MDG 7:
Ensure environmental sustainability

MDG 7 cannot be analysed out of the general context of the MDGs as an integrated development strategy, with specific priorities. Sustainable development is grounded in the recognition of the role played by the environment and natural resources in providing the material and environmental basis, the ecosystems, and the energy on which economic processes depend (ECLAC, 2000 b). MDG 7 is connected, for example, to MDG 6 as the combat of malaria is a health priority, which is related to the environment, housing, and settlement patterns. In all of this, the implications of demographic factors must be considered, either because population growth impacts on environmental sustainability and produces environmental vulnerability, or because migration and other components of demographic change influence the growth of urban slums and deforestation of rain forests, to mention a few of the relevant interactions.

One of the overarching priorities is the sustainability of development, not only in an environmental sense, but also over time. Moreover, sstainable development should be viewed under the lens of international cooperation. This is to say, environmental sustainability is associated with the building of global partnerships, given that, in today's world, all countries are interconnected and interdependent. The global scale of pressure on the environment, epitomised by problems such as global warming and the depletion of the ozone layer, underscores the fact that countries are becoming increasingly interdependent and vulnerable. Sustainability of the environment (MDG 7), therefore, depends on global partnerships for development (MDG 8).

Relationships with poverty (MDG 1) and, to a lesser extent, gender (MDG 3) are also evident. In the case of poverty, these are clearly bi-directional, as environmental degradation can be either the cause or the consequence of the poverty of the population residing in environmentally vulnerable areas. A somewhat unexpected link between MDG 2 and MDG 7 is the finding by some researchers (e.g. Pichón, 1997) that settlers with higher levels of education tend to cause more deforestation than those with less education, possibly because they can leverage more resources for the economic exploitation of the land they occupy. Conversely, there is also a link from Target 11 to MDG 2 in that children living in slum areas often do not have access to education, for lack of a legitimate address for registration (UNFPA, 2007: 28).

Although the notion of a strong linkage between environmental sustainability and population processes is intuitively appealing, historically it has proven difficult to act upon this idea. Young (2005: 93) notes the lack of mutuality between population policy and other aspects of development, particularly issues of sustainability:

> *"The population lobby sets out clearly and forcefully the effects of population increase on environment, food security, poverty, and sustainable development. The institutions and agencies responsible for the latter concerns, on the other hand, do not explicitly recognize that population increase is integral to their policies. The ethically acceptable package of population and reproductive health policies set out in 1994 at the UN Conference on Population and Development must be applied to the objectives of the World Conference on Sustainable Development in 2002. Institutions concerned with poverty, hunger, and environment need to follow the policy road from Cairo to Johannesburg."*

The author regrets that the institutions and lobbies concerned with these issues generally treat population as a given, independent variable, thereby dissociating it from the policy discourse of Cairo.

The United Nations Conference on Environment and Development (UNCED), in Rio de Janeiro, 1992, could have been an interesting opportunity to place population issues on the sustainable development agenda. However, although *Agenda 21* touched on population issues in very general terms, it lacked detail.

> *"Policies should be designed to deal with the consequences of population growth (…) Research should be conducted on how environmental factors interact with socioeconomic factors as a cause of migration (…). An assessment should also be made of national population carrying capacity (…)" (United Nations, 1992: 5.16 and 5.20)*

Some attention was given to promoting the growth of intermediate cities: "(…) to insure that urban sprawl does not expand resource degradation over an ever wider land area and increase pressures to convert open space and agricultural/buffer lands for development" (United Nations, 1992: 7.18), but there was no recognition of the need to accommodate the distribution of settlements on the basis of the distinct resource endowments of a country's different regions.

With the Second United Nations Conference on Human Settlement (Habitat II) (Istanbul, 1996), the matter of environmental sustainability and population processes and their spatial distribution was put more clearly. Going beyond the call for the development of intermediate cities, the *Agenda* specifically recommends "promoting spatial development patterns" in the name of environmental quality, and recognises the need for tradeoffs in regional patterns of land use:

> *"…land management practices that deal comprehensively with potentially competing land requirements for agriculture, industry, transport, urban development, green space, protected areas and other vital needs." (United Nations, 1992: 7.30)*

> *"The quality of life and the activities of all human beings within human settlements are closely interrelated with population change, demographic patterns, including growth, structure and distribution of population, and development variables such as education, health and nutrition, the levels of use of natural resources, the state of the*

> *environment and the pace and quality of economic and social development." (United Nations, 1996: 125)*

The ICPD PoA recognised the relationship between the environment and demographic phenomena, such as the environmental impacts of rural to urban migration, population growth rates, poverty reduction and resource consumption. Para. 3.29 (d) of the ICPD PoA highlighted the need for preservation of natural resources and encouraged particularly the sustainability of production and consumption patterns, although it did so without mentioning quantifiable time-bound targets. In addition, Para. 3.25 of Chapter IX illustrated how the ICPD PoA relates *population distribution*, particularly the rural-urban dichotomy, to *environmental preservation*:

> *"Demographic factors, combined with poverty and lack of access to resources in some areas, and excessive consumption and wasteful production patterns in others, cause or exacerbate problems of environmental degradation and resource depletion and thus inhibit sustainable development."*

Similar statements can also be found in a number of UNFPA documents:

> *"Balancing resource use and ecological requirements will depend critically on population growth, location and movements, on patterns of resource consumption, and management of waste." (UNFPA, 2002 a: 7)*

For the most part, however, ICPD left environmental considerations to Agenda 21 and other Earth Summit documents, and the population and environment lobbies continued to operate more or less independently. Efforts by the IUSSP and the IHDP (Global Science Panel on Population and Environment, 2002) and some nations (Brazil, for example: see Hogan et al., 2002 a) to place population on the Johannesburg agenda were unsuccessful. More recently, the Task Force on Environment assembled by the UN Millennium Project was emphatic in that environmental sustainability is key to achieving not only MDG 7, but all of the MDGs. The MDGs actually define quantifiable time-bound targets, including the preservation of natural resources in Targets 9 and 10. Target 11 of MDG 7 focuses on the environmental impacts of urban agglomerations, as it aims to improve the lives of 100 million urban slum dwellers by 2015, but does not give any explicit consideration to the crucial demographic components of slum formation.

On the whole, it must be concluded that population and environmental concerns have mostly been addressed in separate policy fora. The IUSSP Global Science Panel on Population and Environment (2002), however, argues:

> *"The human population matters for sustainable development in two critical ways. First, it is an agent of change, inducing many of the environmental, economic, and social changes in the world that give rise to our concern about the sustainability of our current development paths. Second, the human population and its living conditions are the ultimate objects of development, with long-term human health, wellbeing, and survival serving as criteria for judging whether development is sustainable or not. It*

> *is the human population and its individual members that ultimately will suffer the consequences of unsustainable paths of development. For these reasons, the systemic integration of population in sustainable development is essential if we are to meet the needs of present generations without sacrificing the livelihoods of future generations."*

The political problems associated with the separate policy settings in which population and the environment have typically been discussed are reinforced by the analytical difficulty of establishing direct and unambiguous relationships between the two. While it is easy to agree with Vaclav Smil (1993) that, in general, any conceivable environmental problem is likely to be aggravated by population growth, the precise mechanisms of this impact are not so easily established, particularly at the local level where many other factors come into play. As Bilsborrow (2002) puts it:

> *"[Instead of multivariate analysis,] many studies focus on one or two factors of particular interest to the authors, who then adduce evidence in support of their ideological stances either in favor or in opposition to those factors. Some (if not most) of the research on population-migration effects on the environment suffers from such an a priori bias towards seeing population as either unimportant and overstated in the literature or as the main factor in environmental decay."*[1]

The two main difficulties are that

1. Some environmental problems are caused by processes in which population admittedly has no or at best only a minor role; and
2. In those environmental problems in which population has a major role, the eventual outcomes may depend very much on institutional and other conditioning factors.

Bilsborrow and Hogan (1999) are among those who made an early effort to overcome simpler, single factor approaches, primarily with respect to the specific question of deforestation and two major population components – migration (new settlements in forest regions have consequences which are not linear extrapolations of the number of migrants) and health (not only the forest but also its new residents suffer consequences, especially with the increased importance of malaria).

Given these difficulties, compounded by the partial nature of the MDG environmental indicators themselves, the task of systematising the different population-environment interactions with respect to the MDG targets is not an easy one. This chapter will go about it according to the following scheme:

7.1. The link between population growth and environmental sustainability
7.2. Population and the sustainable use of space
7.2.1. The role of migration
7.2.2. The role of gender factors
7.2.3. Population distribution and environmental vulnerability
7.3. Population and access to safe drinking water and basic sanitation

[1] Quote from the full version of the paper, available on internet, which was abbreviated in the version cited in the Bibliography.

This structure is partly a product of the structure of the MDG targets themselves and partly of the different analytical approaches to bringing in population considerations. The latter are particularly important in sections 7.1. and 7.2., whereas sections 7.3. to 7.5. are mostly structured around the MDG Targets themselves.

Perhaps the most evident consensus regarding population among scholars and policy-makers is that long-term environmental sustainability cannot be achieved without the stabilisation of population growth. Some MDGRs have also argued for the limits to the consumption of essential non-renewable natural resources. However, these ideas have not necessarily translated into a systematic concern with population factors as integral elements of environmental policy. Opinions on the importance of population trends compared to other determinants of environmental depletion vary greatly, particularly when one moves from the global to the local level and from the long run to more immediate policy interventions. At this level, according to some, population dynamics are insignificant in comparison to a wide array of economic, political, and institutional determinants. Others, who look at sustainability through a macro-systemic lens, consider that the current population pressure is such that it maintains itself at the cost of depleting non-renewable resources, like access to fresh water, arable land, limited carbon dioxide concentrations in the atmosphere, etc.

The more recent literature on population and the environment has largely moved away from generalisations at the planetary level and brings in much greater detail about the spatial characteristics of population and environment connections, especially at the local level. Among other things, this has lead to concepts such as the "sustainable use of space", in addition to older ones, such as "carrying capacity" and "ecological footprint". Some defend that the relationship between population and environment needs refocusing, the issue here is not *how many* use a territory but rather *how* to use, this would imply that urban planning must be taken into account when analysing population needs and environmental conditions.

Another important demographic phenomenon which influences the environment is migration. Even with the decline of rural-urban migration rates in LAC, it is not easy to identify a rule to establish whether migration in general is beneficial or harmful to the environment. To some, migratory population growth still counts as the primary cause for deforestation, while to others it would be the agricultural expansion. Institutional and gender factors also modify the way in which population and more specifically migratory pressures affect the environment.

One of the development targets under MDG 7 is the access to safe drinking water. Although the Target of 92% coverage will probably be met, this does not alter the fact that

in 2002 more than 60 million residents of the LAC region were still not served by safe drinking water. Population dynamics are relevant in this context with respect to two factors: degree of urbanisation and social (or racial) differences. A similar concern applies to the issue of urban slums. The population increase will probably lead to greater urbanisation rates, but its implication for the growth of urban slums is not clear-cut. The challenge consists in reducing urban slums while urban population will still grow, both because of natural increase and migration. Rapid urbanisation has been accompanied by the occupation of marginal lands within or at the periphery of cities, with common problems such as poverty and inadequate infrastructure. Not all urban slums, however, are the result of migratory processes and a substantial proportion of their residents are native urbanites.

The last section of this chapter focuses on the new Target, on the protection of biodiversity, that was introduced in 2006 by the former UN Secretary General. Species extinction is not a new process, but it has been accelerated by some phenomena related to population (migration, according to some), deforestation, over-exploitation, and habitat alteration – all connected factors that suggest the need to protect the environment.

Target 9: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources

The concept of sustainable development policies covers an extremely wide range of issues. However, at the time these issues were condensed into quantifiable indicators, Target 9 focused on a rather limited set of concerns such as the emission of carbon dioxide and the proportion of land area covered by forest, and the population perspective was not considered, nor were Targets of special concern to the LAC region granted a prominent place. Indicator 29 – the proportion of population using solid fuels – is the one most closely associated to human behaviour.

According to ECLAC (2005 a), in spite of hosting Earth's greatest biodiversity heritage, receiving the largest inflow of freshwater and lodging the Amazon rainforest, the LAC region's most critical environmental problems were only marginally approached by the MDG indicators. It is true that Target 9's indicators 25 – proportion of land covered by forest - and 26 – ratio of area protected to maintain biological diversity to surface area – touch upon the preservation of forests, evidently a crucial environmental protection issue for the region that houses the Amazon forest, but MDG 7 does not address such issues more consistently.

> *"The environmental sustainability of Latin American and Caribbean development is increasingly under threat. The region's most serious environmental problems (land and forest degradation; deforestation; loss of habitat and biodiversity; and pollution of freshwater, coastlands and the atmosphere) are generally getting worse and are only partially and imperfectly addressed by the targets and indicators set forth under Goal 7." (ECLAC, 2005 a: 173)*

Argentina's 2003 MDGR seems to agree that some opportunities were missed in MDG 7 to establish the priority of certain themes, a perception shared by the Mexican MDGR (2005):[2]

> *"The evaluation of environmental sustainability is frequently carried out on the basis of just a few indicators, owing to the conceptual complexity of the issue, as well as to the lack of accurate, trustworthy information." (Mexico, 2005: 144*)

The Peruvian 2004 MDGR also remarks that MDG 7 is not adequately adapted to the circumstances of the LAC region, the world's second largest land area covered by forest:

> *"MDG 7's indicator on land area covered by forest does not specify a quantitative value to be reached by 2015. Neither there are targets related to national policies, nor a baseline that could be used as reference to the interventions designed to revert the trends of change in forest coverage." (Peru, 2004: 86)*

Having said that, from the narrower perspective of population in the LAC region, the items of MDG 7 that will merit closer scrutiny in the following sections are the living conditions of slum dwellers (Target 11) and, to a lesser extent, the pressure of population growth on natural resources (in the context of Target 9).

As for the more general question of integrating the principles of sustainable development into country policies, ECLAC (2005 a) remarks that building government institutions to look after the preservation of the environment, to raise awareness, and to change production and consumption patterns has been a trend observed in Latin America throughout the 1990s, but rarely have the appropriate bureaucracies been granted more than 1% of the countries' GDP to shape environmental policies. The same idea is expressed by the Mexico MDGR (2005):

> *"For a long time environmental issues were on the sidelines when decisions were made about economic policy and the principal productive sectors; as a consequence, the economic and social costs of demographic growth were underestimated, as were the costs of the unequal territorial distribution of the population and of the impact of productive activities and urbanization on the quality of the air, water, and soil, thus evading the implications of the degradation and destruction of natural resources." (Mexico, 2005: 152)*

7.1. The link between population growth and environmental sustainability

The relationships between population and the environment are easiest to visualise at the macro level. Perhaps the most obvious and traditional link that can be established is the recognition of the fact that – in the long run – environmental sustainability cannot be achieved without the stabilisation of population growth. This was one of the central ideas of the Brundtland Report, *Our common future*:

[2] The introduction, in 2006, of a biodiversity Target seems to respond to some of this criticism.

> *"Present rates of population growth cannot continue. They already compromise many governments' abilities to provide education, health care, and food security for people, much less their abilities to raise living standards. This gap between numbers and resources is all the more compelling because so much of the population growth is concentrated in low-income countries, ecologically disadvantaged regions, and poor households." (World Commission on Environ-ment and Development, 1987: Chap. IV.2)*

This idea is largely consensual among scholars and policy-makers. Where the opinions differ substantially is with respect to just how far away the long run is and whether the planetary ecosystem is prone to run into any catastrophic resource limits before population can be stabilised. The environmental debates of the 1970s, which signalled the proximity of insurmountable limits to the consumption of essential non-renewable natural resources (the idea most famously defended by Meadows et al., 1972 in their Report for the Club of Rome), have shown these limits to be much more elusive than was thought at the time. The Working Group on Population Growth and Economic Development of the National Academy of Sciences (National Research Council, 1986) has advocated that population dynamics are not a significant factor in the availability of exhaustible resources, and that even renewable ones depend only indirectly on their influence. Other researchers (Pimentel et al., 1994) argue, however, that the limits of optimum sustainable development, which they place at a world population of close to 2 billion, have already been surpassed and that the current world population maintains itself at the cost of increasingly depleting non-renewable resources, in a way that is incompatible with long-term sustainability.

Even if one assumes, unlike Paul Ehrlich and other prophets of the "population explosion", that the planetary ecosystem is unlikely to collapse in the near future as a consequence of unchecked population growth, there are still legitimate reasons to assume that rapid population growth is an aggravating factor in many environmental problems:

> *"Problems of environmental degradation and resource depletion are often exacerbated by demographic factors, especially when these are combined with poverty. Continued growth of populations and economies threatens food and water security, forest resources and biodiversity, and increases pressure on limited natural resources." (UNFPA, 2004 a: 7)*

Today, populations living in countries with scarce natural resources are growing more rapidly than the world population as a whole, putting even greater pressure on these biologically fragile zones (Engelman et al., 2000).

With respect to the contribution of population growth to specific environmental problems, much use has been made of the Ehrlich and Holden (1971) decomposition I=PAT, which states that any environmental impact I is the product of three factors: population (P), affluence (A), and technology (T). The decomposition has often been criticised, among other reasons because there are usually important interactions between the three factors so that it is unrealistic to assume that one can vary independently of the others (e.g. Preston, 1996 b). Despite these caveats, it may be relevant to know that projections by O'Neil et al. (1998), which examined global changes in greenhouse gas emissions over the next 50

years, concluded that, in the short run, income and technological change will have a greater impact than population growth, but that, in the long run, the contribution of population growth will increase.

In the case of fresh water, it is estimated that currently 505 million people are suffering water stress or serious water scarcity (Engelman et al., 2000). Under current trends, 2.4-3.2 billion people may be subject to moderate or high water stress in 2025. Over this period, it is expected that the world will need 17% more water to grow food for increasing populations in developing countries, and that total water use will increase by 40% (United Nations, 2002 b). In the LAC region, the countries presenting the most serious problems are Haiti and Peru (Gardner-Outlaw & Engelman, 1997). This is an issue of freshwater *availability*, distinct from the issue of *access* addressed under Target 10. Currently, people expropriate about 54% of all available freshwater from rivers, lakes, streams, and shallow aquifers. Population growth in the next 25 years is expected to increase this figure to about 70% (Hinrichsen, 2003; UNFPA, 2003 a). The *Perfil ambiental de Guatemala* (IARNA/URL/IIA, 2006) notes that water consumption in that country is 120 litres per person per day in urban and 60 litres in rural areas, whereas households burn an annual 1.8 m^3 per capita of fuelwood. But this level of consumption of varies widely. While 100 litres per person per day is generally considered a minimum for personal use, the average is 29 for Senegal, but 700 for the US (Acreman, 1997). Unsurprisingly, per capita consumption is unevenly distributed across the world's regions and between urban and rural areas. Indeed, there is an inverse correlation between water consumption and income on one side, and population growth on the other side, with high income countries having high water consumption and low population growth. The opposite applies to the less developed nations.

As pointed out by Antón (1996), all the major cities of LAC are facing problems of water supply for their populations. This is due to contamination of water, especially by sewage and waste. This issue of water quality has important consequences for the *supply* of water. The situation is aggravated in the mega-cities of Buenos Aires, Mexico City, Rio de Janeiro, and São Paulo. In the case of Mexico City and Buenos Aires, an over-exploitation of aquifers is a daunting challenge for the sustainability of supply in the long term.

Not only population numbers, but also settlement patterns are important in this context. The higher water consumption of urban households is only one of several potential conflict areas between urban and rural water use. When cities and surrounding rural areas compete for water resources, ecological water requirements (the water needed to maintain ecosystem function and local hydrological cycles) are often neglected. During the past two centuries, rapidly growing urban centres have relied on bringing in water from increasingly distant sources. Conflicts between users in cities and elsewhere have been common. Urban water use requires a higher-quality and more stable supply than that in most rural uses (e.g. irrigation). When water is diverted from agriculture to urban areas, agricultural productivity can be severely affected. Urban centres rely on adjacent ecosystem services to break down their biodegradable wastes, but when the capacities of these local ecosystems are overburdened, downstream agriculture may be damaged and people living in downstream settlements

are put at risk. These same biodegradable wastes may represent the loss of nutrients from agricultural and forestry systems. In many circumstances the institutions for reconciling such conflicts are neither equitable nor efficient (Baumann, Boland & Hanemann, 1998). In particular, the social, economic, and political importance of cities often ensures that their demands are given priority.

Meyerson (1998) examined the historical relationship between population growth and carbon emissions and the challenges facing the signatories of the 1997 Kyoto Protocol on global warming. According to this author, the wide variation in projected population change among developed countries is a significant yet largely ignored factor in the assessment of the targets agreed upon at Kyoto. Even assuming the Protocol is successfully implemented, the global warming treaty cannot succeed without the near-term participation of developing countries, many of which already or will soon produce excessive carbon emissions as a combined result of large population size and fairly high per capita carbon use. Population stabilisation will be a key determinant of the success of any climate plan, but developed and developing countries alike vary greatly in their advance toward this goal, something that was not taken into account in the definition of the emission caps. Conversely, Bremner and Bilsborrow (2005) criticise the MDG agenda for defining its indicators 27-28 only in per capita terms, thereby ignoring the effect of population growth on the overall environmental impact. They prefer the indicators of the Kyoto Protocol, which are defined in terms of overall, rather than per capita emissions; this at least allows the assessment of population impacts, even if they have not been made explicit in the Protocol.

In other words, apart from being a necessary condition in the long run, stabilising population growth by providing access to SRH and family planning is one way (though certainly not the only one) to curb the pressures on environmental resources and available infrastructure in the more immediate future. As Singh et al. (2003) put it, the provision of SRH service can contribute to "balance natural resource use with the needs of the population", thereby enhancing environmental sustainability. Acknowledging that rapid population growth jeopardises the environment, particularly in fragile ecosystems and in underprivileged neighbourhoods, demographic pressures on the environment highlight the contribution the realisation of the ICPD might bear on the achievement of Target 11:

> *"Continued growth of populations and economies threatens food and water security, forest resources and biodiversity, and increases pressure on limited natural resources. Without the realization of the goals of the ICPD Programme of Action, especially universal access to quality reproductive health services, stabilization of global population and more sustainable patterns of production and consumption will remain elusive." (UNFPA, 2004 a: 27)*

At the local level, where the complexities of markets and social institutions come into play, the implications of population growth and density may be very different from the aggregate generalisations that have guided public concern with these issues. Local level studies of land use show that there is often a strong spatial correlation between population density and

the degree of deforestation (e.g. Meyerson, 2001), but this does not necessarily mean that population pressure is the primary driving force behind deforestation.

A central tenet of recent social science thinking about population growth, development, and the environment is that factors such as social institutions, the efficiency of markets, patterns of income distribution, levels of technology, and regulations are at least as important as population growth. The US National Research Council (1992) has put forward the idea that, under some circumstances, higher population density – together with greater availability of physical capital and clearly defined property rights – might actually benefit the ecological sustainability of ecologically vulnerable regions such as the Amazon region. At present, the only way to obtain satisfactory profitability is by making intensive use of the only production factor that is abundantly present, namely land and other natural resources. To put it differently, low populated areas might damage the environment because the inhabitants have no options other than to make the most of the available natural resources either to make a living or to boost the local economic activity. Conversely, the more intensive use of labour, capital, and technology would entertain less aggressive forms of exploitation of the environment if demographic densities were sufficiently high and if a supportive legal framework were operative. The same point is made by Bedoya (1995) in his study of the Peruvian Amazon region, where environmentally destructive modes of production by colonists are generally associated with a lack of affordable labour, due to the competition of the more lucrative coca cultivation in the region. Consequently, he shows that, in the case of Peruvian colonists, there is hardly any relationship between family sizes and cultivated area.[3]

Palloni (1994: 160), who did an extensive review and meta-analysis of the literature, concluded, based on current evidence, that "while population pressure is an important force leading to deforestation, it rarely acts alone to produce this outcome." In their study of deforestation in Costa Rica since 1973, Rosero-Bixby and Palloni (1998) conclude that while population is undoubtedly one of the contributing factors, from a conservationist viewpoint it is less important to establish this relationship than to understand how it works, particularly the factors that may exacerbate or attenuate it. Some researchers even ignore population altogether and attribute deforestation to the uneven distribution of income, land, and access to credit (Stonich, 1989), to rural poverty (Ellen, 1982), to the demand structure of the international markets (Nations & Komer, 1982), market failures due to dysfunctional property rights, or unsuitable technologies (Hecht, 1985).

Others, while recognising the importance of other determinants, nevertheless reserve a role for population-related factors and processes. In particular, it has been pointed out that aggregate population growth is not the only relevant growth quantity when effects on the

[3] There is also a fairly sizeable literature based on the idea that the abundance of land resources in frontier areas stimulates high fertility. This is known as the 'land-labour demand' hypothesis, which holds that greater land access provides a peasant household with higher income to support a larger family and larger holdings will require more in-house labour to work the land (for a systematic treatment of this view, see Clay & Johnson, 1992). Since the explanation of fertility is not the objective of this document, this literature is not discussed here. The opposite viewpoint, that family size drives the size of farms, and hence their environmental impact, has been defended by Cain (1985).

environment are concerned. Pfaff (1999), in a county level analysis of the Brazilian Amazon region for the 1978-1988 period, found that population density was not a significant factor in the explanation of deforestation for the region as a whole, but that factors such as space and timing of population settlement did have a significant impact. Moran (1993), finally, suggests that the impact of human settlement in frontier areas is not uniform, but that it is connected to the structure and life cycle stage of households and that changes in these factors may turn the settlement pattern from detrimental into environmentally neutral.

Particularly the idea that the environmental impact of human settlements depends strongly on the life cycle and other factors pertaining to the micro-demography of the settler's households counts with considerable empirical evidence (Pichón, 1997; Marquette, 1998; Perz, 2001, 2002). MacKellar et al. (1995) have shown, for instance, that since there are substantial fixed energy, waste disposal, and other costs to running a household, some environmental degradation processes, such as the growth in greenhouse gas production, are more closely linked to growth in the number of households than to population growth per se. The same idea has been stated in the context of urban energy demand, where household size appears to have an important effect on per capita consumption, probably because of economies of scale in energy use at the household level (Ironmonger et al., 1995; Vringer & Blok, 1995; Schipper, 1996; O'Neill & Chen, 2002). Smaller households often imply the scattering of population over a larger *number* of households, and there is evidence that the number of households, rather than population size per se, drives consumption (Cramer, 1997, 1998). Research on ecological impacts of changes in household sizes and numbers is more recent but suggests a positive relationship between decreasing sizes, increasing numbers, and ecological impact (Keilman, 2003; Liu, 2003). Local context also seems to be important in determining population and land-use interactions (National Academy of Sciences 2001).

Pebley (1998) also calls attention to the unequal environmental impact of households in different stages of their life cycle. The strongest impacts tend to occur in the 45-54 year age bracket which has the highest expenditures on housing, utilities, and transportation, at least in the US. Both of these findings are bad news for those who expected a direct impact of declining fertility on environmental degradation because the growth of households declines more slowly than population growth, and in the long run concentrates more household heads in the higher age brackets. Considering changes in marriage patterns, the growth of households may become dissociated from population growth, increasing even in the face of fertility decline.

The importance of cohort, age, and gender effects on environmental change is also emphasized by McCracken et al. (1999), who developed a life-cycle model for households in frontier areas. As households aged, moving from a nuclear family with small children to older households with young adult siblings or extended multi-generational households, land use tends to change too. Conversion of forest gives way to pasture or annual/perennial crops as a result of the availability of labour force. Using cross-sectional data, McCracken et al. (2002) confirmed this pattern and also noted the importance of the household labour

force compared to hired labour. Brondízio et al. (2002), using the same data and focusing on deforestation trajectories over time, demonstrated that deforestation rates peak during the first five years, followed by a decrease and another peak four or five years later. This trajectory created a wave pattern or "colonist footprint", which was very similar among cohorts with different dates of arrival during a period of approximately 15 years.

The discussion above illustrates the basic reality of population-environment linkages: while population is undoubtedly one of the driving forces behind environmental change, the specific impacts depend on many other factors; consequently, policy responses require a relatively high level of analytical complexity to design interventions at the appropriate levels and in the appropriate ways. Despite the many caveats that need to be stated in this regard, most researchers and policy makers would nevertheless agree with Vaclav Smil, one of the major experts on the issue, who several years ago observed that "I find it impossible to believe that greater crowding will make for a higher quality of life." (Smil, 1993: 207).

7.2. Population and the sustainable use of space

While much of the literature on population and environment has emphasized the idea of a *race* between population and natural resources, where the former is continually at risk of out-running the second, there is also another, complementary perspective which is more concerned with the spatial dimension of population and environmental dynamics. An important variant of this perspective has its roots in the debate on the Earth's *carrying capacity* (how many people the planet can sustain) (Marquette & Bilsborrow, 1994; Cohen, 2005), and its more recent version, the *ecological footprint* (what per capita land area is needed to sustain a population with a given living standard in the long run) (Wackernagel & Rees, 1996).

This debate is intimately linked to the issue of population trends and policies designed to influence them. According to some, these concepts reflect a strong bias towards population control. Others have questioned the per person nature of footprinting, arguing that the model favours households with more children: a large house with ten children has a smaller *per-person* footprint than a house half its size with only one person. This is considered a perverse result, since having more children adds to global overpopulation, with high ecological costs in the future (Van den Bergh & Verbruggen, 1999).

One of the conclusions that have arisen from some studies based on the ecological footprint concept is that, given present consumption levels, the world has already exceeded its maximum level of sustainable use of space by about 20%, meaning that it is using resources in ways that are not sustainable in the long run. Europe, in particular, is said to have an ecological footprint that is twice as large as the land resources the continent has available (European Environment Agency, 2005). In the LAC region, the situation is more varied, as shown in Table 7.1. While much of the region (Argentina, Bolivia, Brazil, Colombia, Peru, and others) still has ratios between its ecological footprint and its biocapacity that are well below 1, several countries have already exceeded this limit: Costa

Rica, Cuba, Dominican Republic, El Salvador, Haiti, Jamaica, Trinidad and Tobago, and – most significantly because of the country's size – Mexico. These conclusions are more pessimistic than earlier carrying capacity estimates based on potential food production. Higgins et al. (1982), for instance, estimated the potential population of Mexico in 2000 at 183.3 - 696.2 million, depending on the level of technological inputs used, whereas Haiti and Jamaica could support populations of 4.0 - 11.4 and 2.2 - 9.2 million, respectively. Their estimates for Central America as a whole (including Mexico and the Caribbean) were 292.3 - 1,293.4 million and for South America 1,417.6 - 12,375.3 million.

Table 7.1: Ecological footprint versus biocapacity per capita for countries of the LAC region (2002)

Country	Ecological footprint /capita *	Biocapacity/ capita *	Ratio
Argentina	2.2	6.7	0.33
Bolivia	2.0	15.4	0.13
Brazil	2.1	10.1	0.21
Chile	2.2	5.4	0.41
Colombia	1.2	3.6	0.33
Costa Rica	2.0	1.5	1.33
Cuba	1.7	0.8	2.13
Dominican Republic	1.6	0.8	2.00
Ecuador	1.4	2.3	0.61
El Salvador	1.2	0.6	2.00
Guatemala	1.2	1.3	0.92
Haiti	0.6	0.3	2.00
Honduras	1.3	1.8	0.72
Jamaica	1.7	0.5	3.40
Mexico	2.4	1.7	1.41
Nicaragua	1.2	3.6	0.33
Panama	1.7	2.6	0.65
Paraguay	1.9	5.4	0.35
Peru	0.9	4.2	0.21
Trinidad and Tobago	4.3	0.4	10.75
Uruguay	2.1	7.5	0.28
Venezuela	2.3	2.4	0.96

*Both are measured in global hectares, i.e. hectares with productivity equal to the world average.
Source: European Environment Agency, 2005

Advocating a different, less aggregated perspective on the sustainable use of space, Martine (2000) suggests that the discussion on the relationship between population and environment needs refocusing. While he concurs with the idea that any given population growth tends to make matters worse when an environmental challenge arises, he dismisses the linearity and uniformity between the two processes, and highlights that beyond population growth, the spatial patterns of production and consumption in the developing world play a crucial role in defining the use of natural resources.

Since changing population growth is a long-term process with a large amount of *embedded inertia*, the idea is that focusing on these spatial processes, which are more amenable to change in the short run, may be a more viable policy option:

> *"Halting population growth will not be easy or quick (…). Sustainability would still be problematic, even if population growth could somehow be halted abruptly today." (Martine, 2000: 5)*

In few words, the idea here is that since *demographic inertia* and *population momentum* would likely thwart the efficiency of interventions in demographic growth for the next half century or so, policy-makers would enjoy more success in acting on *how* a territory is used than attempting to determine merely *how many* use it. At the local level, the overwhelming majority of policy decisions involve the spatial dimension. Rationality of occupation is the key to sustainable use of space, and the potential of city planning for changing urban environments is fundamental.

Table 7.2: Urban and rural population densities for the world and the LAC region by major ecological zones

Ecological zone	World			LAC region		
	Urban land share	Urban population density/km2	Rural population density/km2	Urban land share	Urban population density/km2	Rural population density/km2
Coastal	10.2%	1119	69	8.8%	789	15
Cultivated	6.8%	793	70	4.6%	548	11
Dryland	2.1%	749	20	2.7%	541	7
Forest	2.0%	478	18	1.2%	685	6
Inland water	3.2%	826	25	2.8%	655	7
Mountain	1.7%	636	26	2.7%	746	14
Overall	2.8%	770	25	2.6%	656	9

Sources: CIESIN et al., 2004 a b

It is often stated that the goal of rational demographic planning should be a "balanced distribution" of population, a term which is rarely clarified. However, if a "balanced distribution" is to imply a homogeneous demographic density, this is probably one of the worst scenarios conceivable. Rather than a threat to environmental stability, as implied by common sense and alarmists, urban population concentration may actually be a solution to accommodate people in ways that are cost-efficient. When it comes to deforestation, for example, the relationship is inverse:

> *"A major additional unanswered question is how urbanization (the increasing proportion of the population living in urban areas) forecasts for developing countries (…) 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 (…). While existing land use land cover change research discusses the importance of the local context on deforestation (Geist & Lambin, 2002), it provides little guidance for gauging the effects of future urbanization on forest cover in the developing world." (Bremner & Bilsborrow, 2005: 6)*

Other resources are used more intensively in urban areas. The emission of greenhouse gases, for instance, tends to increase with urbanisation (Bremner & Bilsborrow, 2005). For the most part, however, urbanisation is not a problem per se, even though urban development

that ignores its ecological implications can create many problems. One should distinguish between the often negative impacts of urban development on ecosystems services and the often positive comparisons that can be made between well-managed urban development and alternative, less urban, development options. The optimisation of rational use of resources requires the concentration of most of the population in high density agglomerations, where environmental services can be provided cost-efficiently, whereas a relatively small proportion of the population should be settled in small and scattered communities, taking advantage of a highly capitalised and efficient agricultural technology. Dispersed rural settlements can bring about more vegetation fragmentation than urban population concentration, with a strong negative impact on inland water systems. The concentration of population in urban areas makes it easier to treat waste water and avoid pollution, as localised pollution sources are more likely to be controlled or eliminated. There are also many ways to reuse urban wastewater and practice demand-side management for conservation. With respect to drylands, it has been suggested that urban development implies a lower risk of desertification than agricultural development (Portnov & Safriel, 2004). The keyword is urban planning, i.e. taking into account population needs and the environmental conditions of a particular setting, what Hogan (2002 b) has called "socially determined economic-environmental vocations".

The recent Millennium Ecosystem Assessment places the positive and negative aspects side by side:

> *"Partly because of the demands that urban systems place on ecosystems in the surrounding region, cities and towns are often presented as environmentally damaging. This is misleading, particularly if human well-being is a central concern. If urban activities and residents moved to rural areas, the demands placed on ecosystems would be more dispersed, but not reduced. Yet even if, from an ecosystems perspective, urbanization is preferable to most rural alternatives involving similar economic production levels, urban pressures are increasing rapidly as the result of population growth, economic growth, and urbanization. Moreover, for adjoining ecosystems, the concentration of people and activities in urban areas can be a particular burden. Urban centers in the vicinity of fragile ecosystems are especially problematic. Cities associated with highly polluting industries typically have a greater impact on nearby ecosystems than those dominated by service industries. Poorly managed urban development can be especially destructive to nearby ecosystems." (Millennium Ecosystem Assessment, 2005 a: 814)*

In its treatment of urbanisation and migration, in *Population, environment and poverty linkages*, UNFPA (2001 a) calls attention to recent tendencies in policy orientations, expressing a similar concern: the policy approach taken by a majority of countries favours integrated urban and rural development programmes that adapt to, rather than attempt to modify, population dynamics. Land-management policies and human-settlement programmes typically include measures to upgrade infrastructure and services, control the location of new housing and, in general, ensure sound land use. Unlike policies adopted in the 1970s and 1980s, there are very few attempts being made to contain the growth of the largest cities. Redirecting population growth to new, secondary cities may be part of such

a strategy, although, as it is, these urban areas are already growing faster than the largest metropoli. The 2007 *State of the World Population* report (UNFPA, 2007) points out that past policies to stop rural-to-urban migration across the board have been largely ineffectual and that acting on the natural growth generated internally by large urban areas may be a more effective approach than trying to stop migration. Acting on rural population growth may also be part of the answer, as expressed by Singh et al. (2003: 6) when they state that "providing SRH services may help stabilise rural areas and slow urban migration".

There is much confusion and undue generalisation with respect to the maximum limits of population density that can be realised without compromising the quality of life of a population. On the other hand, there is much undue romanticism with respect to the merits of low population densities, even when they make the provision of basic social and environmental services extremely costly. And finally, the relationship that particular populations, with their specific modes of production, maintain with their environments has not always been correctly appreciated. In particular, the idea that indigenous populations provide a model of a non-destructive relationship with the environment has to be qualified, as this only applies in the context of simple technologies and extremely low demographic densities.

There are significant disadvantages attached to a uniformly distributed low density population, even in rural areas. In the case of wilderness areas and species diversity, population concentration is clearly preferable to dispersion. Forest ecology theory suggests that dispersed settlements can be quite harmful. For example, scattered settlements strung along roads can create islands of forest land or jagged borders between forest and cleared land, which can be far more destructive to wilderness than a small number of concentrated settlements that leave large, contiguous tracts of land untouched (National Research Council, 1986; Wilcove, McLellan & Dobson, 1986).

Areas of above average rural population density often stand a better chance to develop and reduce poverty than comparable areas with low population densities, as Sachs points out with respect to Asia and Africa:

> *"The Asian countryside is densely populated, with a relatively extensive road network that can carry fertilizer to the farms and farm output to the markets. Farmers use fertilizers and irrigation, and food yields are high. Donor agencies gave ample support to the development of new high-yield varieties in Asia. Under these conditions Asian farmers were able to adopt high-yield crop varieties that produced the famous Green Revolution of rising food production per farmer. The African countryside is much less densely populated, with an absence of roads to transport fertilizers and crops. Farmers do not use fertilizer on food crops, and depend on rainfall rather than irrigation." (Sachs, 2005:70)*

Arguments of this kind have been advanced most famously by Esther Boserup (1965) and although they do apply under certain circumstances, they are subject to a delicate balance. There are plenty of historical examples of societies that overshot their optimum path of population density and technical development and, as a consequence, collapsed (e.g. Taylor & Brander, 1998, on the case of Easter Island).

> *"(…) cross-country comparisons indicate two trends. First, the 'Boserup response', that the poor and hungry will take action to intensify their farming methods, no longer takes place once countries reach a condition of high rural population densities (relative to land production capacity), landlessness and poverty. Second, in the absence of major opportunities for urban migration or non-agricultural income, high human fertility and hence population growth increases poverty and, since money buys food, hunger." (Young, 2005: 87)*

Pender (2001), writing on the case of Honduras, recognises that, while population growth can sometimes lead to innovation, sustainability generally requires other interventions such as improved roads, off-farm income opportunities, and new technology. Cuffaro (2001) analysed the responses of agriculture to population growth for 60 developing countries from 1962 to 1992, in order to verify Boserup's hypothesis that farmers will intensify their cultivation methods when obligated to do so by population pressure. Her results show a rise in the labour/land ratio for 43 countries and a productivity increase in almost all. This suggests that thus far population increase has led to intensification of production methods, although in 12 countries land productivity rose less than population. The rise in labour productivity, on the other hand, has been much smaller, remaining nearly stationary in 12 countries and declining in 5. As population growth is frequently associated with landlessness, the landless do not benefit from any rise in the productivity of land and consequently the process may exacerbate income inequality. Other undesirable side effects include the degradation of common land, constraints on the use of inputs, and ineffective application of agricultural research. The author concludes that in some very poor, densely populated, and intensive agricultural areas, further intensification may be very costly and the growth of effective demand too slow to provide incentives for Boserupian technological shifts.

In the LAC region, considering its high levels of urbanisation, agricultural intensification is an issue of lesser importance. Accomodating urban growth in environmentally appropriate areas, as Martine (2000) and Hogan (2002 b) have suggested, is a more central concern. The Habitat programme, for example, is the Mexican public policy instrument designed to organise urban growth, build and manage urban spaces, provide them with social value, and improve the living standards of the population of poor urban areas. Habitat gives much attention to the status of women in such homes, especially if they are heads of households, thus acknowledging the interrelationship between urban planning and gender roles.

A systematic application of the perspective of sustainable use of space requires population to be an integrating element in any territorial planning policy at the national or the local level. Economic-Ecological Zoning programmes, encouraged and financed by the World Bank in countries of the region, are based on this assumption. UNFPA has made some initial steps in this direction as well, with projects and activities in Colombia, Ecuador, Mexico, and Nicaragua. The project in Colombia, in particular, has produced a number of documents (Colombia, 2004 a b) to help guide the municipal planning process in this regard. What these projects and activities have made clear is that meaningful territorial planning cannot be carried out strictly in physical or legal terms, without reference to a population context.

7.2.1. The role of migration

The ICPD PoA recognised population distribution as part of the larger demographic dynamic and touched on these issues in both the sustainability (III) and migration (IX) chapters, although relatively little attention was paid to the development of the relevant interrelations. This contrasts with the literature on population and environment, which generally considers migration factors quite important, particularly at the local level:

> *"For the use and preservation of natural resources, then, population mobility is the most significant demographic factor. Where the population lives, works and plays will always have an impact on nature – and vice-versa." (Hogan, 2002 a: 5)*

> *"Migration, in its widest sense, includes processes such as urbanization, tourism and commuting, all of which can radically change the relationship between native or resident population and its environment." (Zaba & Clarke, 1994: 13)*

One of the most notable demographic shifts of the last two decades is the decline in migration rates in Latin America, especially rural-urban migration (Busso, 2006). Consequences for urban growth and potential for improving quality of life will be important to consider in the short-term future. On the other hand, the predominant focus on rural-urban migration often hampers the correct appreciation of rural-rural migration, which in many countries is the predominant form of spatial mobility (Bilsborrow, 2002). Due to its high level of urbanisation, this is less true in the LAC region than elsewhere, but the fact remains that in some Latin American countries, such as Guatemala (IARNA/URL/IIA, 2006), rural-rural migration continues to be important or even predominant.

In theory, migration affects both the areas of origin and destination, but research on its effects in the areas of origin, where it might, for instance, alleviate population pressure or, to the contrary, disrupt the existing social structure, are extremely scarce. Preston (1998) suggests, for instance, that in the Camacho Valley of Bolivia out-migration led to less intensive grazing and improvement of the environment. But in the Peruvian Andes, Collins (1986) found that out-migration led to a depletion of the labour force which made it difficult to maintain mountain terraces and thereby aggravated soil erosion. In practice, the research focus has been on the effects of migration in the receiving areas and particularly on the deforestation resulting from migrant settlement in forested areas.

Agricultural expansion is the leading proximate cause for deforestation in all parts of the world; in the LAC region, permanent agriculture is responsible for about half of the problem (Geist & Lambin, 2002). The connection of roads and agricultural expansion (and especially cattle raising) is particularly important in the LAC region (e.g. Wahl, Limachi & Barletti, 2003). Some (Allen & Barnes, 1985) have gone so far as to qualify local population growth as the primary cause of deforestation, but this probably understates the role of other determinants. Demographic factors, according to the meta-analysis by Geist and Lambin, derive their importance from their combination with economic, institutional, technological, and cultural factors: 61% of the 152 deforestation cases they

evaluated worldwide (53% of the cases, among those of the LAC region) could be related to human population dynamics. In 47% of the cases, demographic factors – especially in-migration of farmers into forested frontier zones – directly underlie the expansion of cropped land and pasture. By and large, this confirms the idea that approximately half of the variation in extent of deforestation is explained by variation in population (Mather, Needle & Fairbairn, 1998, 2000), but not in isolation.

Kaimowitz and Angelsen (1998), among others, have pointed out that population can also have considerable indirect impacts through its effects on labour markets, demand for agricultural and forest products, and induced technological or policy/institutional change. Aide and Grau (2004), for example, point out that lowland deforestation for cattle grazing and slash-and-burn agriculture in Latin America has called most the attention of the conservationist efforts, but the relative importance of these drivers of deforestation is giving way to much more indirect effects:

> *"Today, soybean production--the majority of which is shipped to China for animal consumption--is the major cause of deforestation of millions of hectares of seasonally dry forests in Brazil, Bolivia, Paraguay, and Argentina. … In fertile lowlands and valleys, small farms have been converted to large-scale modern agriculture, which frequently results in a decrease in the labour demand and rural-urban migration."*

Geist and Lambin (2002) estimated these effects based on their case studies and concluded that they accounted for 12%, 41%, and 13% of their cases, respectively, with demand for wood products constituting the most important single factor. Excluding those cases in which factors overlap, they concluded that indirect population impacts accounted for 54% of the cases. Joining these cases with the direct population impacts of the previous paragraph, they found that population was directly or indirectly involved as a causal factor in 76% of the deforestation cases they evaluated.[4]

In the LAC region, more than elsewhere, the combination of land availability and migration is an important explanatory factor in deforestation. Economic factors are reported to drive demographic factors, e.g. in the frontier areas of Bolivia, Brazil, Colombia, Costa Rica, the Dominican Republic, Ecuador, Honduras, and Peru, where in-migration of colonising settlers into forested areas – and, to a much lesser degree, local growth and rising population density – contribute to deforestation. In particular, the growth of modern, mechanised cash crop agriculture for export may push migration to the frontier. Only in the foothill and lowland zones of Bolivia and in the Napo region of Peru, Colombia and Ecuador, international demand for cocaine attracts migrants and causes deforestation, although less so than pasture creation for ranching and other cropped land expansion. In a few cases, local industrial growth, such as oil exploration or commercial logging, and low land prices may induce in-migration (Geist & Lambin, 2002).

[4] In an interesting sideline, Geist and Lambin analyse how the identification of demographic, economic, technological, policy or institutional, and cultural or socio-political factors as determinants of deforestation varies with the disciplinary background of the authors carrying out the respective studies. Ecologists and geographers, in particular, are unlikely to pay much attention to any of these factors, whereas demographic factors are most likely to be acknowledged by economists, sociologists, and historians.

Natural population growth, as opposed to migratory growth, has a much smaller impact as a driver of deforestation. Studies of ecologically fragile areas show that "there is immense geographical variation in population pressure, which may bear little relation to population density" (Zaba & Clarke, 1994: 20). However, in-migration of colonising settlers into sparsely populated forest areas shows a distinctly negative influence on deforestation through increasing population density:

> *"In-migration and, to a much lesser degree, natural population growth drive the expansion of cropped land and pasture in 47% of the cases in Africa and Latin America (22% in Asia), concomitantly with other underlying drivers (…). Expansion of pastures emerges exclusively from mainland South American cases, in association with processes of both planned colonization and spontaneous settlement by colonist agriculturalists." (Geist & Lambin, 2002: 149)*

The effect may be particularly harmful in the case of frontier areas. Pfaff (1999), in his county level study of the Brazilian Amazon region between 1978 and 1988, concluded that migration into "empty counties" had significantly more impact on the environment than the same absolute population increase in previously occupied areas. Similarly, Cruz (1999), in her study of Costa Rica, attributed a major negative influence to the migration of landless peasants to agricultural frontier areas.

Even in a context of low rural growth rates, the internal movement brought about by rural-rural migration can stimulate deforestation. In addition, as Bilsborrow (2002: 82) points out, it is through migration that natural increase propagates from one ecosystem to the next:

> *"While increasing rural population pressures cannot be considered a major proximate cause of recent deforestation in the Brazilian Amazon (since the rural population of the Amazon, as well as in Brazil as a whole, has been declining), this agnostic view disregards the effects of high fertility and population growth in areas of origin of many of the migrants settlers to the Amazon."*

Migration: beneficial or harmful to the environment?

In general, it is difficult to generalise on whether migration is beneficial or harmful to the environment, because this depends on many other factors. According to Cassels et al. (2005), one important mediating factor is the degree of migrant incorporation into the local community: a greater degree of migrant incorporation mediates the impact of a migrant's detrimental effects on the environment. Modes of incorporation describe the reception of migrants in places of destination. They include government policy towards migrants, public perceptions of migrants, the size and coherence of migrant ethnic enclaves already present in a destination, and other factors. In this context, Cassels lists the following typical environmental problems associated with migration:

1. Short-term outlook. Migrants often have expansionist attitudes that fail to consider long-term effects of resource extraction and land-use (e.g. Pichón, 1997).
2. Poverty. Migrants are more likely to be poor than non-migrants. The poor and hungry often over-harvest and degrade their surrounding environment in order to survive. An impoverished migrant may not be able to practice sustainable resource extraction in order to ensure future environmental productivity when immediate consumption needs are so strong (Broad, 1994).
3. Misapplication of technology. Migrants may use inappropriate technology to extract natural resources, which may be unsustainable. Technological changes imposed by migrants without knowledge of social and ecological context are more likely to fail and decrease ecological resilience. In the Calakmul Biosphere Reserve of Mexico, for instance, environmental degradation has resulted from the use of crops and technologies by newly arrived colonists that are inappropriate for the area (Ericson, Freudenberger & Boege, 1999; for other examples, see Begossi, 1998; Perz 2003).
4. Social norms and common property regimes. Migrants are often out of touch with social norms and expectations. For example, migrant may feel freed from familial norms and social pressures, and may feel anonymous when they are in a new community. This may lead the migrant to make poor, risky decisions regarding sexual behaviour. The same theory can be used for migrants' decisions regarding sustainable resource extraction and land use.

Incorporation into the destination community plays a role in each of these. If a migrant is incorporated into the community, he/she can rely on community members to satisfy the immediate, short-term needs of survival, so that his/her actions may not be as detrimental on the environment if they have support to invest in longer-term outcomes. Poor migrants may be able to rely more on the community for short-term help instead of making unsustainable decisions that endanger the natural environment. More integrated migrants also have more access to appropriate technology and local knowledge of the community's resources. Finally, migrants that are integrated into a community (for example, through marriage) may be under social pressure to comply with local rules and regulations such as common property regimes and make fewer risky decisions. For example, dynamite fishing may satisfy immediate needs and supply many fish, but the individual may risk being scorned by the community for the lack of regard for long-term sustainability of the reef and thus avoid such actions. But the fact that the "social connectedness" of small farmers may be related to their migratory status is not universally acknowledged. Pretty and Ward (2001), for instance, in their extensive literature review on social capital and environmental management institutions, do not mention it as a factor that may interfere in the ease with which such institutions can be formed.

Model of interrelations among population, development and environment: an application to Mexico's Yucatan peninsula

In Mauritius, Lutz (1994) developed a model of the interrelations among population, development and environment, with the objective of producing planning instruments. This was followed by a series of other country studies at the International Institute for Applied Systems Analysis (IIASA), all of which followed a similar methodology. In the Yucatan Peninsula, in Mexico, and in several African countries (Cape Verde, Mozambique, Botswana, Namibia and Egypt), Lutz and his collaborators sought to develop holistic models which could contribute to regional and national planning. The population component, at the core, was standardised and permitted a degree of comparability to the studies, in spite of important local differences. Indeed, the most significant result of these studies was to reinforce the complexity of population-environment relationships, with emphasis on local context. In each country, the history of human occupation of the territory and the natural resource endowments were determining factors in the population-development-environment equation. In Cape Verde, for example, emigrants and their remittances were fundamental features of an economy whose major driving forces are outside the country (Wils, 1996), while in Egypt the water issue is central (POPNET, 2004). In Botswana, Namibia and Mozambique, population-environment relationships cannot today be considered outside the context of the AIDS epidemic (IIASA, 2001). For the LAC region, IIASA's most pertinent study was carried out in the Yucatan Peninsula. This study underlines the importance of historical and ecological contexts:

> *"Whether a given ecosystem can support a certain human population is not simply a question of the size of the population – as is the case for the carrying capacity of animal populations. It also depends on the behavior, the state of economic development, the technology, and even the culture and social institutions of the specific population under consideration (…) Similarly, the impact of the human population on the environment (…) depends not only on the sheer number of people, but on the production and consumption patterns of these people and, of course, on the frailty of the specific ecosystem as well." (Lutz, 2000: iv)*

Among the contextual features considered in the Yucatan study were the Mayan history of the area, its water resources, tourist potential, and commercial fishing activities (Lutz, Prieto & Sanderson, 2000). Carr (2003), who interviewed community leaders in 28 communities of origin of migrants to the Sierra Lacandón National Park throughout rural Guatemala, found that migration was often driven by large household sizes. The fact that rural-to-rural migration in Latin America is mostly male, whereas women tend to migrate to urban areas also means that deforestation is primarily associated with male migration (Barbieri & Carr, 2005).

7.2.2. The role of gender factors

The role of gender factors in environmental problems is a much discussed issue, but its precise connotations depend on the way the relationship is framed. In this context, one should distinguish between at least three different issues:

1. Differences in the *consequences* of environmental problems for men and women, due to both innate biological factors and to differential exposure resulting from gender specific behaviours and activities.
2. Gender factors affect the way in which human populations interact with their *local* environments, particularly in rural areas, which may imply greater pressure on resources or, to the contrary, more protective ways of dealing with nature. This involves problems such as acid rain, air and water pollution, desertification and other forms of land degradation, floods, and localised environmental accidents.
3. Gender factors which might be relevant at the *global* scale, with respect to major environmental problems such as depletion of the ozone layer, global climate changes, accumulation of toxic chemical or radioactive wastes coupled with the exhaustion of sinks, human over-appropriation of biomass, and loss of biodiversity.

With respect to the first point, most specialists agree that the negative impacts of many environmental problems are stronger for women than for men. These impacts can be of two types: an increased amount of time to be allocated to carry out traditional tasks, or health consequences for the woman and her children. Regarding the first, it has been observed that fuelwood, animal fodder, and water are becoming increasingly scarce in certain parts of the world, and that women are most affected by such shortages (Braidiotti et al., 1994; Rodda, 1991). Given that women are usually in charge of the sick, the family health consequences also tax women's time. An overview of differential health consequences of environmental impacts on women, compared to men, can be found in Sims and Butter (2000), who suggest that women bear the brunt of negative environmental health consequences, even with respect to problems in which conventional wisdom attributes a disadvantage to men, such as exposure to pesticides. It is estimated, for example, that flower workers in Colombia are exposed to 127 different types of chemicals, many of which have been banned in the US and the UK (WEDO, 1999). Note, however, that according to a recent assessment by WHO (2006: Chapter 5), 33% of the male disease burden of lung cancer and 18% of other kinds of cancer in developing countries can be attributed to environmental factors (in the broad sense), compared to 25% and 16%, respectively, in the case of women. In the case of musculoskeletal diseases due to heavy work or poor ergonomics, the percentages are 41% versus 32%, as men were found to engage more often in occupations that exposed them to risk. Women in developing countries, on the other hand, were found to be at a distinctly higher risk of respiratory diseases due to indoor exposure to smoke and other airborne contaminants.

Whatever the case may be, the issue of differential vulnerabilities is of limited consequence in the present context, which deals primarily with population and gender as causes or conditioning factors of environmental change. In this respect, Martine and

Villarreal (1996) point out that the relevance of gender factors depends very much on the exact type of interactions being looked at. Gender issues that affect the way populations impact on the environment are mostly relevant at the local level, particularly in rural areas, but the authors doubt that they have much relevance for the major environmental issues at the global scale. They even point out that "those countries which have achieved the greatest reduction in their gender gaps (the industrialised or developed countries) are currently responsible for the major forms of resource depletion and environmental degradation." They admit that some studies have shown that women tend to express higher levels of concern toward the environment than do men (e.g. Davidson & Freudenburg, 1996), but they consider that most of this discussion deals with secondary or local environmental issues, and does not apply to critical or global environmental problems. There is no evidence, for example, that women in the developed countries use resources more sustainably than men in connection to critical environmental problems. Nor are there women's movements or women in decision-making roles in the economic or political domain that effectively promote the drastic change in the consumption patterns of the rich throughout the world which would be needed to address the problems that compromise the future of the planet, or other attitudes which are more coherent with global sustainability.

The role of gender factors, therefore, is mostly circumscribed to the issues mentioned under point 2 above. In this context, it has been stated that women's full participation as resource managers is essential for the attainment of sustainable development (World Resources Institute/UNEP/UNDP, 1994). Women may well have a predisposition to practice sustainable agriculture and maintain overall land quality – precisely because of their strong reliance on natural resources. Examples of this are easier to find in Africa and Asia than in the LAC region, which is more urbanised and where the participation of women in subsistence agriculture is more limited. A World Bank study in Ghana, for example, found that women's plots had a lower rate of decline in soil fertility than men's – even in the same household (Khandker & Udry, 1997). One must realise, however, that the gender structures that maintain women in dependent positions in which they rely more on natural resources may be the same structures that, on the positive end, predispose women to more sustainable modes of agriculture. This situation is not unlike the behaviour of the traditional peasant who, precisely because of his lack of capital and technology, may possess more intimate knowledge of such practices than the modern mechanised farmer. Gender dynamics, rather than innate biological behaviour patterns, are the key to understanding such relationships. Thus, while men have generally engaged in cash crop cultivation (usually mono crops), women tend to be in charge of subsistence crops cultivated in home gardens, with a high degree of biodiversity. In the Andean region, women plant diverse potato seeds according to their traditional knowledge, in order to combine the desirable attributes of frost resistance, nutritional value, taste, quick cooking time, and resistance to blight, while men follow the extensionist's advice to plant only one species (Bunning & Hill, 1996).[5]

[5] The attribution of certain innate characteristics to women that are actually determined by existing gender relation patterns is not limited to the area of gender and the environment. Although this line of argument is not generally viewed in a positive light by the gender literature, it is often used in popular discourse to argue that women are more risk averse and more mindful of collective family interests than men, supposedly because of their innate characteristics.

In this context, Martine and Villarreal are particularly critical of the notion that women are inherently better resource managers than men and that they have a privileged relation with nature stemming from the caring, nurturing, sustaining and non-violent attributes, said to be innate in women, which would predispose them to conserve the environment. Ecofeminists,[6] for example, explain men's and women's relationships with nature using a scheme reminiscent of Lévi-Strauss' notion that women are related to nature and men to culture. The obvious danger in this position is that it contradicts the very concept of gender, for if biology determines the relation of men and women to nature, it also determines universal gender roles. Just as gender roles change over time and in response to changing circumstances, no particular kind of knowledge can be associated with men or women as such, but with their culturally constructed and sanctioned behaviour and attributes. As stated by Rocheleau (1995) and cited by Martine and Villarreal: "Boundaries of gendered knowledge are neither fixed nor independent."

None of this denies, of course, that the decision power about the use of natural resources in traditional agricultural may be distributed not only unjustly, but also irrationally from the viewpoint of sustainable resource management. No matter whether the contribution of women is based on innate female characteristics or on acquired gender roles associated to a particular division of labour, it has to be heard and taken into account in the implementation of agricultural policies and programmes:

> *"(…) women's use and management of local environmental resources is fundamental to household and community wellbeing. Agricultural extension services are heavily biased towards men. Education and outreach efforts in support of sustainable farming and land management methods often pass them by. National law or local customs often effectively deny women the right to secure title or inherit land, which means they have no collateral on which to raise credit. Given the opportunity, women may well have a predisposition to practice sustainable agriculture and maintain overall land quality – precisely because of their strong reliance on natural resources." (UNFPA, 2001 b: Chapter 4)*

7.2.3. Population distribution and environmental vulnerability

But how to promote the sustainable use of space from a population perspective? Martine (2000) lists three possible solutions: 1) to identify populations at risk of falling victims to natural disasters such as hurricanes, earthquakes, floods and landslides, which would at best require rapid reaccommodation; 2) to identify the fragile ecosystems that need to be preserved from human occupation; and 3) to offer viable social and economic alternatives in areas that could host the redistributed populations.

> *"If population distribution is consequent upon the spatial location of economic activity, the reduction of vulnerability and the protection of the environment requires an integrated approach to development and to the use of space." (Martine, 2000)*

[6] For a systematic discussion of the different theoretical perspectives on gender and the environment, plus a historical overview of their influence on international conferences, particularly in the LAC region, see Rico (1998).

A study that examined the ecological situations of neighbourhoods affected by flooding and the socio-demographic characteristics of residents has been carried out in Brazil by Torres (1999). As he notes, "the notion of risk changes from social group to social group, as well as over time." The task of the analyst is "to search for connections between risk and socioeconomic condition, in the sense of pointing to an understanding of a complex and multi-faceted socio-environmental dynamic." Combining geographical risk information with population distribution helps identify people at risk, taking into account road networks for evacuation and relief, hospitals and emergency facilities in planning response and property distribution in estimating damage.

In their review of the history of squatter settlements in Latin America, Hardoy and Satterthwaite (1989) show that governments in the region have always resisted rural-urban migration and urbanisation. As a result, migrants were forced to occupy marginal, ecologically fragile or dangerous lands such as riverbanks or steep slopes. This has contributed enormously to the squalor and misery of the new urban population. It is estimated, for instance, that in Caracas 67% of the land occupied by *barrios* is unsuitable for housing because of geological instability and frequent landslides (World Resources Institute, 1997). In the future, such problems are sure to become much worse if urban spread is left to market forces since many options previously available to low-income urban populations are disappearing. The failure to plan ahead for the accommodation of poor people has greatly contributed to the ecological degradation of the cities. When local governments finally decide to accept these marginal settlements as an established reality and try to provide them with minimal services or to reduce their negative ecological impacts, the economic costs of doing so become astronomical. The lack of planning, the inadequate location, the lack of access roads and the sheer accumulation of miserable conditions make it practically impossible to provide services or redress the accumulated ecological damage a posteriori (Martine, Hakkert & Guzmán, 2002).

The Mexican MDGR (2005) draws attention to the fact that the country's metropolitan areas are subject to serious risks of natural disasters in the face of, among other factors, disorganised urban growth. Human settlements proliferate on the outskirts of the main Mexican cities' planned areas, contributing to environmental degradation of unprotected ecosystems and biomes. The report states that there are 74 populated areas where 12 million people live exposed to tropical cyclones. As many as 22.2 million people live in areas susceptible to flooding, 20 million to volcano activities, and 4.8 million to land sliding – amounting to approximately 60 million Mexicans who face the prospect of being removed from their homes. Not surprisingly, poorer families are more prone to becoming victims of natural disasters, since they live in more precarious houses inadequately endowed with infrastructure and access to public services. By the same token, the Brazilian MDGR underscores that:

> *"The most affected social groups are the poor and the Afro-descendant population, who live in areas with higher levels of inadequate housing and do not have access to credit for housing purposes." (Brazil, 2004: 75)*

The same document highlights the country's efforts for preventing disasters and diminishing the extent of its damages – although remedial rather than structural actions prevail – by training of Civil Defence agents and implementation of the National Centre for Disaster Management.

Target 10: By 2015, reduce by half the proportion of people without access to safe drinking water

7.3. Population and access to safe drinking water and basic sanitation

Worldwide, the percentage of people without access to treated water and sanitation has been virtually constant at about 17%, despite the increase of infrastructure during the 1990s (UNFPA, 2003 a). Bremner and Bilsborrow (2005) point out that, given the population increase that will occur until 2015, the additional number of people to be served is in the order of 1.6 - 2.2 billion. What makes matters worse is that, if per capita consumption continues its current upward trend, about two thirds of the world population will face moderate or severe water scarcity. The LAC countries are undergoing an intensive process of expansion of coverage for drinking water, according to WHO/UNICEF (2005). In 1990 coverage was 83%, reaching 89% in 2002.

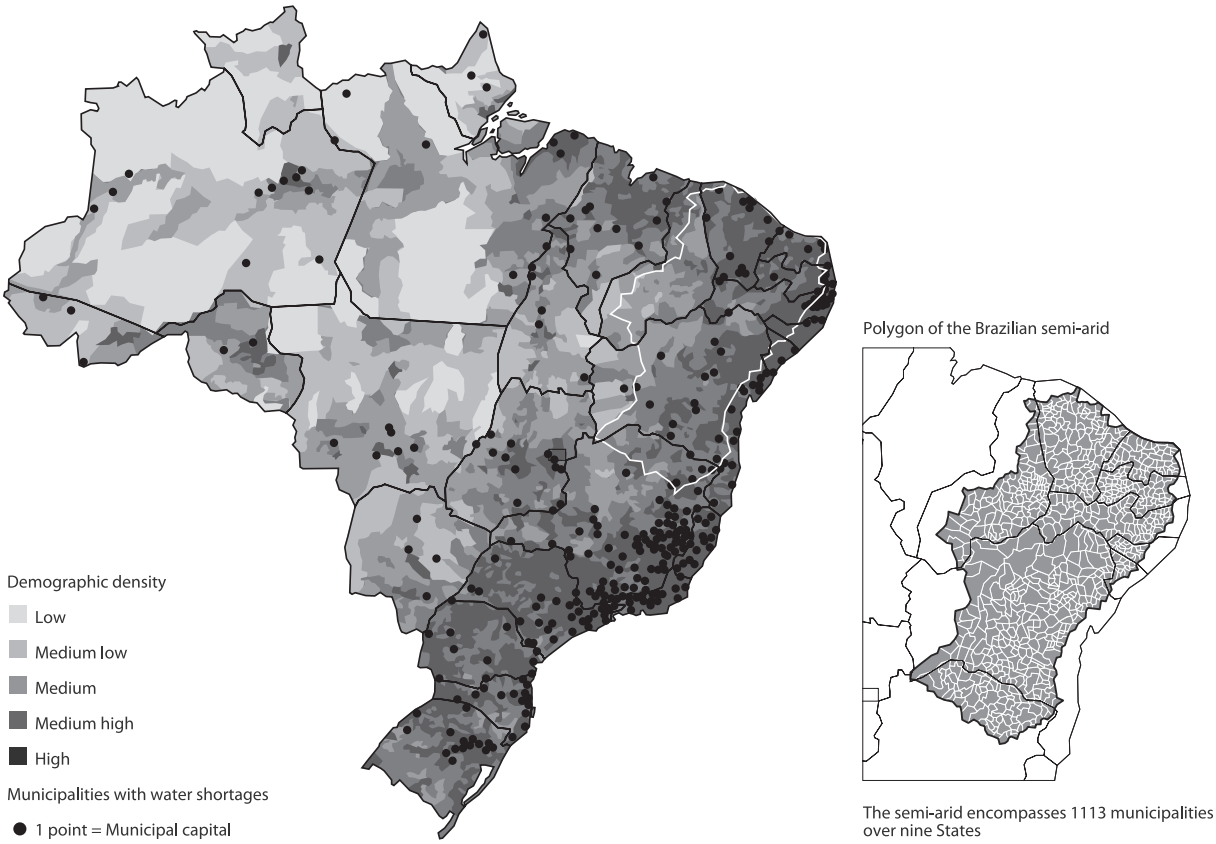
There is an important differential in terms of rural and urban distribution of access to water. According to Lenton (2003), in 2000 the urban population of the LAC region not served by improved water was only 6 million, compared to 34 million in rural areas. For sanitation, these numbers were 14 and 48 million, respectively. However, these numbers change dramatically once population change is taken into account. Due to the fact that all population growth in coming years will be urban, the need for providing water and basic sanitation in the cities actually exceeds that of rural areas. In urban areas, 121 million people will require improved water supply and 132 million improved sanitation, compared to 20 and 29 million, respectively, in the rural areas. These projections are based on aggregate trends that do not take into account that population growth in under-served urban areas may be higher than in areas that already have adequate infrastructure. If this difference is factored in, the urban requirements may even be higher, but to our knowledge no such scenarios have been carried out so far.

According to UN Habitat (2006), 22% of the 2.6 billion people without access to basic sanitation live in urban areas; in the case of the 1.0 billion people without access to treated water, the proportion is 15%. Considering that the LAC region has one of the highest degrees of urbanisation in the world, the achievement of Target 10 in this region will be greatly facilitated. Based on the analysis of service provision in 43 low and middle income countries, the report argues that water and sanitation provision is worse in small urban centres and especially those with fewer than 100,000 inhabitants. Apart from the greater difficulties faced by small towns and communities to obtain investment loans, the cost of water delivery to individual households in small towns may be prohibitive. According to UN Habitat (2006), the scale of water and sanitation needs in small urban centers is extremely large. Whereas a large proportion of the global population lacking adequate provision of

water live in these centres, most official statistics greatly overstate the quality and extent of provision. Hence, the means and strategies needed to improve the water and sanitation conditions of the poor in small urban areas are not so obvious. Large-scale management and provision of services through public/private partnerships and community participation can help reduce the cost of supply and increase the possibility of cost recovery.

The 2007 *State of the World Population Report* (UNFPA, 2007) comes out strongly in favour of proactive planning with respect to inevitable population growth. In the long run, it is much more cost-efficient to plan infrastructure (e.g. minimally serviced plots) in accordance with the growth – both natural and migratory – that should be expected than to try first to stop this growth, only to be faced with a much higher cost of providing infrastructure after the fact.

Figure 7.1: Demographic density and water shortages in Brazil, 2002



Source: Brazil, 2005

In terms of population and environment relationships, there are two aspects to consider: the sustainability of water supply and the spatial distribution of population. The Brazilian MDGR (2005) comes to the conclusion that:

> *"Access to basic sanitation is one of the main determining factors of the living standards of a given country, making its population less vulnerable to hydric diseases and contributing to the reduction of pollution and environmental degradation rates." (Brazil, 2005: 156)*

The same report (2005) relates demographic density to the lack of access to water and sanitation services. At the national level, 36 million of 180 million people do not have access to these services, while the deficit is relatively larger in the less populated and less urbanised areas of the North, Northeast and Centre-West regions (see Figure 7.1). That means that, in absolute terms, the number of people deprived of water and basic sanitation services is also significant in the country's main urban areas in the more developed and richer Southeast and South. The black points on the Figure 7.1 mark those urban areas with a water deficit.

A common problem is that *population* concentration almost never coincides with *water* concentration. The historical solution of inter-basin transfers is today placed in check by increasing demand. Regional competition for water is becoming more common, as in Mexico City (Izazola, 2001) and São Paulo (Carmo, 2005), for example. Urban sprawl in middle-sized and large cities of the LAC affects water services in several ways. Problems like the distances involved in expanding the pipe system and water loss in the system are directly impacted by the expansion of the urban network. It is important to note that concentration does not necessarily mean overcrowding, and that it may promote better distribution of water services. In most countries, there are legal instruments like zoning to organise urban growth, though these are not always effective.

However, whereas in the Southern region – Brazil's industrial and financial heartland, which concentrates the largest share of the country's population and GDP (but not territory) – 88% of the urban population enjoy access to water and sanitation services, only 37% have this access in the urban Northern region – home to the Amazon Basin and, paradoxically, the world's single largest reservoir of fresh water. Such figures illustrate the problem of territorial distribution, despite the sufficiency of resources on the whole. The national MDGR thus emphasizes the need for regional planning measures to respond to this unequal distribution.

The Brazilian report is also quite specific in dealing with social and racial differences in access to services. Rather than direct discrimination, this is a consequence of greater poverty among blacks and mixed race populations; the result is that coverage for households headed by whites is 19% higher. A similar pattern is observed regarding housing quality for blacks and whites. While the racial issue was not fully addressed in the ICPD – except perhaps for indigenous communities in Chapter VI-D – it is arguable that focusing on under-privileged groups might help achieve Target 10, apart from being a human-rights issue in and by itself.

Taking into account the asymmetrical distribution of resources and the lack of access to public services of underprivileged communities, the Peruvian MDGR (2004) refers to Chapter VI-D of the ICPD when acknowledging that this social gap will not be bridged without specific policies for indigenous communities:

> *"The coverage of access to water and sanitation services is much more critical in the 1,450 indigenous communities than elsewhere. Therein only 12% of the native indigenous communities of the rainforest relies on any form of water supply and only as much as 10% to basic sanitation." (Peru, 2004: 100)*

The Cuban national report (2005) notes that the country has already reached Target 10, seeking to improve the quality of services. It is worth noting, nonetheless, that the report calls for UN funds and agencies to join this endeavour:

> *"The United Nations agencies, funds and programmes should keep on cooperating in forwarding financing expedients in order to support the efforts that Cuban government undertakes." (Cuba, 2005: 37)*

Unfortunately, the chapters devoted to MDG 7 in the national reports of the LAC Region omit the demographic implications of improving access to water and basic sanitation services, as well as the implications for improving the lives of slum dwellers. While some references to the role of rural-urban migration can be found, SRH issues are almost entirely absent from these chapters.

General characteristics of water, like unequal distribution over time (seasonality in tropical regions), are also important to consider in LAC, because the result is recurrent periods of water shortage every year. Despite the existence of pipes, during two or three months of the year there is a risk of having no water at the tap. According to Izazola (2001: 310), this paradoxical situation is common in Mexico City, where, despite having connections to the water system, more than one million inhabitants are served by water delivery trucks.

7.3.1. Population determinants of the expansion of basic sanitation in the LAC region

Access to basic sanitation in the LAC region is not homogeneous: while Cuba, Jamaica, Panama, and Suriname have 99% access, Belize, the Dominican Republic and Venezuela have rates close to 70%, and Haiti registers 50% coverage (UNDP/UNEP/World Bank/World Resources Institute, 2003). Target 10 is not defined in terms of absolute numbers of people to be reached by 2015, but rather in terms of the proportion of the population that should gain access to safe water supply and basic sanitation. Consequently, the actual numbers depend on population growth up to 2015. This will affect not only the number of people to be reached, but also the cost and financing strategies used for this purpose, which depend upon the settlement patterns of target groups: rural communities, small towns, large towns, or mega-cities. The transformations that will take place between these different types of human settlements will greatly influence the choice of strategies for pursuing Target 10. For example, if most of the communities to be reached end up being located in small towns of under 100,000 inhabitants, where about 25-30% of the urban growth between 2005 and 2015 will take place and which have about double the level of sanitation needs of urban areas in general, and if the rural communities are located in hard-to-reach remote areas, then fast-track strategies based upon the use of mass approaches like franchising may be necessary.

In Brazil, for instance, several cities, including the capital Brasília, follow a condominial sewerage system developed for low-income communities in the 1980s in the State of Rio Grande do Norte, which has now become a standard solution for entire urban

areas, irrespective of residential income. This implies a shift from conventional sewerage technology to a technically equivalent lower-cost alternative. The lower cost does not imply lower technical standards, but arises from current scientific and technical research, as well as current experience and innovation. Community participation is an integral part of the model, as a way of helping to find solutions for the common interest within the block. This is analogous to ownership of neighbourhood level sanitation infrastructure in some other models. Within the first eight years of its adoption, 121,000 homes were linked to the system, using over 1,300 km of condominial branches and over 660 km of public networks at average costs per person and per meter of sewer network of US$ 27.00 and US$ 16.00, respectively. The public network is divided into two parts, namely, a number of parallel micro-systems and a citywide system. The micro-systems are defined by sub-dividing or unbundling the urban area into small natural drainage basins, each with its own independent sanitation system, from collection to treatment and disposal, which can be operated as independent systems permanently or they can be connected to a citywide system (Lenton, 2003).

At present, the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation does extensive research on the available data bases of countries around the world, to track progress toward the realisation of MDG Target 10. Based on these data, they also make extrapolations to the year 2015, in order to assess whether countries are on track or not. In the case of the LAC region, it is projected that by 2015 the absolute number of people without access to improved drinking water will have diminished by 25 million and the absolute number of people without improved sanitation by 24 million (WHO/UNICEF, 2006). These are, however, nothing more than extrapolations based on current trends. In order to be true projections, it would be helpful if they considered at least two important causal factors related to the coverage of water and sanitation systems:

1. The relationship of the expansion of water and sanitation networks to economic inputs, which are very substantial. At present, countries in the LAC region invest between 1% and 7% of their GDPs in infrastructure. According to data announced at the Third World Water Forum in Kyoto (2003), the present annual investment of developing countries in water services needs to be expanded from US$ 75 billion to US$ 180 billion if the water and sanitation MDGs are to be met. In some countries, such as Brazil, where investments have declined in recent years, one should expect a slow-down of the growth of coverage, whereas in others, such as Chile, one observes the opposite trend.
2. The relationship between the coverage of water and sanitation networks to demographic trends, such as population redistribution and changes in household structures, including the potential impact of factors such as residential segregation and intra-urban mobility.

A recent assessment of environmental prospects (Millennium Ecosystem Assessment, 2005 b) does contain population projections as part of its comprehensive scenario-building

efforts. However, as is often the case, these scenarios are of a global nature and do not enter into any detail on specific population-environment interactions at the local level, even though they do recognise that household transformations may be relevant determinants of the consumption of specific resources, such as energy.

One of the few studies to address the issue of how the sociodemographic characteristics of households may affect their coverage by water and sanitation systems is Rezende's thesis (2005), on the case of urban Brazil.[7] Among other things, this study shows that, after controlling per capita income and education of the head of household, as well as geographic region and type of administration of the local network, coverage still varies significantly by sex of the head of household (17% lower among households with male heads), age of the head of household (1% increase per 5-year age category), marital status of the head of household (higher coverage among household with married heads), and – most significantly – by household size and size of the community. Coverage is highest among households with less than 4 members and in communities with 20,000-50,000 members (see Table 7.3).

Unfortunately, not all the implications of this type of analysis for the expansion of service networks are immediately obvious. Some categories of households may have higher proportions of access to water and sanitation because these services can be provided to them more cheaply. The most obvious case is the advantage of urban populations over rural populations, which has been widely documented. In Table 7.3, this scale factor is also reflected in the significantly lower odds ratios for sanitation in communities with under 5,000 inhabitants, compared to larger communities. However, other factors influence this relationship as well. The lower sanitation indices for communities with more than 50,000 inhabitants may be due to diseconomies of scale, but more likely they are caused by intense rural-to-urban migration, which creates a delay in the provision of these services for the most recent urban residents, particularly those living in the urban periphery.

The variation by household size is even more difficult to interpret. On the one hand, it is possible that small households tend to live in physical locations where sanitation infrastructure is more easily provided. On the other hand, it may be that small households have a higher propensity to seek homes which have sanitation infrastructure, independently of their location and of the original costs of providing this infrastructure. Finally, it should be pointed out that smaller households also imply more households to accommodate the same total population size. This means that, in terms of the number of *people* provided with basic sanitation, the relationship between average household sizes and coverage may actually be positive. So far, very little empirical work has been done on sorting out these multiple interactions and their potential impact on the attainment of MDG Target 10 is little understood.

[7] Focusing on urban sanitation obviously provides a partial view of the task ahead. Nevertheless, because of the high degree of urbanisation and urban growth of the region, most of the work to be done is in urban areas: 121 million people requiring improved water supply and 132 million requiring improved sanitation, compared to 20 and 29 million, respectively, in the rural areas (Lenton, 2003).

Table 7.3: Odds ratios for the presence of water provided by in-door plumbing and sanitation in urban homes in Brazil, 2000

	Household/Community Characteristics	Water	Sanitation
Household variables	Head of hh. male	0.83	0.81
	Age of head of hh.	1.01	1.01
	Head of hh. white	1.19	1.19
	Head of hh. married/widowed	1.68	1.06
	Income/cap. < 0.5 minimum wages	1.00	
	Income/cap. 0.5-1.5 minimum wages	1.11	1.00
	Income/cap. 1.5-3.0 minimum wages	1.57	1.15
	Income/cap. 3.0-5.0 minimum wages	2.10	1.36
	Income/cap. > 5.0 minimum wages	2.69	1.88
	Head of hh. with < 1 year of education	1.00	1.00
	Head of hh. with 1-3 years of education	1.32	1.20
	Head of hh. with 4-7 years of education	1.67	1.43
	Head of hh. with 8-10 years of education	2.20	1.77
	Head of hh. with 11+ years of education	2.51	2.34
	Less than 4 hh. members	1.72	1.52
	4-7 hh. members	1.60	1.31
	8-10 hh. members	1.22	1.10
	11+ hh. members	1.00	1.00
Community variables	North	1.00	1.00
	Northeast	1.73	2.61
	Southeast	9.49	32.14
	South	3.74	1.97
	Centre West	1.73	1.36
	Municipal system (directly administered)	1.12	16.12
	Municipal system (with autonomy)	2.25	28.22
	State	1.86	17.29
	Federal	1.17	1.92
	Private	1.00	1.00
	Community with < 5,000 inhabitants	-	1.00
	Community with 5,000-20,000 inhabitants	-	1.43
	Community with 20,000-50,000 inhabitants	-	1.93
	Community with 50,000-200,000 inhabitants	-	1.52
	Community with > 200,000 inhabitants	-	1.65

Source: Rezende, 2005

Target 11: By 2020 achieve significant improvement in the lives of at least 100 million slum dwellers

7.4. The link between population growth and the growth of urban slums

Under this heading, some MDGRs have introduced additional indicators, such as the following, listed in the 2005 MDGR of Brazil:

- Households in subnormal agglomerates, by major regions;
- Quantitative housing deficit by income bracket and area of residence;
- Number of households in informal settlements;
- Number of slums, substandard inner city housing, irregular and clandestine lots;
- Satisfaction of the population with housing conditions, by major regions;

- Percentage of families with housing problems;
- Percentage of permanent urban private households with adequate housing conditions, by major regions and the colour/race of the heads of household.

The opening statement of the 1996 *State of the World Population* (UNFPA, 1996) is that "the growth of cities will be the single largest influence on development in the 21st century". The 2007 edition of the same report, which cites these words, sums up the relevant contributions that can be made to urban management from a population perspective:

> *"Population specialists, in particular, can help to generate and promote key lessons through data, analyses and concrete examples, including a) the inevitability and real advantages of urbanization and urban growth; b) the futility of anti-urban biases and policies; c) the increasing share of national poverty, disaggregated by gender, in urban areas; d) the effectiveness of proactive approaches to deal with the needs of poor men and women in cities; and e) the importance of involving the poor in decisions that affect their habitat." (UNFPA, 2007: 42)*

There is some ambiguity with respect to the meaning of Target 11. Does it mean that the absolute number of slum dwellers in 2015 should be at least 100 million less than in 1990? Not necessarily. Martine (2005) points out that the number of slum dwellers worldwide is projected to increase from 924 to 1,477 million between 2001 and 2020 and that the improvement of the lives of 100 million is not going to make much of a dent in this trend. Bremner and Bilsborrow (2005) also suggest that the modest scope of the Target may imply that the proportion of urban residents without access to basic services may be greater in 2020 than it is today, even if the Target is met. They also note that the Target of 100 million slum dwellers was first mentioned in the 1999 Cities without Slums initiative, as only one objective within a much broader programme. By taking it out of its original context, the number has become dissociated from population forecasts, setting a rather low benchmark for meeting the basic needs of the urban poor.

As a hypothetical exercise, given that the LAC region has 13% of the world's slum dwellers, it may be reasonable to translate the world figure of 100 million into 13 million for the region. As was pointed out above, it is not entirely clear how this figure deals with population growth, i.e. if the 2015 Target is to be 100 million below the absolute number of slum dwellers in 1990 or 100 million below the 2015 "no intervention" scenario. Assume for a moment that it is the former, much more ambitious target. Finally, it may be reasonable to stipulate that the reduction should be proportional to the present percentage of urban slum dwellers, e.g. from 50% to 20% in one country, from 30% to 12% in the next, or whatever the proportionality factor may be. If things are understood in this manner, what does it imply for the region and for individual countries? Based on the urban population, as projected by the UN Population Division, the proportion of urban slum dwellers in the LAC region would have to be reduced from the 35.8% found in 1990 and the 32.2% found in 2001 to 19.5% by 2015. In Haiti, it would imply a reduction from 85.7% in 2001 to 51.2% by 2015, in Nicaragua from 80.9% to 48.4%, in Peru from 68.1% to 40.7%, and so on. If, on the other hand, the Target is understood in the sense of a 13 million reduction

with respect to the 2015 "no intervention" scenario, the total *number* of slum dwellers in the region is still bound to increase substantially.

Urban agglomerations are expected to house half the world's population by 2007 (UN Population Division, 2004), when the extension of the Earth's surface occupied by cities will increase from 1% to 2%. While this may be taken as a sign of progress and modernisation, UN Habitat (2003) identifies the sombre side and estimates that out of the 2.923 billion urban residents in 2001, 924 million people lived in slums. Urban centres in the developing world will account for the overwhelming majority of the net population growth:

> *"Of the anticipated 2 billion persons to be added to the world's total by the year 2030, fully 1.9 billion are expected to reside in the cities and towns of Africa, Asia, and Latin America and the Caribbean." (Montgomery, 2004: XXIV - 1)*

The LAC region alone will be responsible for over 200 million of the 2 billion increase, raising the region's urban population by 50% in 2030. Consequently, Latin America's level of urbanisation will increase from an already high 75.5% to 84.6%, above Europe and the world average, second only to North America. At present, the LAC region houses 13% of the world's urban population, as well as 13% of its slum dwellers. In 2001, the highest percentages of urban residents living in slums were found in Haiti (85.7%), Nicaragua (80.9%), Peru (68.1%), Belize (62.0%), Guatemala (61.8%) and Bolivia (61.3%); Venezuela (40.7%), the Dominican Republic (37.6%), and Brazil (36.6%) registered considerably lower levels; while Chile (8.6%), Uruguay (6.9%), Suriname (6.9%), and Guyana (4.9%) constituted the most favourable group (UN Habitat, 2005).

Slum incidence varies greatly from one country to another. Central America (excluding Mexico), is the least urbanised sub-region (52%) but is experiencing the highest urban growth and has the highest slum prevalence, at 42.4% in 2001. The Caribbean sub-region enjoys a lower prevalence, with 21.4%, showing better overall performance in terms of access to basic services. In South America, where urbanisation has reached very high levels, the proportion of slum dwellers was 35.5% in 2001 (UN Habitat, 2004).

In terms of growth rates, the challenge ahead consists in reducing urban slums during a period in which overall urban growth will amount to 1.7% per year. Not only migration, but also the resident population's natural growth rate contributes to more rapid growth of slums than the rest of the urban population. For the LAC region as a whole, Montgomery et al. (2003) estimate that the fertility of the urban poor is roughly 10% lower than the fertility of rural areas, whereas the fertility of the urban non-poor is 33% below that of the countryside. Table 7.4 presents TFRs for urban slum and non-slum areas and for rural areas in five of the countries with the highest percentages of urban population in slums. While inter-country differences are considerable, what is most striking in this table is the gap in the fertility decline between slum and non-slum areas. Although it is to be expected that slum populations will ultimately come to approximate the behaviour of non-slum populations (already at or below replacement fertility in most cases), it is clear that natural population increase will be a significant factor in population growth of slums in the near future. Unmet need for contraception in slums reveals opportunities for SRH policies which would also contribute to improving the urban quality of life.

Table 7.4: Total Fertility Rates for urban slum and non-slum areas and for rural areas

	Bolivia (2003)	Guatemala (1995)	Haiti (1995)	Nicaragua (1998)	Peru (1996)
Urban Non-Slum Areas	1.95	3.34	1.65	2.09	2.05
Urban Slum Areas *	3.46	4.42	3.21	3.43	3.53
Rural Areas	5.51	6.75	6.71	4.93	5.78
Total	3.82	5.59	5.16	3.64	3.57

* A dwelling is defined as belonging to a slum area if it has no indoor plumbing, no connection to the urban sanitation network, no electricity, or if it has an earthen floor.
Source: Computed from DHS data

The Colombian MDGR (2005) proposes an additional and more ambitious objective under Target 11, aiming at the reduction of the number of urban households living in precarious settlements to 4%, from a baseline (2003) of 16%. Unlike the vaguer definition of Target 11 which neither precisely describes what "improve the lives of slum dwellers" means, nor assigns clear-cut, measurable responsibilities to national governments, the Colombian government chose to cut by three-fourths the number of slum households rather than merely consider improvements in the *tugurios*.

Urbanisation in Brazil

The process of urbanisation in Brazil in the 20th century was exceptionally rapid, even compared to that observed in developed countries generally. In 1920, São Paulo was hardly more than the capital of a wealthy state, becoming one of the world's largest metropoli around 1970 (Fuchs et al., 1994: 18). Until the 1930s, Brazil was predominantly agrarian. However, its urbanisation – not unlike other Latin American countries – was not followed by adequate urban planning, resulting in the formation of favelas, in urban sprawl and the encroachment on environmentally fragile ecosystems.

One example of this process is the recent occupation of the shores of the Billings Reservoir. Originally built to generate electricity, this dam became an important source of water to supply São Paulo's demographic and economic growth. Although the region was declared an environmentally protected area in the 1970s, urban expansion is now threatening the reservoir. Residential areas on the shores result in soil erosion and waste discharges into the water. Much of this population is low income, but there are also gated communities of the wealthy.

The São Paulo Metropolitan Region is paradigmatic in terms of the spatial distribution of population. For different reasons, both high and low-income groups seek housing outside the city centre. Low-income groups look for land where they can buy or rent a house. The neighbourhoods they establish have dense building patterns and are often not legally secure, even though they have been purchased, not invaded. Higher income groups seek security, environmental amenities and larger lots. The resulting urban sprawl affects urban quality of life, especially with longer commuting times.

A second major issue in the consideration of urbanisation perspectives is the phenomenon of mega-cities – those cities with more than 10 million inhabitants. At the world level their number will increase from 19 to 26 by 2020, 19 of which will be located in the developing countries (UNDP, 1998). The Brazilian MDGR (2004) suggests that the phenomenon of growing slums, which are found in every city of more than 500,000 people, is strongly related to their size and demographic density. A region of precocious urbanisation, LAC will be a noticeable presence in this group. The early urbanisation experienced in the region may cause its mega-cities to be better prepared to meet the demands of its populations than in other regions. Mexico City, São Paulo, Rio de Janeiro, and Buenos Aires face staggering challenges, but they have been doing so for many decades. This may be an area where the Latin American experience will be able to contribute to international urban policies.

On the subject of world population growth being concentrated in urban agglomerations, Para. 9.18 of the ICPD PoA – restating earlier positions of the Rio Conference – suggested that demographic and spatial management could benefit environmental sustainability:

> *"Governments should promote the development and implementation of effective environmental management strategies for urban agglomerations, giving special attention to water, waste and air management, as well as to environmentally sound energy and transport systems."*

Massive urbanisation has taken place in developing countries since the 1950s and it is in these cities that most population growth will occur in the next half century. Developing countries' urbanisation history has been one of more rapid growth and greater concentration in metropoli and mega-cities.

Different situations prevail within the metropoli, especially in terms of access to sanitation services. Suburban areas are in a critical situation. Torres (2002) presents 2000 census data to show that:

> *"In other words, there is no "island of privilege" at all in the Brazilian contemporary suburbia. If it is the case of generating development initiatives for the countryside, the urban periphery must also clearly be the object of such initiatives. Besides the income differential, most of the time those areas also present worse indicators in terms of urban infrastructure, housing and sanitation, both inducing the destruction of the environment of the region and contaminating the local population." (Torres, 2002: 6)*

Torres (2002) also points out that 75% of the households of the capital cities of the 9 principal metropolitan areas of Brazil have access to sewage collection. In the suburban areas, just 56% of the households have access to this service.

Urbanisation and population growth walk hand in hand not only with economic opportunities and employment, but also with poverty and inequality. Demographic expansion was not as closely followed by economic growth and wealth distribution so as to bridge the gap of the housing deficit and infrastructure, which lead to the formation of favelas and tugurios in medium and big cities. The LAC region is the most urbanised

region in the developing world, yet the scarcity of affordable land and housing in the region's urban areas has led to high rates of informal and irregular tenure among poor families (ECLAC, 2001).

The spatial distribution of population is an important factor in this context. Those population groups with the greatest needs often have least access to social programmes that are, in principle, aimed at them. Public policies are often tailored to the situation of the average citizen. They may fail to consider that the costs of transportation are higher for the poor, making them more dependent on facilities close to home. Nevertheless, health-care and other facilities tend to be located far from the places where poor people live. Transportation costs are high and people gather in crowded health-care facilities not necessarily adapted to their needs. It is common to find services directed to old people in areas with a high concentration of children and vice versa. Similarly, the public school system is not necessarily located where it is most needed. Due to intra-urban migration, it is common to find schools in places without children and places with children but without schools (Torres & Marques, 2001). The regulations on land use and property restrain the possibilities for providing some other social services. These locational factors are often overlooked in dealing with this issue of slum settlements. Perlman (2004), for example, estimates that 20-40% of the slum dwellers of Rio de Janeiro would be able to pay for formal housing, but instead prefer to live in the slums due to their greater proximity to services and job opportunities.

Due to legal problems, governments often cannot provide proper infrastructure and services in irregular and/or squatter settlements. In addition, in the spatial planning process, poor neighbourhoods, which lack the political power to affect such decisions, are often disproportionally affected by the proximity of waste-disposal facilities, polluting industries, and other locational health hazards. In the worst situations, there is a cumulative effect of lack of social services and infrastructure: people may live in areas that simultaneously face environmental risk, as well as lack of proper housing, sanitation, education, and health services (Martine, Hakkert & Guzmán, 2002).

Even when facing joblessness, squalor, overcrowding, environmental hazards, and diseases, most squatter and slum residents are better off than the rural poor on the grounds that their access to public services faces fewer obstacles. Slum populations may even experience considerable social and economic mobility. In a follow-up of her early 1970s study on some favelas of Rio de Janeiro, Perlman (2004) found that 30 years later about two thirds of the inhabitants that she could locate had moved either to formal housing projects or to regular neighbourhoods. As many as 18% of the children had completed university education. Nor is it true that urban poverty is limited to slum areas, as Montgomery (2004), among others, points out:

> *"It is common for debates on urban poverty in the developing world to be framed wholly in terms of the living conditions of slum dwellers. But there is, as yet, surprisingly little evidence on the relationship between urban poverty overall and the living standards of slum populations. It is not known, for example, what proportion of the developing-country urban poor live in slums, nor what proportion of slum*

dwellers can be counted as poor in terms of income and other socioeconomic criteria." (Montgomery, 2004: XXIV.2-3)

The same author presents evidence gathered in DHSs that the urban and the rural poor are similar when it comes to the unmet need for family-planning and RH services. Nevertheless, it seems logical to believe that achieving Target 11 will help to make progress in MDG 1 (halving poverty and hunger), since inner-city slums lack infrastructure that fuels intergenerational deprivation and they generally house the more needy sectors of society who are unable to move into neighbourhoods entitled to public services. The UN Millennium Project Task Force on Slums noticed that efforts to improve the lives of slum dwellers would naturally generate spill-over effects on both slums and urban poor, especially if its recommendations of "slum upgrading today" and "urban planning for tomorrow" are taken into account, which entail the active participation of the beneficiaries.

7.4.1. The link between migration and the growth of urban slums

The issue of migration and the growth of squatter settlements in the LAC region has been at the centre of the region's urban sociology and demography for half a century. The phenomenon of spontaneously occupied lands within or at the periphery of cities has accompanied the region's rapid pace of urbanisation. Theoretical debates about marginal populations with rural values and dependency have given way in recent decades to efforts to integrate these settlements into prevailing systems of social and environmental services. In many countries, organised land invasions now coexist with earlier (and sometimes new) spontaneous settlements. Their common problems of poverty and inadequate infrastructure have meant that both forms of illegal or non-formal land occupation are often treated under the same heading, in both academic and public policy thinking. Added to the (mostly native) populations of traditional decayed inner city tenements (deteriorated, but not necessarily illegal), these groups form the urban slum population.

The absolute growth of more than 230 million urban inhabitants in the last 35 years was due in large part to rural-urban migration. This very expressive volume of population added to urban areas explains, at least in part, the growth of slums and the difficulties in providing such basic services as sanitation (ECLAC, 2005 c). These once high levels of growth have now declined in most countries and what growth continues to exist is now predominantly based on natural, rather than migratory increase of urban areas. During the 1970s, demographers were predicting that Mexico City, for example, would reach 30 million people by the year 2000. In fact, Mexico City did not grow much beyond 20 million, as migrants began to search for better opportunities in other cities such as Guadalajara, Monterrey and other locations. This experience was similar in São Paulo, where net migration declined by 58,000 migrants between 1980 and 1991 and by another 50,000 thousand between 1991 and 2000.

More than 75% of the region's population already lives in cities: the highest proportions are in South America (77.2%), followed by Central America (68.2%) and the Caribbean (63.1%). By 2005, only three countries of the region had more than half their population

living in rural areas (Guatemala, Haiti, and Honduras) and another three had less than 60% urban (El Salvador, Nicaragua, and Paraguay). Bolivia, Costa Rica, and Ecuador also continue to have important rural populations. These countries, then, still have stocks of rural population which can migrate to urban areas. In Bolivia, for example, rural living conditions remain critical and rural-urban differences are growing (CODEPO, 2004: 34), making migration the most important factor of urbanisation. But in most of the region, especially in the larger countries, the pool of potential migrants has declined, and the intense waves of migration which characterised the third quarter of the 20th century cannot be repeated.

Given the different stages of the demographic transition in Guatemala and Peru, Cerezo (2003) and Riofrío (2003) arrive at different conclusions regarding the importance of migration in explaining the growth of slums in Guatemala City and Lima. Cerezo's findings are based on a survey of 4,435 households carried out in 1993 and suggest the possible importance of migration for slum formation:

> *"Fifty-nine percent of the household heads are immigrants, with 52.3% being from other departments, predominantly from the south-west and south-east of the country. Only 6.6% migrated from other municipalities in the Metropolitan Region, while the rest were born in Guatemala Municipality. Seventy-one percent of the migrants explained that they had migrated to improve their family's economic situation." (Cerezo, 2003: 8)*

Some policies and actions were taken to improve the slum conditions and alleviate poverty, but, according to Cerezo, there is no sign of decrease of the pace of migration to the Metropolitan Region of Guatemala City. According to Riofrío, however, the kind of new low-income settlements where people first reside, before constructing and installing services, "have concentrated the bulk of the low-income immigrant population who began to arrive in the 1950s. At present they house low-income families born in the same settlements or in other parts of the city" (Riofrio, 2003: 4). In other words, migration appears to no longer an important driving force of the slum formation in Peru.

One of the reasons for this change, of course, is the fertility decline, which has lowered growth in sending regions, as well as in urban slums. Rapid urbanisation coincided with the years of high population growth. Fertility differentials have followed the classic pattern of the adaptation of rural migrants to city life, and migrant behaviour is in between rural and urban norms. In the State of São Paulo, for example, where the TFR is at or below replacement level (and where the greater part of the population is poor), it is clear that the urban poor also have few children. Research has consistently shown, however, that some poor women live in pockets of isolation from RH services in urban slums (not only in distant rural areas).

However, neither the abatement of migration, nor the decline of fertility seem to be stopping the growth of slum populations. In 2001, one third of the urban population (32%) of the LAC region was living in slums, representing 128 million people. These numbers are increasing. Marques et al (2003), for example, using GIS methodology combined with census data for the 1991-2000 period, found that the number of households in favelas in the municipality of São Paulo grew from 196,000 to 287,000, at a rate of 2.97% per year,

considerably higher than that for the total population, 0.87%. The proportion of municipal population living in favelas grew from 9.1% to 11.1%, and in terms of area, favelas grew from 24.7 km^2 to 30.6 km^2. In Rio de Janeiro, they made up only 7.2% of the population in 1950, but by 1990 they had grown to 16.1% and by 2000 they had come to constitute 18.7% of the population (Perlman, 2004).

That said, it is clear that much of the continued growth of urban slums is provoked by other factors. Under- and unemployment, together with a housing market which is directed to middle and upper class demands, mean that affordable housing, on reasonable credit, is not produced on a sufficient scale in most of the region. This is a key component of the marked social inequality characteristic of the LAC region. As much as migration, slum formation is associated with economic booms and busts related to the globalisation process, the cyclical nature of capitalism, and increased demand for skilled versus unskilled labour. In short, it is driven by a combination of rapid rural-to-urban migration, urban poverty, the inability of the urban poor to access affordable land for housing, and insecure land tenure.

Efforts to ameliorate rapid urban growth in Brazil in the seventies, by promoting middle-size cities, were unsuccessful. In an era of lower population growth – and lower urban growth – such investments may now be more viable. The largest cities are already losing their attraction, and the short-distance moves which are more characteristic of migration today are directed to smaller cities – often within the metropolitan regions of the mega-cities. While this may simply transfer the problem to a different scale, most planners believe that growth will be easier to manage in smaller cities.

Advances made in health and mortality indicators – and advances still to be made – are directly related to water and sewage treatment in the region's cities. Less documented on a comparative basis is the importance of household density (generally higher in slums) on health and the recurrence of diseases once controlled in urban areas (dengue fever and malaria, for example). It is in poor neighbourhoods (often slums), where piped water may be available but is stored inadequately, creating the necessary conditions for the reproduction of the disease vectors, that these diseases have their highest incidence.

The demographics of urban slums, then, reveal a transitional situation. With slower population growth, less rural-urban migration and slowed urbanisation rates, the persistence of slums is due less to continuing migration than to unemployment and deficient housing markets. Slum residents in all but the most rural countries of the region are no longer recent rural migrants, but city natives and migrants with longer residence periods in the city. Short-distance, inter-municipal migration, reflecting comparative advantages of local labour markets, favours the growth of some cities at the expense of others. Fertility patterns suggest a trend toward convergence, but natural growth rates of slums, especially in the largest cities, reflect a continuing gap in the provision of RH services.

7.5. A new Target under MDG 7: the protection of biodiversity

The last of the new Targets introduced by the former UN Secretary-General on October 2nd 2006 refers to the protection of biodiversity. Although the process of species extinction

and the creation of new species has always existed, human activities have accelerated this process to an unprecedented degree. Paleontologists estimate the background rate of species extinction – the long-term extinction rate exhibited prior to humanity's influence – at 1-10 extinctions per decade among every million fossil species. The present rate, however, is 100-1,000 times faster than this historical background rate (Pimm et al., 1995).

Based upon mathematical relationships comparing animal body size to habitat area, human population is estimated to have reached over 30 times what would have been expected had agriculture not been adopted (Cincotta & Engelman, 2000). The extent of human numbers, per capita consumption, and technological prowess are measurably altering global biophysical and atmospheric processes. From projected habitat losses based on current trends, some biologists project that 2-13% of the world's species could become extinct in the period between 1990 and 2015 (Reid, 1992). More could disappear as a result of other causes, such as invasions of exotic species and diseases, pollution, over-harvesting, and human-induced climate change.

Many of the causal mechanisms underlying the loss of biodiversity are the same as those that are involved in the other environmental problems discussed above. Thus, Lutz (1996), while commenting eight case studies on protected areas notes that, at the local level, migration is a much more damaging population process than natural growth, just like what was found in the case of deforestation, incidentally one of the main contributing factors to loss of biodiversity:

> *"First, by far the most important population-related problem that affects all the protected areas is migration. The arrival of people who do not come from the protected area itself or the immediately surrounding region, tends to be the single most important threat to the studied ecosystems (…) The second somewhat surprising finding is that the natural growth of the human population within a protected area did not constitute a problem in any of the eight case studies; it proved to be insignificant in all cases. As to the population in the areas surrounding the parks, high population density is a serious problem in several cases. Only in the case of the Kenyan Nakuru Park, however, is it associated with current levels of high natural growth. In all the other cases, the high density is due to past natural growth or migration." (Lutz, 1996)*

However, among the specific mechanisms responsible for most of the present loss of biodiversity, the following three seem to be most important:

1. Overexploitation: Many species are hunted, trapped or killed above their rate of replacement. Lutz (1996) cautions that, while some of this is population driven, there are also many human pressures on biodiversity that originate from cultural practices and that could be avoided by limiting profiteering and some fashion fads which fuel global demand and drive commercial over-exploitation. The ecosystem-damaging sea-cucumber fishing in the Galapagos Islands, for example, has nothing to do with population growth in Asia or Latin America. Instead, it rests with the Asian belief that the sea cucumber works as an aphrodisiac and with the purchasing power of those who demand the sea cucumber.

2. Invasive species: A travelling or migrating human population contributes to the spreading of so-called "invasive" or "alien" species. These are highly adaptable plant or animal species that, once introduced into a new environment, manage to reproduce successfully, and then compete with native species for resources, often outcompeting or even preying on more susceptible and vulnerable species. Endemic species are especially threatened by the invasion of non-native species. In Hawaii, for instance, 75% of the original flora and fauna has been replaced by non-native, invasive species. The problem is also quite serious in the Galapagos Islands, where human-introduced, invasive exotic species and humans have already caused 11 of the 13 full species extinctions and the other approximately 15 extinctions of subspecies, races, varieties, and populations (MacFarland & Cifuentes, 1996).
3. Habitat alteration: Habitat alteration is by far the most significant cause of global species decline. Large land mammals with a need for large home ranges, and endemic species (species that are highly adapted to a restricted geographic area and do not occur anywhere else on Earth) are most affected by habitat transformation. As habitats dwindle, so does the possibility for species to move and migrate. Should weather patterns change, plants and animals cannot shift their range as they were able to in the evolutionary past, and are thus more vulnerable to extinction. Deforestation is quite possibly the greatest threat to biodiversity at present because forests are biodiversity "hotspots". Intermittent patterns of land occupation, even when they leave part of the forest cover intact, can still be highly disruptive to the extent that they interrupt the natural movements of species and their access to waterholes and other resources necessary for their survival. In Latin America, the construction of hydroelectric power plants is also a major cause of habitat destruction.

The concerns for the protection of the world's biological diversity were formalised at the international level at the UN Conference on Environment and Development in 1992, with the elaboration of the Convention on Biological Diversity. The Convention entered into force on 29 December 1993, as an international Treaty, aiming to conserve biological diversity and promote its sustainable use in an equitable sharing of the benefits of genetic resources. The most recent edition of the *United Nations List of Protected Areas*, the definitive list of the world's national parks and reserves, is the 2003 List (IUCN, UNEP, Conservation Monitoring Centre, 2003). The list contains 102,102 protected areas covering more than 18.8 million km^2; leaving aside marine areas, the terrestrial extent of protected areas is 17.1 million km^2 (11.5% of the Earth's land surface). The land surface protected in the LAC region is given below.

Table 7.5: Protected areas in the LAC region

Sub-region	Number	Percent of total land area in protected areas
Central America	762	27.9%
Caribbean	953	29.6%
South America	2749	22.2%

Source: IUCN, UNEP, Conservation Monitoring Centre, 2003

In the decade and a half of the treaty's existence, population issues have been treated in the context of limits to residence and economic activities in officially protected areas (Begossi, Hanazaki & Peroni, 2000; Carneiro da Cunha & Almeida, 2000, 2001; Ferreira, 2002). Such areas have grown in number since 1992 and are often considered together with indigenous reserves and extractive reserves, a newer concept which allows the sustainable use of resources (Westley et al., 1998). Countries of the region have regulated these areas according to their priorities. In Brazil, for example, the SNUC (National System of Conservation Units) was approved in 2000, which restricts the presence of population in protected areas. This legislation foresees the relocation of residents of protected areas, a process which is slow and often involves conflicting views of whether it is possible to reconcile the presence of populations with the objectives of environmental protection (Ferreira, 2004; Redford & Stearman, 1993).

The management of these areas employs concepts such as buffer zones, which are transition areas less restricted to population settlement. Each area has its management plan (*plano de manejo*) which seeks to regulate populations' access to the area and to promote protection and recuperation. The coming decade in the LAC region will witness efforts to expand the protection of biological diversity through the creation of additional protected areas as well as the regulation of existing areas. Critics of radical restrictions point to the sustainable use of natural resources by traditional communities and to the related issue of the ability (and associated rights) of these communities to identify species useful for human health and welfare. Efforts will be required to protect the cultural integrity of traditional populations, a key element in the protection of the region's biodiversity.

MAIN IDEAS ON MDG 7:

General conclusions

- Although the notion of a strong linkage between environmental sustainability and population processes is intuitively appealing, historically it has proven difficult to act upon this idea.
- The ICPD PoA recognised the relationship between the environment and demographic phenomena, such as the environmental impacts of rural to urban migration, population growth rates, poverty reduction and resource consumption. Para. 3.29 (d) of the ICPD PoA highlighted the need for preservation of natural resources and encouraged particularly the sustainability of production and consumption patterns, although it did so without mentioning quantifiable time-bound targets. In addition, Para. 3.25 of Chapter IX illustrated how the ICPD PoA relates population distribution, particularly the rural-urban dichotomy, to environmental preservation. For the most part, however, ICPD left environmental considerations to Agenda 21 and other Earth Summit documents, and the population and environment lobbies continued to operate more or less independently. On the whole, it must be concluded, therefore, that population and environmental concerns have mostly been addressed in separate policy fora.

- The political problems associated with the separate policy settings in which population and the environment have typically been discussed are reinforced by the analytical difficulty of establishing direct and unambiguous relationships between the two. While it is easy to agree that, in general, any conceivable environmental problem is likely to be aggravated by population growth, the precise mechanisms of this impact are not so easily established, particularly at the local level where many other factors come into play. The two main difficulties are that 1. Some environmental problems are caused by processes in which population admittedly has no or at best only a minor role; and 2. In those environmental problems in which population has a major role, the eventual outcomes may depend very much on institutional and other conditioning factors.
- Perhaps the most evident consensus regarding population among scholars and policy-makers is that long-term environmental sustainability cannot be achieved without the stabilisation of population growth. However, this idea has not necessarily translated into a systematic concern with population factors as integral elements of environmental policy.
- In spite of hosting Earth's greatest biodiversity heritage, receiving the largest inflow of freshwater and lodging the Amazon rainforest, the LAC region's most critical environmental problems were only marginally approached by the MDG indicators. It is true that Target 9's indicators 25 – proportion of land covered by forest - and 26 – ratio of area protected to maintain biological diversity to surface area – touch upon the preservation of forests, evidently a crucial environmental protection issue for the region that houses the Amazon forest, but MDG 7 does not address such issues more consistently.
- Building government institutions to look after the preservation of the environment, to raise awareness, and to change production and consumption patterns has been a trend observed in Latin America throughout the 1990s, but rarely have the appropriate bureaucracies been granted more than 1% of the countries' GDP to shape environmental policies.

1. The link between population growth and environmental sustainability

- To some, population dynamics are not a significant factor in the availability of exhaustible resources. To others, the limits of sustainable development have already been surpassed and the world population maintains itself at the cost of depleting non-renewable resources. However, one need not go so far to be aware that there are good reasons to assume that rapid population growth is an aggravating factor to many environmental problems.
- Environmental sustainability in the long run cannot be achieved without stabilisation of population growth. The questions that continue to stir up controversy are how far away the long run is and what resource constraints may impose limits to population growth before then.

- In the long term, for instance, population stabilisation is a necessary condition to ensure the success of any global climate plan.
- The MDG agenda has been criticised for defining its indicators 27-28 only in per capita terms, thereby ignoring the effect of population growth on the overall environmental impact. The indicators of the Kyoto Protocol are defined in terms of overall, rather than per capita emissions; this at least allows the assessment of population impacts, even if they have not been made explicit in the Protocol.
- Some projections of greenhouse emissions stipulate that, in the short run, income and technological change will have a greater impact than population growth; in the long run, however, the contribution of the latter will increase.
- According to estimates, currently 505 million people suffer water stress or serious water scarcity and this may accumulate to 2.4-3.2 billion people on moderate or high water stress in 2025. Water stress is significantly correlated with population distribution patterns.
- Besides being a matter of rights, stabilising population growth by providing access to SRH and family planning is an instrument to curb the pressures of demographic factors on environmental resources and available infrastructure in a more immediate future.
- At the local level, the implications of population growth and density may be very different. The mainstream macro-argument is that population generates pressures that accelerate the exhaustion of environmental resources. At the local level, however, this is not always true. It has been argued that, in some cases, higher population density may actually benefit the ecological sustainability of ecologically vulnerable regions.
- It is difficult to provide clear estimates of the long-term impact of population growth on environment sustainability. Population is one among many important factors on environment sustainability; it rarely acts alone to produce outcomes such as deforestation.
- Aggregate growth is not the only population factor to affect the environment. Others, such as space, timing and life cycle of population settlement, also have significant impacts. For some environmental impacts, the number of households is a more significant determinant than the number of people.

2. Population and the sustainable use of space

- Another perspective on the relationship of population and natural resources is the ecological footprint (related to the earlier concept of carrying capacity), i.e. what per capita land is needed to sustain a population with a given living standard in the long run. According to some analyses of this kind, given present consumption, the world has exceeded its maximum level of sustainable use of space by about 20% or even more. In LAC, most countries are within their sustainable population limits, but some (Costa Rica, Cuba, Dominican Republic, El Salvador, Haiti, Jamaica, Mexico, and Trinidad and Tobago) have exceeded this limit.

- According to some, the relationship between population and environment needs refocusing. Indeed, population growth tends to make matters worse but there is not necessarily linear between the two variables. Spatial patterns of production and consumption play an important role.
- Since demographic inertia and population momentum would likely thwart the efficiency of interventions in demographic growth for the next half century or so, policy-makers would enjoy more success in acting on how a territory is used than attempting to determine merely how many use it. At the local level, the overwhelming majority of policy decisions involve the spatial dimension. Rationality of occupation is the key to sustainable use of space, and the potential of city planning for changing urban environments is fundamental.
- Urban population concentration may actually be a solution to accommodate people in cost-effective ways. Urban planning is how to take into account population needs and the environmental conditions of a particular setting. Even in the rural context, population concentration is preferable to dispersion, since dispersed settlements can actually be quite harmful.
- Although urbanisation is generally a positive factor in ensuring long-term sustainability, urban life and affluence is also associated to some environmental problems. The emission of greenhouse gases, for example, tends to increase with urbanisation.
- The sustainable use of space requires integrating demographic factors to any territorial planning policy at national or local level. There is much confusion with respect to the maximum limits of population density and, at the same time, romanticism concerning the merits of low population densities, as in the case of indigenous populations.
- Increasing population density can sometimes lead to innovation but sustainability generally requires interventions, such as improved roads, off-farm income opportunities, and new technology. According to the so-called Boserup thesis, population has contributed to the intensification of agricultural production methods. This thesis has to be qualified, however, because there are also examples of societies where an excessively rapid process of densification lead to technological and demographic collapse. In LAC, agricultural densification is an issue of lesser importance because the region is so heavily urban.
- Even if migration is declining in LAC, it is another demographic factor which still plays an important role on the use and preservation of natural resources. Agricultural expansion, for instance, is a cause for deforestation and research points to the conclusion that half of it can be explained by population. Natural population growth, as opposed to migratory growth, has a much smaller impact as a driver of deforestation. Studies of ecologically fragile areas show that there is immense geographical variation in population pressure, which may bear little relation to population density. However, in-migration of colonising settlers into sparsely populated forest areas shows a distinctly negative influence through increasing

population density. Also, migration into previously empty countries has significantly more impact on the environment than in previously occupied areas.

- Overall, it is difficult to generalise on whether migration is beneficial or harmful to the environment, a greater degree of migrant incorporation mediates the impact of a migrants detrimental effect on the environment. Some of the problems associated with migration include:
- Migrants often fail to consider long-term effects of resource extraction.
- As migrants are more likely to be poor, they tend to over-harvest and degrade their surrounding environment to survive.
- Migrants do not necessarily have the knowledge of the context in order to use the appropriate technology, which may be unsustainable.
- Away from their families and social norms and pressures, migrants can take risky decisions regarding sexual behaviour.
- The integration of the migrant may be important to the protection of the environment as well. If incorporated to the community, the migrant may rely on community members to satisfy short-term needs of survival, not making unsustainable decisions that endanger the environment. Integrated migrants have more access to appropriate technology, local knowledge, and also may be under social pressure to comply with norms.
- Some negative impacts of environmental problems are stronger for women than for men, either due to an increased amount of time to be allocated to traditional tasks, to health consequences for the woman and her children, or even due to differential susceptibility to health consequences of certain environmental factors. Other environmental effects are stronger in men, particularly certain environmentally related cancers and musculoskeletal diseases.
- Women's full participation as managers is essential for the attainment of sustainable development for it is argued that women tend to practice sustainable agriculture. Men tend to be engaged in cash crop cultivation (usually mono crops), while women tend to be in charge of subsistence crops. While this adequately describes gender roles in many parts of the world, some eco-feminists have gone further, arguing that women have a privileged relation with nature stemming from the caring, nurturing, sustaining, and non-violent attributes, said to be innate to women, which would predispose them to conserve the environment. This contradicts the very concept of gender, in that, if biology determines the relation of men and women to nature, it would also determine universal and innate gender roles.
- Even if women affect the environment differently, this impact may be relevant at the local level, but not necessarily at the global scale. Although some studies show that women tend to express higher levels of concern with the environment, this does not necessarily apply to global environmental problems. Due to their higher consumption, the countries with the greatest reduction in gender gaps are actually characterised by high levels of resource depletion and environmental degradation.
- In order to promote a sustainable use of space from a population perspective, it is important to identify populations at risk of falling victims to natural disasters. The

analyst should search for connections between risk and socioeconomic condition, even though some studies indicate that the notion of risk changes according to social group as well as over time.

- LAC governments always resisted rural-urban migration, forcing migrants to occupy marginal, ecologically fragile or dangerous lands. These options tend to disappear in the future and contribute even more to the ecological degradation of cities. If governments try to provide minimal services, due to lack of planning, inadequate location, lack of access to roads, and miserable conditions, costs could soar.
- Metropolitan areas tend to be subject to serious risks of natural disasters due to disorganised urban growth. Human settlements on the outskirts of cities contribute to environmental degradation of unprotected ecosystems and biomes. Poorer families are more prone to becoming victims of natural disasters because they live in more precarious housing without infrastructure or public services.

3. Population and access to safe drinking water and basic sanitation

- LAC countries are expanding the coverage of safe drinking water. The region should be in a favourable situation to surpass the MDG target of 92%. However, there are differentials in terms of urban-rural distribution, which greatly favour the first over the second.
- Not only there are differences between urban and rural settings, but also between cities. It is argued that water and sanitation is worse in small urban centres, especially those with less than 100,000 inhabitants.
- Large scale management and provision of services through public/private partnerships and community participation can help reduce the cost of supply and increase the possibility of cost recovery.
- In the case of Brazil, the deficit of access to water and sanitation services is larger in less populated areas of the North, Northeast and Centre-West regions. In order to tackle these regional disparities, regional planning measures are paramount. Not only there are regional differences but also social and racial ones.
- In LAC one other under-privileged group are the indigenous peoples. The social gap that separates them from the general population will not be bridged without specific policies.
- All major cities of LAC are facing problems of water supply, such as contamination of water, situation which is aggravated in the mega-cities of the region. Supply issues are also related to the unequal distribution of water over time, with periodic water scarcity limiting access even where adequate infrastructure is in place.
- Even if there is progress regarding water and sewage, sanitation measures are still a high priority, due to the considerable differences of the situation between countries and between rural and urban areas. Also health and mortality issues are related to water and sewage treatment in the region. Piped water may be available but, if it is stored inadequately, it creates the necessary conditions for the reproduction of the disease vectors.

- In the the LAC region, WHO and UNICEF project that by 2015 the absolute number of people without access to improved drinking water will have diminished by 25 million and the number without improved sanitation by 24 million. These are, however, only extrapolations based on current trends. Actual projections should consider at least two important causal factors related to the coverage of water and sanitation systems: 1. The relationship of the expansion of water and sanitation networks to economic inputs. LAC countries invest 1-7% of their GDPs in infrastructure. According to data announced at the Third World Water Forum in Kyoto (2003), the annual investment of developing countries in water services needs to expand from US$ 75 billion to US$ 180 billion to meet the water and sanitation MDGs. In countries like Brazil, where investments have declined in recent years, a slow-down of the growth of coverage is expected, whereas the opposite happens in Chile. 2. The relationship between the coverage of water and sanitation networks to demographic trends, such as population redistribution and changes in household structures, including the potential impact of factors such as residential segregation and intra-urban mobility.
- A study on urban Brazil shows that, after controlling per capita income and education of the head of household, as well as geographic region and type of administration of the local network, coverage still varies significantly by sex of the head of household (17% lower among households with male heads), age of the head of household (1% increase per 5-year age category), marital status of the head of household (higher coverage among household with married heads), and by household and community size. Coverage is highest among households with less than 4 members and in communities with 20,000-50,000 members.

4. The link between population growth and the growth of urban slums

- Slum incidence varies. Central America is the least urbanised sub-region. It is experiencing the highest urban growth and highest slum prevalence. Slum prevalence in the Caribbean is about half as large, while South America, with very high urbanisation levels, finds itself in between.
- Even with the increasing urbanisation process all over the world (LAC region should reach 84.6% by 2030), the number of slums residents is increasing as well. However, the MDG targets are stipulated for a period in which population will also grow. The challenge ahead consists in reducing urban slums while population is growing. The natural population increase will be a significant factor in population growth of slums in the near future. Access to SRH would therefore contribute to improve urban quality of life.
- The phenomenon of mega-cities (over 10 million inhabitants) is long known by LAC countries and this experience may actually contribute to international urban policies. In LAC, massive urbanisation has taken place since the 1950s and since 1970 urban population increased 240%.

- There are spatial differentials within metropoli, the suburban areas normally face more critical situations, for instance regarding sanitation services.
- In LAC, demographic expansion and urbanisation were not followed by economic growth and wealth distribution, which lead to the formation of favelas and tugurios. In particular, land and housing policies have failed to provide affordable housing to the urban poor.
- The spatial distribution of people is also important when analysing services and social programmes and the eventual need of transportation. Costs of transportation are high for the poor which can virtually render those services and programmes inaccessible. Spatial misallocation of services is a common phenomenon, for instance: schools in areas with a high concentration of older people, as well as services intended for the latter in regions with more children.
- Poor neighbourhoods are often located near waste disposal facilities, polluting industries, and other locational health hazards, facing environmental risks and not necessarily having access to social services.
- Nevertheless, urban slum dwellers generally face better living conditions than the rural poor, because they have better access to public services and face fewer obstacles. Slum populations may even experience considerable social and economic mobility. In a follow-up of some favelas of Rio de Janeiro, it was found that 30 years later about two thirds of the inhabitants that could be located had moved either to formal housing projects or to regular neighbourhoods. As many as 18% of the children had completed university education.
- Although they are often confused, urban poor and slum dwellers are not synonymous terms.
- As MDGs are inter-related, efforts regarding Target 11 would have a spill-over effect on poverty, both urban and rural.
- Although migration has been important historically, more recently high levels of rural-urban and inter-regional migration have declined in the LAC region. By 2005, only three countries in the region have more than half their population living in rural areas. Overall, this means that the pool of potential migrants has declined and the migration waves of the 20th century will not be repeated.
- This is also caused by the fertility decline, as migrant absorb urban norms and behaviour, so that the urban poor also end up having fewer children. At present, the fertility in urban slum areas tends to be intermediate between rural and urban non-slum areas. Nevertheless, the growth of the slums as a percentage of the total population in cities like São Paulo and Rio de Janeiro has continued unabated.
- Therefore, although migration is historically important, much of the growth of slums is provoked by other factors, such as under- and unemployment, a difficult housing market, and no access to reasonable credit for construction.
- With a lower population growth, investments in middle-sized cities seem more viable. Migration is now turning to smaller cities, where planners believe that growth will be easier to manage.

5. A new Target under MDG 7: the protection of biodiversity

- A newly introduced target, the protection of the biodiversity aims at the extinction process, accelerated by human activities.
- Estimates argue that the human population would be 1/30 than the present without the adoption of agriculture. Human population, consumption and technology are altering global biophysical and atmospheric processes in a way that 2-13% of the world's species could become extinct between 1990 and 2015. This number can increase due to the action of diseases, pollution, over-harvesting, and human-induced climate change.
- Environmental problems of the other MDG 7 issues can also cause the loss of biodiversity. Migration, for instance, is said to be more damaging than natural population growth, in the case of deforestation which, in itself, contributes to the loss of biodiversity.
- Over-exploitation, the introduction of invasive species, and habitat alteration are the main proximate causes of loss of biodiversity. The movement of human population (through travel or migration) spreads "invasive" or "alien" species which manage to reproduce in a new environment, competing with native species for resources and often outcompeting them. Habitat alteration is the most significant cause of global species decline; as habitats dwindle, so does the possibility for species to move and migrate. Should weather patterns change, plants and animals cannot shift their range as they once did, and become more vulnerable to extinction.
- The Convention on Biological Diversity, which entered into force in 1993, seeks to conserve biological diversity and promote its sustainable use in an equitable sharing of benefits. Population issues have been treated in the context of limits to residence and economic activities in officially protected areas, which have grown in number since 1992. Some countries of the region have regulated these areas with systems and legislation in order to enhance environmental protection.
- The coming decade in the LAC region will witness efforts to expand the protection of biological diversity through the creation of additional protected areas, as well as regulation of existing ones.