiple scales which is finding that the relationships between demographic aspects and the environment may differ at different scales (individual, household, community, regional, and global). While recent population-environment research has not led to a new comprehensive and accepted theory, there is great excitement about the empirical evidence coming forth which may, inductively, lead to significant theoretical advances in the near future. Unlike many other special areas or subfields of demography, the population-environment nexus is inherently multidisciplinary, which makes it more difficult to achieve theoretical advances or even to conduct empirical research which all can accept as valid. On the other hand, there is widespread agreement about the complexity of the relationships and the importance of the topic at local, national and global scales.

***Target 9: Integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources.***
*Indicators 25 and 26: Forests and Biodiversity*

The loss of tropical forests represents one of the most significant anthropogenic impacts on the global environment and also has serious consequences for biodiversity conservation (Brooks et al., 2000) and carbon storage (Fearnside and Laurance, 2004). The humid tropical forests of the Amazon basin, which constitute the world's largest tropical wilderness area (Mittermeier, 2003; Myers et al, 2000), experienced record rates of forest loss in both 2003 and 2004, losing 20,000 $km^2$ of forest annually[10]. Studies on the Amazon have identified several major factors contributing to the loss of forest cover, including road building, agricultural colonization (often involving fire), and logging. While the Amazon has been a key region of recent land use land cover change (LULCC) research, there is a now a growing body of LULCC literature on other regions as well, at multiple scales of analysis, for various land cover types, and using a variety of research techniques and analytical/statistical approaches.

Demographic factors can affect forest clearing by households at the frontier through several pathways, including the settlement of farms by agricultural colonists (the Malthusian extensification of agriculture, 1798); the extraction of timber for housing or fuelwood; the growth of demand for agricultural commodities by growing urban populations; and inducing changes in institutions and agricultural technology (e.g., as population density increases, inducing agricultural intensification à la Boserup, 1965).[11]

[10] Recent newspaper reports from Brazil state that deforestation has slowed in 2005, but ambitious future road-building programs in Brazil and elsewhere indicate that this may be a temporary respite.
[11] See Bilsborrow and Geores (1994) and Bilsborrow and Carr (2002).

In a recent meta-analysis of research on the factors causing deforestation in the tropics, Geist and Lambin analyzed 152 case studies, identifying key regional-scale proximate and underlying drivers, including road construction, natural resource extraction, agricultural colonization, commercial agriculture, growth of urban markets, and government policies (2001). While many factors were identified as important factors in deforestation[12], the expansion of the agricultural area was the single most common proximate cause[13] (*ibid.*). In about half of these cases, population factors (primarily in-migration, but also to a lesser degree natural population growth) were reported to directly drive agricultural expansion (*ibid.*).

Since population growth is identified a proximate cause of deforestation through colonization and migration (Geist and Lambin, 2002), existing ambitious plans for further expanding road networks and agricultural production in forest frontiers are likely to significantly hinder progress towards achieving the MDG target 9(25) pertaining to forest cover. Because the world's most biologically diverse land areas are tropical forests (Mittermeier, 2003; Myers et al, 2000), the future loss of forest cover to agricultural expansion will also hinder goals related to conservation of biodiversity.

In the context of forest frontiers, one relevant type of LULCC research has been the analysis of household land use in relation to deforestation. Studies have investigated the role of population variables such as household size, age and sex composition, population density on the farm, and migration, in addition to a litany of other socio-economic and biophysical variables (e.g., Pichon 1997; Godoy et al. 2001; McCracken et al. 2002; Vance and Geoghegan 2002). Such studies have found various demographic factors important – especially household size and the number of male adults – but the results have not been consistent across studies or contexts, nor have they been based on nor led to universally accepted theories. In addition, though many have called for studies to explicitly take into account the theoretically plausible effects of contextual factors on LULCC at the farm household level (such as community population size, local infrastructure, linkages to larger cities and markets, prices of major crops, etc.) there has been little quantitative research nor evidence of an association with deforestation.

In relation to forest cover and clearing, demographic factors at the regional level appear important, since agricultural expansion would not occur without the heavy in-migration of people to the tropical forest frontier, but evidence at the household level is more elusive. In any case, achievement of this aspect of MDG 7 (Target 9, indicators 25 and 26) require careful attention to migration, which is not discussed in relation to this or other MDGs. In addition, farm-level research has also provided useful findings about factors linking population as well as related factors to the different MDGs and forest cover. For example, some household level studies on LULCC find that more education is linked to *greater* deforestation not less (Pichón, 1997; Godoy et al., 1998), perhaps due to its leading to higher consumption aspirations and/or higher labor productivity – increasing the capacity to earn more from agriculture. This suggests that in some settings

[12] Multiple proximate factors were found in 96% of the cases.
[13] Agricultural expansion was implicated in 146 of 152 cases or 96% and was defined to include cropped land and pasture (Geist and Lambin, 2001).

the achievement of MDG 2 of universal primary education (which is of undisputed importance for human welfare) could have negative impacts on forest cover.

If migration to the frontier and associated agricultural colonization is often a major proximate cause of forest clearing, then the ultimate or underlying drivers of deforestation are those factors that lead to that migration. Included among these drivers is the development paradigm characterizing the tropical forest biomes as extractive sectors (e.g., petroleum, mining, or lumber). But the migrants must come from somewhere, and are influenced by various factors at the household or higher levels to leave their places of origin. Those factors are then also underlying drivers behind the deforestation at the frontier. Thus, multivariate research is needed to determine the factors leading to migration to forest frontiers.

A major additional unanswered question is how urbanization (the increasing proportion of the population living in urban areas) forecast for developing countries (UN, 2004) will affect forest cover and resource use. An inverse relationship between urbanization and forest cover loss can be postulated based on the experience of the world's developed countries (FAO, 2000). While existing LULCC research discusses the importance of the local context on deforestation (Geist and Lambin, 2002), it provides little guidance for gauging the effects of future urbanization on forest cover in the developing world.

*Indicators 27 and 28: Energy Use and $CO_2$ Emissions*

Global warming has the potential to cause dangerous changes to the Earth's climate (O'Neill and Oppenheimer, 2002). $CO_2$ emissions from burning fossil fuels have been implicated as a leading contributor to global climate change, and population has been identified as an important factor in $CO_2$ emissions (Schelling, 1992; O'Neill et al, 2001). Models projecting future $CO_2$ emissions have until recently addressed population simply through the direct impacts caused by changes in population size resulting from different population growth scenarios (O'Neill, 2004). It is now clear, however, that the relationship between population and climate change is far more complex than simply a scale relationship, and that projections should also consider population aging, changes in household size, and changes in population distribution (from urbanization) (O'Neill et al, 2001). Consequently, researchers have begun to look at how changes in population composition may affect energy use, consumption patterns, and CO2 emissions (O'Neill and Chen, 2002; Dalton et al., 2005; Jiang, 2005). This research is, however, in its initial stages: Dalton et al (2005) suggests that, although "compositional changes in population will occur … the effects of these changes on energy demand and emissions are currently unknown."

Unfortunately, the MDG indicator for $CO_2$ emissions provides no measurable target for achievement; and in addition, because it is a per capita measure, the indicator completely ignores the role of population change. While decreasing or stable per capita $CO_2$ emissions may be seen as an indicator of increased energy efficiency, it is *total* $CO_2$ emissions that is important for climate change. All population projection scenarios of the UN indicate that global population will continue to grow for most of the 21$^{st}$ century

(UN, 2005). Thus, even the most optimistic scenarios show total emissions increasing through 2040 or 2050 despite gains in per capita efficiency (IPCC, 2000). In contrast, the targets for $CO_2$ emissions created by the Kyoto protocol, focus on total rather than per capita emissions[14] (UN, 1997). Thus, while total emissions policies and indicators at least indirectly consider population changes, the use of a per capita indicator for MDG 7 essentially eliminates population from emissions targets.

In contrast, the related indicator, energy use per unit of Gross Domestic Product, does not eliminate population, though population is only implicit. Both future population growth and internal migration in the form of rural-urban migration (movement of people from a relatively low per capita energy use location to a higher per capita energy use area) tend to increase demands for energy. This urbanization effect is likely to be considerable in many countries because of the much higher consumption of energy/electricity in urban areas for heating and cooling, household appliances, factories and offices, and transportation from home to work. The effects of population growth and redistribution on energy use per unit GDP will vary from one country to another and can be attenuated by policies that improve the efficiency of energy use and consumption, especially in urban areas.

***Target 10: Halve by 2015 the proportion of people without sustainable access to safe drinking water and Sanitation.***
*Indicators 30 and 31: Water and Sanitation*

Although the total number of people with access to improved water and sanitation increased during the 1990s, the *proportion* of the world's population lacking access to an improved water source remained stable at approximately 17% due to population growth (UNFPA, 2003). Some United Nations estimates suggest that, based on the medium projections of future population growth, to attain target 10 by 2015 will mean providing an additional 1.6 billion people with access to safe drinking water and an additional 2.2 billion people with access to improved sanitation systems. If current upward trends in per capita water use continue, two-thirds of the world's population will experience moderate or severe water stress by 2025 (ibid.).

The world's fresh water supply, fresh water consumption, and access to sanitation services are all very unevenly distributed across the globe (Falkenmark, 1997). Per capita water consumption is much higher in nations with high incomes and low population growth rates (UN, 2005), whereas many of the nations already facing water scarcity and lacking adequate safe drinking water and sanitation for a large part of their populations are also simultaneously facing rapid population growth (UN, 2005). Thus, the challenge for these nations is how to expand infrastructure to meet the needs of currently underserved populations while at the same time accounting for future infrastructure needs caused by population growth.

[14] The Kyoto protocol calls for developed countries to reduce their total greenhouse gas emissions relative to 1990 levels but does not impose limits on developing countries since it was argued that such limits would constrain their economic growth.

Access to an improved water source should not be the only water concern of the MDGs. Research has found that the quantity of water available to households (even non-potable water) is important in preventing diarrheal diseases (Van der Hoek et al, 2001). Demographic dynamics can affect the quantity of water available for households in several ways: through changes in population size and age composition as well as in urban-rural location. As households continue to become smaller in future decades (declining mean household size, due to both declining fertility and decreasing extended family arrangements), the future will be characterized by a growing number of households even as population growth subsides. Meeting water needs will become an even greater challenge if income growth occurs in developing countries (as is the hope of the MDG 1), as increasing incomes result in higher household consumption[15].

Thus population and economic growth will place increasing demands on water sources and lead to greater water stress in areas already facing scarcity. An additional factor affecting the quantity of water available to populations for household consumption will be the water needs of agriculture (Falkenmark, 1997). The need to increase food production to feed growing populations will increase demand for water in areas already experiencing water shortages. Unfortunately, however, MDG 7 does not address water consumption needs of agriculture, which are linked to household food demands. It is possible that ongoing research on increasing the efficiency of use of water in agriculture will attenuate these effects[16], but rural populations will inevitably face the dual problem of inefficient or incapable institutions, unable to provide services in remote areas, as well as scarcity of water for agricultural needs.

There are, nevertheless, some likely population changes which will *positively* impact the indicators for target 10. The main one is that virtually all population growth expected in the next thirty years will be in urban areas. The UN projects that the world's urban population will grow from 3 billion in 2003 (48% of the world population) to nearly 4.9 billion by 2030 (60% of world population) (UN, 2004). The majority of urban population growth will occur not in mega-cities, as commonly believed, but rather in small-to-medium sized urban settlements (less than 500,000 inhabitants), almost all in less developed countries. Rural-urban migration and natural population growth in urban areas with established water and sanitation systems will lead to increases in the proportion of the country's population with access to safe drinking water. Unfortunately, urban services, including safe drinking water and sanitation, in these small to medium sized urban settlements already lag behind current needs (Montgomery et al, 2003). Decentralized urban population growth will thus require a decentralization of urban development planning, finance, and governance to meet future needs. Future urban growth will require the foresight and planning to extend urban services to existing slum areas as well as emerging squatter areas receiving new migrants. Municipal water systems will also face the challenge of preserving and managing watersheds to protect the

[15] There has actually been a decline or leveling off of per capita consumption in developed countries, but this is due to improved efficiency in agriculture and industrial water use and not to decreased consumption by households.
[16] For example, see Postel (1996).

sources of water so as to be able to provide sufficient water for growing populations, as well as identifying and transporting water from new sources. In areas with large demands for water (e.g., Southern California) conflicts have already arisen between different user groups including municipal governments and agriculturalists over the water rights. With the growth of urban populations and increasing water scarcity, increased conflicts among competing water users are very likely.

***Target 11. Have achieved, by 2020, a significant improvement in the lives of at least 100 million slum dwellers.***

*Indicator 31: Proportion of population with access to secure land tenure.*

Current estimates suggest that the number of slum dwellers[17] ranges from 837 to 930 million (Herr and Karl, 2002) meaning that 28-30% of the world's current urban population lives in slums[18]. The projections of urban population growth mentioned above have several important implications for target 11. First, the target of improving access to basic services for 100 million slum dwellers is an extremely modest goal considering that the number of slum dwellers in 2020 will number well over 1 billion (UN, 2005). In fact, the modest target of helping only 100 million slum dwellers implies that the proportion of urban residents without access to basic services could be greater in 2020 than it is today even if the MDG goal is met. It should be noted that the target of 100 million was first a target in the UN 1999 "Cities without slums initiative" This target was only one objective in a much broader program that proposed to work with 50 national programs (UN Millennium Project, 2005)[19]. Unfortunately, because this number was taken out of context for use in the MDGs, the result is a target which essentially ignores population forecasts and sets a low benchmark for meeting the basic needs of the urban poor.

It is often assumed that the urban poor, because of their proximity to urban infrastructure, have better access to basic human services than their rural poor counterparts. Case studies on meeting the needs of the urban poor have found that, in many cases, inadequate basic services are not a result of an inability to pay but rather of the unwillingness of governments to provide services as well as poor efficiency of service provision (Satterwaite, 2002). Future urban population growth and the need for decentralization of urban services will further challenge the willingness and efficiency of governments to provide services and therefore will involve issues of economic efficiency and pricing as well as political mobilization.

Improving the lives of slum dwellers will require improving several conditions, most important of which are: access to safe water and sanitation and access to secure housing

[17] UN-HABITAT defines a slum household as a group of individuals living under the same roof who lack one or more (in some cities, two or more) of the following conditions: security of tenure, structural quality and durability of housing, access to safe water, access to sanitation facilities and sufficient living area.

[18] UN-HABITAT defines a slum as a contiguous settlement where the inhabitants are characterized as having inadequate housing and basic services

[19] This particular target was chosen for the MDGs because it was the only measurable target in the "Cities without Slums" initiative (UN Millennium Project, 2005).

of adequate quality. Because other MDG targets focus on basic human services, the only indicator specific to slums is indicator 32, which relates to tenure security. Target 10 focuses explicitly on improving water and sanitation services in urban areas, and our discussion above implicitly includes slum dwellers. In our estimation, however, the absence of indicators specific to urban slums will only hinder measurement of progress towards meeting target 11 and continue to obscure the living conditions of slum dwellers. In addition, the measurement of urban living conditions will become more difficult as urbanization disperses geographically to small and medium settlements.

A common misconception about urbanization is that rural-urban migration will drive future urbanization. In fact, natural increase of existing urban populations has been the greatest contributor to urban population growth for several decades in most of the world (Chen et al, 1998). Thus two important research questions that will affect the achievement of Target 11 are the following. (1) What are future fertility rates and therefore natural growth likely to be in urban slums? (2) And, what proportion of rural-urban migration will end up in existing slums or create new ones? The selectivity of migration suggests that the behavior of urban migrants may differ in important ways from that of the urban population added through natural increase. For example, fertility and labor force participation both tend to be higher overall for migrants than for urban non-migrants (though there is no evidence on differences in fertility between "native" slum populations and migrants to slums).

Apart from future urban planning successes that upgrade slum areas to non-slum status, these two demographic factors, migration and natural increase, will determine the extent of future growth and the composition of slum populations. Research is thus needed to better characterize and understand the heterogeneity of urban slums. While research of this nature is ongoing (see Montgomery, 2005) the improvement of urban services in the near-term will have difficulty addressing socio-economic, cultural, and demographic diversity within slum populations. Taking into account the spatial distribution of the urban poor, and the often rapid changes in these populations as some households improve their conditions or move into better parts of the city, while others continue to lack basic needs is a key factor in planning for urban services to achieve target 11.

In closing, we hope that our examination of the relationship between population and MDG 7 will serve as a starting point for discussion in the cyber-seminar. We believe that in some cases there is clear evidence that the absence of explicit consideration of population dynamics in MDG 7 will hinder achievement of the proposed targets. In other cases, knowledge of these relationships is still in its infancy. In all cases, however, a clear understanding of the relationship between population and the MDG 7 targets awaits further discussion and research. It is our hope that the cyber-seminar will stimulate such debate, thus providing input for the improvement of the MDG 7 indicators as well as identifying new areas of research.

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