Population Policies for a Sustainable Human Development

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Abstract
Sustainable human development involves both environmental security and social security. Issues of environmental security and access to natural resources cannot be isolated from social security and access to the human and financial resources required for social support. The paper addresses some of the causal mechanisms that underlie the observed interaction between population and environment. First, current modelling perspectives on the population-environment interaction are reviewed briefly. Some model developers feel that models are not seldom based on ambiguous theory and scattered empirical evidence and call for studies of the causal mechanisms that underlie the population-environment linkage. The causal mechanism need to be addressed at the level of the individual actors, i.e. at the micro-level. The main thesis of the paper is that individuals involve in activities and networking (relationships) to satisfy a hierarchy of needs. The security needs are among the most basic needs. In most societies, people rely on their families to satisfy these needs. With development, security needs can be satisfied with smaller families and they are increasingly satisfied by the public sector (social security schemes). These processes can be influenced only partly by policies. For policies aimed at sustainable development to be effective, they should account for the hierarchy of needs that govern behaviour at the micro-level.

Introduction
The root cause of most violent conflict in history has been competition for scarce resources, including land (Lonergan, 1996; p. 4). When the availability and quality of resources are at stake, humans or other actors (e.g. firms, organisations, governments) who in normal conditions live and work together and share resources relatively peacefully, start competing for resources; the competition takes various forms ranging from an emphasis on self-reliance instead of solidarity (sharing of resources), to rules governing access to resources (and exclusion), to aggression and violent conflict to either gain access or to preserve access to resources. It seems that to many, population control is one of the instruments to secure access to high-quality resources. For instance, Falkenmark (1994) states: "It is important that the land be manipulated in such a manner as to optimize productivity... This can be accomplished through minimizing population growth." Large families that cause rapid population growth,
may lead to environmental insecurity. To millions of people, however, a large family is the only source of social security they have. There is no environmental security without social security. Consequently, it seems to me that the issue of environmental security and access to natural resources cannot be isolated from social security and access to the human and financial resources required for social support.

Population growth is a factor in competition for resources since the global cake must be shared with more people. Every year, about 100 million people are added to the world population. Development is another factor since with development comes a growing need for food, shelter, transportation, clean water and air, etc. Traditionally, the contribution of population growth to the demand for resources and the degradation of the resource-base (environment) is captured in the expression \( I = P A T \), where \( I \) is the environmental impact (i.e. energy consumption or numerical value of some pollutant), \( P \) the population size, \( A \) an index of affluence (measured by e.g. GNP per capita) and \( T \) the level of technology (e.g. amount of energy or pollution per unit of GNP). By taking logarithms, the equation may be expressed in terms of the growth rate of each element: \( \eta = r_P + r_A + r_T \). For instance, Myers (1994) notes that carbon dioxide emissions in the world grew by an estimated 3.1 per cent between 1950 and 1985, during which period world population grew by 1.9 per cent. Therefore, he concludes, population growth was responsible for about two-thirds of the rise in carbon dioxide emissions. The equation contributed significantly to the awareness that population growth may be detrimental to sustainable development. To gain insight in the population-environment interaction, the model is far too simplistic. It omits heterogeneity and interaction. Heterogeneity refers to differences between subpopulations with different levels of development, activity patterns or ways of life; interaction refers to the interactions between the elements in the equation. For instance, Lutz (1994) shows that the contribution of population growth to the rise in carbon dioxide emissions is significantly smaller if regional differences in population growth and emission levels are accounted for. The reason is that the major increase in emission levels took place in regions with low population growth (developed countries). If the emission levels in developing countries are allowed to increase, however, the impact may be tremendous (Myers, 1992, p. 27). A change in one element of the equation is likely to affect the other elements. For instance, with increasing affluence (development), population growth is likely to decline and environmentally-friendly technologies are developed. The relation between population pressure and technological innovation (in agriculture) was stressed by Boserup (1981). In order to

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5) This statement echoes the view of Lonergan (1996) in his background report to the meeting.

6) The expression was developed by Ehrlich in his book The Population Bomb (1986).
account for heterogeneity and interaction, and to uncover the mechanism through which population affects the environment. relatively complex models have been developed and applied at a country level or even a lower level instead of a global level (see e.g. Lutz, 1994a). The question whether the increase in the number of people on our planet is a major reason for the growing stress on the environment can only be answered effectively if we know the mechanism by which population influences the environment. In addition, policy intervention without proper knowledge of the mechanism at work is bound to be ineffective.

The paper is organised as follows. the next section briefly describes the approach adopted in models that have been developed to picture the population-environment interaction. Although the models increase the awareness that population interacts with the environment, they fail to uncover the basic mechanism of the population-environment interaction. Then presents a different approach to the study of the population-environment interaction is presented. The main idea is that observations at the macro-level relate to results or manifestations of interactions; the mechanisms of interaction can be uncovered only by studies at the micro-level, i.e. at the level of individual actors. Key concepts are processes (dynamics), interaction and hierarchy. In most societies, population growth is directly related to the reliance on the family for social support. Section 3 concludes the paper.

**Modelling the population-environment interaction**

Models have been developed to represent the population-environment interaction. Population is generally categorized by age and sex with different degrees of age detail. The environment is represented by the major natural resources water, land, and energy resources; resources are differentiated on the basis of location and/or sensitivity to damage and depletion. The impact of population on the environment is mostly indirect, through the activities people engage into. Most attention is paid to economic activities to which population supplies labour and receives goods and services in return. The quality of labour depends on education. Although the demand for goods and services depends on living arrangements (household size), models do not take that into account. Models typically describe the flows of goods (including emissions), labour (including socially undesirable flows of people), capital, and information (e.g. directives, regulations, legislations).

Most models are at least indirectly based on systems theory. Forrester's systems dynamics language DYNAMO provided a major push to modelling complex dynamic linkages (applications to Industrial Dynamics, Urban Dynamics, and World Dynamics, in that order).
The best known application of the modelling technique is of course the World3 model by Meadows et al., (1972). The model is better known for the message it contains than for its scientific relevance. It is not uncommon that models are developed to convey a message rather than to disentangle complex links that exist in the real world. One example, according to Sanderson (1994) is the POMA model (Interactive Model of Population and Environment in Costa Rica; Arcia et al., 1991) which is part of the series of USAID-funded RAPID models that have been developed over the past 20 years to demonstrate the negative effects of population growth on development and 'to motivate them (policy makers) to spend more resources on programs to reduce fertility' (Sanderson, 1994: p. 62). The ECCO model, developed by Slessor and King of the University of Edinburgh, and written in DYNAMO, is also intended to explore policy options. As is the case with many models, this one promises a lot7 without revealing the basic mechanism of the model in sufficient detail to allow independent quality checks.

A major attempt to model population-environment interaction was by Lutz and his group at IIASA in Laxenburg, Austria. The model has four components: a population module, an economy module, and two environment modules covering water dynamics and land use (Lutz and Baguant, 1992; Lutz, 1994a). Population is taken as a point of departure; people are the actors ('agents') who affect the environment through their activities, mainly economic activities. The economic model (an input-output table) describes the activities and serves as a linkage between population and environment. Consumption patterns depend on age and education, not on household size and composition. A guiding principle in the design of the model is that only unambiguous and direct relationships are hard-wired in the model; all other aspects that are not known with sufficient accuracy are soft-wired and determined by scenario-setting. The approach is due to lessons learned from global modelling in the 1970s and 1980s. 'The system should not become an artificial world in itself which, due to many predefined feedback loops, develops its own life and takes off in directions that can hardly be followed by common sense and have little to do with reality. We wanted to avoid hard-wired unchangeable feedback loops that are based only on ambiguous theory and scattered empirical evidence.' (Lutz, 1994a: p. 214).

In discussions of population-environment models, frequent reference is made to black boxes and inadequate understanding of the causal mechanisms that underlie the linkages that are either observed or simulated by the model. Models that are based on ambiguous theory and scattered empirical evidence are omnipresent and pollute the public debate. Often, the public attention models receive seem to depend more on their ability to catch public attention and increase

7) 'The ECCO model allows one to test the benefits and advantages of perceptions and intuition.' (Slessor and King, 1994, p. 140)
awareness (e.g. by impressive presentation graphics) than on the scientific validity of the representation of reality.

**Population-environment interaction: basic mechanism**

This paper focuses on the basic mechanism of the population-environment interaction. The approach is micro-analytic. The micro-approach is necessary for two reasons: understanding and policy-making. A growing number of social scientists take the view that, in order to understand interactions at the system- or macro-level (e.g. between population change and environmental change) one should move beyond statistical association between macro-level variables and examine processes or mechanisms internal to the system that produce the system effects. In social systems, all such mechanisms involve actions of human beings; in economic systems, they involve actions of individual firms. For this reason, the theoretical (or explanatory) primacy lies on the individual (micro-) level, although the analytic primacy is at the aggregate level. This approach to understanding is known as *methodological individualism* (see e.g. Coleman, 1990; p. 5)\(^8\). The second reason is policy-making. Since a myriad of individual actors determine the impact of population on the environment, policies are effective to the extent that they affect individual behaviour. The impact of policies on individuals is mediated by several layers of social institutions. The challenge is to design policies that are effective to change behaviour without infringing on the basic individual (human) right. That is particularly relevant for population policy, since the free and responsible choice of family size and child spacing is an accepted human right; governments are expected to provide the means to execute this basic right.

The main idea of the paper is that, in order to satisfy needs, actors involve in activities and activities require resources. The myriad of individual decisions made by actors with different strategies and operating (living) in different conditions and having varying degrees of control over contextual factors such as resources, result in the changes at the macro-level that we are able to observe. On the other hand, policies to stimulate a more effective use of resources or to limit depletion of the environment are successful to the extent that they can reach the individual actor and cause behavioural changes. This perspective is consistent with the view, expressed by Lonergan (1996), that environmental security must focus on individuals and communities (see also Dahlan, 1994).

\(^8\) This perspective on individual actions giving rise to collective phenomena is consistent with the 'commons dilemma'.

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A universal feature of individuals is the hierarchy of needs (Maslow, 1987; Figure 1). The physiological and safety needs are basic needs (security); the needs for social contact, self-esteem and self-actualisation are growth needs (mobility). Water, food, shelter and protection from violence are among the most basic needs. In order to meet needs, people involve in activities, economic activities being the most important ones. When formal and informal job opportunities or other income-generating projects are readily available, people are able to meet most security needs easily. When opportunities are limited or when access is restricted, people try to find opportunities elsewhere. If that is not possible, individual security is threatened and survival strategies (strategies to maintain a minimum standard of living) start to dictate behaviour. It should be no surprise that people struggling for survival have low mobility needs, including the need to protect the environment for other reasons than their own survival. For instance, in large part of the world, people rely on fuelwood for cooking. The collection of fuelwood continues although it is clear to everyone that the resource is depleted quickly (wood is becoming scarce and people have to walk longer distances to collect wood). Alternative energy resources are inaccessible, either because of unavailability or excess cost. Safe drinking water, health, a minimum income, waste handling, etc., are beyond limits for millions of people. The bottom billion poorest people are seen as an important cause of over-exploitation of the environment. Environmental security without individual security is not sustainable: it may even not be morally acceptable in a world that is characterized by rapidly growing inequity. At least some development seems to be a precondition for environmental security.

Hierarchy of needs, according to Maslow (1987)

Source: Ickes, 1985: p. 6

9 What immediate threats are more significant than delayed threats.
10 What applies to the micro-level also applies to the macro-level. Natural resource depletion is enhanced by governments in developing countries in order to pay debt and provide employment.
In order to meet security needs, people develop social support systems, the family being the most important one in most countries. Population growth is related to the reliance on (large) families for social support. The support functions of the family change substantially with development. In early stages of development, when economic activities outside of agriculture or trade are limited and individual security (including prospect for survival) is low, a large family is an asset. In many developing countries, children are the only old-age security and disability insurance. Individual security relies on enough children surviving to the age at which they are called upon to provide for parents in need. Because of the focus on surviving children, fertility may increase when the chances for child survival decline. For instance, preliminary results of a retrospective survey in Northern Ethiopia to assess the demographic impact of famine and drought, revealed that during the 1984-1985 famine, fertility increased although the ability to support children (food, etc.) declined (Ezra, forthcoming). Elderly women without children are among the most vulnerable people on earth, in particular in communities where the family is the basic social support unit. When chances for child survival are relatively high, even when development is low, the desired number of children is low. For instance, in the state of Kerala in India, which has a low level of economic development but an adequate health system, the average number of children a woman has in her lifetime (Total Fertility Rate) is not higher than in The Netherlands. The two-child norm is strong and an increasing number of women have one child only. In some societies, support of the elderly is the duty of sons; daughters move to their husband's family at marriage. In these societies, e.g. India, the focus is on surviving sons and fertility decline is less rapid than in other societies.

With development, the chances for child survival increase. The costs of raising children grow, due to education. The security needs can be satisfied with less children. At the same time, formal social security programmes are established as more people participate in the formal sector of the economy. At this stage, the establishment of social security programmes may reduce the desired number of children. Chinese demographers today advocate the establishment of social security programmes in rural areas as an effective strategy for reducing rural population growth (Zeng Yi, 1994). At the same time, the Chinese government continues to encourage the traditional family support system, because it is expected that the old-age insurance system will be limited in its capacity and that, consequently, old-age support is the shared responsibility of the state and the family (Zeng Yi, 1996). What applies to China applies to most developing countries: the family remains the most important social support system.
With further development, an increasing number of support functions are transferred from the family to the public (government) sector. The family gradually loses its support functions and, a growing proportion of couples choose to remain childless. The emphasis on individual autonomy, generally interpreted as individual economic independence, as the highest good (see Maslow) stimulates the trend towards smaller social units based less on family ties (households instead of families). The rapid increase in one-person households and casual partnerships avoiding long-term commitments is a manifestation of the final stage of a process of declining size and function of the family. This process is known as the second demographic transition (Van de Kaa, 1987). This pattern of social change has severe implications for the environment since the per capita demand for resources depends on the living arrangement. In early stages of development, high fertility is sometimes considered to undermine natural support systems: at later stages of development, natural support systems could be undermined by highly inefficient living arrangements and social organisation based on individual autonomy. For instance, Batenburg and Knulst (1993) found in a study in the Netherlands, that emancipation and small household size are important determinants of rapid increase in car use and the associated environmental problems. Social trends in Western countries do not contribute to sustainable development and environmental security.

The stage of individualisation may give way to a new stage when social support functions are transferred from the public sector to private business. The increased costs and uncertainties, that are associated with the transfer, may give rise to new informal support systems to meet security needs. With the decline of families as support units, people must look for other relationships to create a basis for risk sharing and social security in case the private sector shows to be an unreliable partner in situations when the security needs are highest.

Conclusion
Processes at the micro-level result in the well-known population dynamics at the macro-level. Although a myriad of people make decisions every day, a pattern arises. At early stages of development, child mortality is high and fertility is high. With increasing child survival and increased investment in children (education), couples wish to limit the number of children and look for reliable means to do so. Government policies may enhance or discourage this process by controlling the flow of information (awareness), goods (e.g. contraceptives) and services (health and family planning). When a sufficient proportion of couples (about 20 percent) limit family size, new couples adopt family planning at a rate that is characteristic for a diffusion process. It is very difficult to affect the pattern and direction of the process. Policies may affect

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11) and, because of the mechanism of risk classification and insurance pricing, access to insurance may be limited.
the speed of the process: the effect is frequently short-term. At the macro-level, fertility change throughout the demographic transition may be described by a process of innovation and diffusion. The validity of the innovation-diffusion model is one of the most interesting findings of empirical fertility research in recent decades (see e.g. Rodriguez and Aravena, 1991; Rosero-Bixby and Casterline, 1993). The innovation-diffusion model and its micro-level underpinning provides a foundation for a simulation model of fertility change (van Vianen et al., 1994). The model is one of the modules of the TARGETS model of global change, that is being developed by the Netherlands Institute of Public Health and Environmental Protection (RIVM) (see Rotmans et al., 1994).

References


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