

**POTENTIAL ENVIRONMENTAL IMPACTS OF CHANGES
IN POPULATION SIZE, AGE, AND GEOGRAPHIC
DISTRIBUTION**

Michael Barrett

University of Toronto, Toronto, Ontario, Canada

Simon Miles

Public Policy Consultant, Toronto, Ontario, Canada

Henry Regier

University of Toronto, Toronto, Ontario, Canada

and

Chris Winter

The Conservation Council of Ontario, Toronto, Ontario, Canada

Résumé — Cette étude récapitule les liens entre le développement démographique et les conditions écologiques qui ont une conséquence sur le bien-être économique et social. Les impacts écologiques sont examinés par rapport à: l'agriculture, les forêts, la gestion des ressources en eau, la faune, domaines naturels, la manutention des déchets, et les conflits en utilisation agricole.

Les conclusions clés sont que les Canadiens sont en train d'épuiser leur capital écologique d'une façon insustainable; ont besoin de réhabiliter leurs écosystèmes dégradés; et ne réussiront à passer au développement réhabilitatif et sustainable (du développement conventionnel exploitatif) que sans un accroissement majeur de la population.

Abstract — This paper summarizes the linkages between demographic development and environmental conditions that are of consequence for economic and social

well-being. Environmental impacts are examined relative to: agriculture, forestry, water resources management, wildlife and natural areas, waste management, and land-use conflicts.

Key conclusions are that Canadians are depleting their environmental capital in an unsustainable manner; need to rehabilitate their degraded ecosystems; and will succeed in shifting to rehabilitative and sustainable development (from conventional exploitive development) only without a major population increase.

Key Words – population, environment, environmental carrying capacities, sustainable development, rehabilitative development

Introduction

As a result of efforts by the Canadian delegation to the 1974 United Nations Population Conference in Bucharest, the Draft Action Plan on World Population was amended to incorporate the following principle:

In the democratic formulation of national population goals and policies, consideration must be given, together with other social and economic factors, to the supplies and characteristics of natural resources and to the quality of the environment and particularly to all aspects of food supply including productivity of rural areas.

The demand for vital resources increases not only with growing populations but also with growing *per capita* consumption. Attention must be directed to the just distribution of resources and to the minimization of wasteful aspects of their use throughout the world... (United Nations Economic and Social Council, World Population Conference, 1974, Report No. E/Conf. 60/19)

We suggest here that this internationally acknowledged link between population and the natural environment has not been sufficiently studied or recognized in the Canadian context. Our goal in this paper is therefore to draw attention to perceived relationships between human population and environmental issues and to both influence and advise the political process associated with these matters.

The Conservation Council of Ontario believes that Canada's current efforts to correct past environmental abuse are insufficient to the task. Continued

population growth will simply increase the chances of failure of this already insufficient level of effort aimed at environmental clean-up and resource rehabilitation.

The Problem

A dominant theme with respect to the Canadian economy is "progress through growth and development." The economy has become progressively more capital-intensive and technology-dependent. These trends are due, in part, to the need to compensate for the progressive debasement of natural ecosystemic capital. Growth and development have progressed due to persistent hygrading — the selective removal of the highest quality resources. This has occurred in forestry, in fisheries, in agricultural soils, and in locales for settlements. Husbandry practices that are adequate to offset the degrading effects of progressive hygrading have not been developed. Instead, our response has been to use capital (earlier savings) and new technology to upgrade or compensate for such low-valued ecosystem products and services as remain in our debased ecosystems. In turn, the forms of capital and technology that are actually applied then act to debase the ecosystems even further. This vicious circle persists in most parts of Canada to the present.

Ecosystemic debasement is not limited to the immediate locale in which progressive development occurs. A kind of domino effect spreads outwards from the centre of such development. This domino effect is due to ecological, economic, and social linkages in the man-nature ecosystem. The rate of population growth and the rate of ecosystemic degradation are now closely linked in Canada. Additional people, whether materializing through natural increase or net immigration, generally accept our conventional ideology of progress through exploitive growth and development. Thus the more people in a locale, the greater is the adverse impact locally and the stronger is the degrading domino effect on other locales. People affect the natural environment and its renewable resources base in small part through direct interactions involving individuals, and, in large part, through indirect connections via exploitive economic development.

Population Projections: An Overview

Population Size and Growth

Five possible scenarios for Canada's population growth from 1984 to 2031 are given in Figure 1. The fertility rate and net immigration assumptions on which they are based are presented in Table 1.

What this figure indicates is that, at least for the next 25 to 30 years, even under the lowest growth scenario (projection 1, in the Table 1), Canada is expected to experience population increase. Quite possibly, it will continue to expand as in scenario 4. For the most part, therefore, with regard to these scenarios, our analysis here, given the limitations of this overview report, is confined to commenting on the implications of an increase in population. Only occasionally do we contrast the environmental implications of a higher growth scenario (projection 4 or above) with a lower growth scenario (projection 3

**TABLE 1. ASSUMPTIONS UNDERLYING THE PROJECTION
IN FIGURE 1**

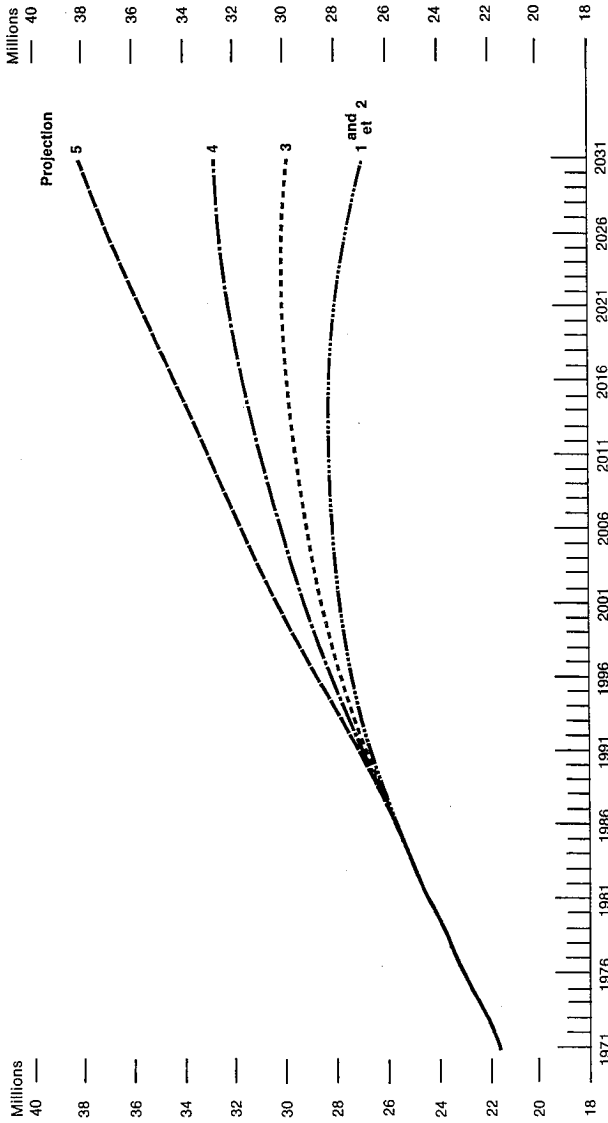
Projection Number	Fertility Rate (1)	Net (2) Immigration	Internal Migration Pattern (3)
1	1.4	50,000	A
2	1.4	50,000	B
3	1.66	50,000	B
4	1.66	100,000	A
5	2.2	100,000	C

(1) Current rate is approximately 1.7. A level of approximately 2.06 represents replacement fertility in Canada.

(2) Assumes 50,000 emigrants per year. A net of 100,000 would mean 150,000 immigrants per year. The 1987 immigration levels set by the government are 115-125,000 which would give approximately 65-75,000 net international migration.

(3) A=continuation of current trends; B=gradual return to westward flow; C=recent rates remain constant.

Source: Canada, Statistics Canada. 1985:41.



SOURCE: Canada, Statistics Canada. 1985:44.

FIGURE 1.
TRENDS IN TOTAL POPULATION OF CANADA, 1971-2031, ACCORDING TO FIVE PROJECTIONS

or below). Any increase in population size will result in increased demand for both renewable and non-renewable resources, and in increased problems associated with waste disposal. The central thrust of our analysis, therefore, is aimed at understanding and documenting the environmental implications of a larger population size *per se*, and to show that the *rate of growth* also has ecological consequences.

Population Distribution

The present population of Canada is unevenly distributed between the provinces (Table 2), and the environmental pressures in areas currently of high population density will rise as numbers increase, if distribution remains unchanged. Unequal distribution of immigrants between the provinces (Figure 2) exacerbates the effects of population concentration in the major recipient provinces — Ontario, Quebec and British Columbia.

Seemingly slight differences in annual net immigration rate can have numerical and environmental implications when influenced by slight changes in distribution patterns. For example, in 2006 Ontario could have either 34.6 per cent of the population (10,068,000) according to scenario 3, or 36.8 per cent of the population (11,076,800) according to scenario 4. This represents a difference of over one million people within 20 years, depending on whether a low growth or higher growth scenario prevails (Table 2).

Age Structure

Both the higher and lower growth scenarios show continued aging of the population, with the percentage under 17 declining, the percentage over 65 increasing, and the percentage 18-64 changing only slightly, at least until 35 years from now. We do not know what impact the change in age structure is expected to have on the environment. Thus we would suggest it be investigated. However, our impression is that, for the most part, the ecological implications of the changing age structure are of far less importance than those of population growth, decline or distribution.

Reform Initiatives

In March 1985, the Government of Ontario commissioned the Conservation Council of Ontario to provide an overview assessment of the extent to which conservation and development policies and programs pursued by the

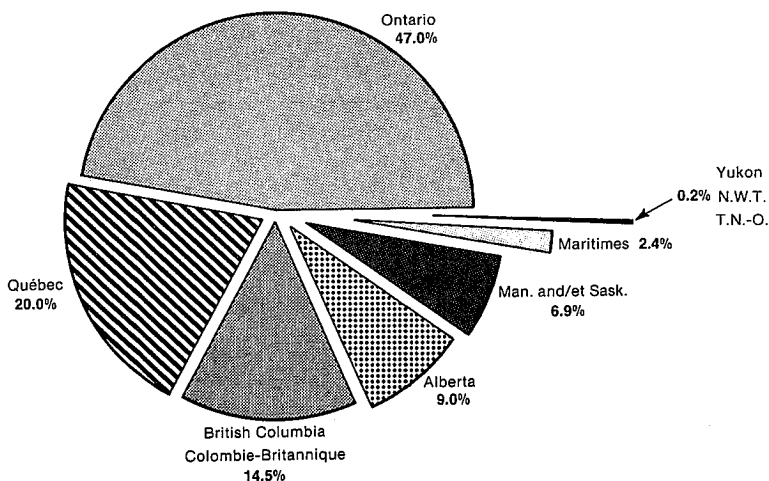
TABLE 2. POPULATION DISTRIBUTION AMONG THE PROVINCES AND TERRITORIES

Province	1983 Estimate	2006 (Projection 3)	2006 (Projection 4)
(Percent of Total Population)			
Newfoundland	2.3	2.2	2.5
Prince Edward Island	0.5	0.4	0.5
Nova Scotia	3.5	3.1	3.3
New Brunswick	2.8	2.6	2.8
Quebec	26.2	23.5	24.2
Ontario	35.4	34.6	36.8
Manitoba	4.2	3.9	4.1
Saskatchewan	4.0	4.2	4.4
Alberta	9.4	11.5	9.3
British Columbia	11.4	13.7	11.8
Yukon	0.1	0.1	0.1
Northwest Territories	0.4	0.2	0.2

Source: Canada, Statistics Canada. 1985:59.

Ontario Government and its agencies support the objectives of the World Conservation Strategy. The Council's report, "Towards a Conservation Strategy for Ontario," was released in April 1986. It identified 52 priority concerns in six major areas: agriculture, forestry, land-use, waste management, water resources, and wildlife and natural areas. In total, the report makes some 250 recommendations for improving the province's commitment to conservation and environmental protection.

Here, we draw on the Council's report to offer an overview of the impact, on these six major areas, of possible changes in the size, rate of growth, geographic distribution and age-structure of the Canadian population.



SOURCE: Canada, Statistics Canada. 1985:33

FIGURE 2. CURRENT AND PROJECTED DISTRIBUTION OF IMMIGRANTS TO CANADA (VALUES BASED ON A THREE-YEAR AVERAGE 1979-80 TO 1981-82)

Agriculture

Overview

Canadian agriculture is a technology- and capital-intensive industry dependent upon the availability of reasonably priced energy and capital. The days of labour-intensive operations on farms of 100 acres or less are likely to remain in our past. In those days we fed 30 people from 100 acres. Today, our society demands that our agriculture produce quantities and varieties of food capable of feeding three or four times the population level of a few decades earlier. A similar situation pervades the western industrialized world. In order to enjoy our cheaper food, to maintain a competitive position in international markets, and to achieve other social goals, we have resorted to living off our environmental capital.

The Issues

Soil erosion: the loss of exposed topsoil through surface water run-off and blowing winds;

Soil salinity: the concentration of salt in surface soil through intensive farming, a problem prominent in the Prairie provinces;

Loss of soil organic matter: the removal of essential nutrients, and the disruption of natural ecological cycles by the repeated harvesting of crops.

Surface and ground water pollution from agricultural activities: the introduction of excessive nutrients, chemicals, organic matter, and micro-organisms into the environment;

Loss of plant, animal, and microbial genetic diversity: the loss of valuable genetic material through, in particular, the trend towards monocultural practices; and

Energy use: the dependency of agriculture on energy, both for on-farm use and, more significantly, in processing crops and producing equipment, fertilizers, and pesticides.

In an effort to develop a more environmentally sound form of agriculture, a growing number of farmers have begun to experiment with a new style of food production, including zero-till and organic farming. As alternatives to conventional agriculture, these methods of production are only in their infancy, and several barriers must be overcome before they can be considered viable on a large scale. Organics, for example, requires a specialized market, and zero-till is heavily dependent on herbicides. Thus the primary emphasis is on modifying conventional agriculture. Proposed initiatives centre on improved education in conservation management practices, research into new methods and technologies, incentive programs, and modifications to existing legislation in order to promote sound conservation management of agricultural lands.

Although the current abundance of many agricultural products would tend to indicate that we should, in fact, be reducing our yields, the long-term demographic forces will likely result in an increased overall demand for cheaper agricultural products. The initial results of the increased demand will be a tendency towards increased intensive monoculture farming, larger farm size, and increased pressure to develop marginal land, including both natural areas (such as wetlands and woodlots) and non-prime farmland.

Our conclusion is that any appreciable increase in population will likely result in an acceleration of the existing environmental problems outlined above. In addition, the migration of young workers to the urban centres, combined with an aging population, will place a further strain on the traditional "family farm."

Forestry

Overview

The multiplicity of demands that our development process makes of our environment is well illustrated by the roles we expect our forests to play: a source of timber products; a habitat for wildlife; a source of energy and means of energy conservation (through shelter and shading offered); a setting for recreation; a means of conserving soil and water and of renewing atmospheric oxygen; a source of jobs; and a source of exports for a favourable trade balance.

As with agriculture, the current economic returns on forestry appear to belie any claims of impending crisis. Ontario, for example, still has about 24 million hectares or 26 per cent of its land area under "production" forest. This figure grows to an even larger area of about 38 million hectares if we talk of "productive" forest. (All figures on forest production used here are taken from Ontario, 1986.) There are 70,000 jobs in the forest industry and another 70,000 indirectly servicing that industry. In 1983, forestry earned Ontario a net trade surplus of \$2.04 billion. None of this sounds like there is a crisis looming, until we look at the difference between the rates of harvesting and restocking. There is a very big gap. In the fiscal year 1984-85, Ontario cut 217,000 hectares and restocked 123,000 hectares. And that appears to be considerably better than we have been doing in most recent years.

The Issues

Depletion of local supplies: the shrinking resource base due to overharvesting and inadequate reforestation;

Monoculture stands: an emphasis on specific species, due to the pressure to increase supplies, leading to a lack of diversity and hence a greater susceptibility to disease and insect infestation;

Pesticides: the use of pesticides, in particular chemical sprays, to control insect infestations, and the undesirable side effects on air, water and soil quality and thus on the health of local populations;

Pollutants: the impact of pollutants, in particular acidic precipitation, on stand health (see also the section on Waste Management below); and

Competing uses: the conflicts arising between the various possible uses of forest resources (see also the section on Land Use Conflicts below).

The use of forest products — whether for newsprint, lumber or fuel — will vary from region to region and in urban areas as compared with rural. Some fluctuation in the market can be expected from a restructuring of popu-

lation age and geographic location. However, since forest products are marketed globally, as well as locally, we cannot restrict our assessment of the impact of population changes to Canada alone. In general, an increase in population in industrialized countries will result in an increased demand for most forest products, at least in the medium term.

The increased demand for a dwindling resource will probably carry the following consequences: stronger pressure for chemical-based pest control to preserve the remaining stands; increased friction between competing uses; and increased pressure to increase yields through monoculture reforestation programs. Each of these potential developments suggests that increases in population in Canada are likely to further intensify pressures on our forest resource base.

Water Resources Management

Overview

Water touches everything in the lives of people, plants, animals, and micro-organisms. It is both central to our developmental activities — our production processes, our consumption patterns, and our lifestyles — and extremely difficult to manage in the interests of all members of society and all species of wildlife. The many demands made of our aquatic systems have put considerable stress on them, to the point where they cannot perform the roles expected of them without costly rehabilitation.

The way we treat our water is primarily a result of the value we attach to it. We have a false perception of plenty. Further, the direct charges to the consumer — the only costs visibly identified with water — are minimal. The true costs are partly hidden: partly in charges against the general tax levies of our governments; partly in non-monetary forms, such as poorer health, poorer wildlife and recreational opportunities; and partly in the form of an ever-growing bill to be paid by future generations for activities such as cleaning up the Great Lakes. Because we do not see these costs, we place little value on water. Thus we mistreat it, especially as a sink for our wastes.

Thanks to some minor crises, we are making progress. When we heard that Lake Erie was dying, we knew something was wrong with our water. The awareness grew when we learned that we could not swim in Lake Ontario. Closed beaches in municipal areas, plus talk of diversions to the American South have put water on the political agenda. The progress has, however, been slow. The approach to the problem is still largely on an issue-by-issue

basis. Thus we have reduced phosphorous loadings through detergent bans and more efficient sewage plants. We have controls on the emission of acutely toxic substances such as arsenic and mercury. We have controls on mine tailing loadings and on dumping wastes from ships. We also control the flows through hydroelectric power plants.

In Ontario, although not yet in other provinces, we are also beginning to see the introduction of an ecosystem approach where controls are based on the overall tolerance of the ecosystem, rather than on the individual polluter. This approach places the onus on industry to maintain the same standard of pollution abatement regardless of economic growth. This illustrates how ecosystem rehabilitation can be accommodated in production processes. What it also suggests, though, is that once the true costs of growth are incorporated into the production process (that is, the formerly externalized environmental costs are also included), continued increase in population size will place greater stress on our efforts to further rehabilitate aquatic systems, let alone prevent their on-going degradation.

The Issues

Water quality: the deterioration of water quality for human consumption, recreational use, and other species;

Rates of flow: the modification of natural areas (for example, the removal of woodlots and the draining of wetlands) in watersheds has resulted in poorer retention of rain waters, giving rise to downstream flooding, soil erosion, and ground water shortages;

Fisheries: the depletion of both inland and ocean fish stocks;

Consumption: the consumption of water for energy and industrial production processes, municipal use, and agricultural irrigation. Irrigation, in particular in the west, is having a serious impact on the level of underlying aquifers; and

Diversions: the possible ecological impacts of the proposed diversion from Canadian watersheds, in particular the Great Lakes, due to water shortages in other regions (poor ecosystem planning).

Most of these issues are regional although, through the domino effect, they will have an impact on all of Canada. The concentration of the population in Ontario, for example, would have a significant impact on the management of water resources in the Great Lakes basin.

Wildlife and Natural Areas

Overview

Our development process has led to enormous changes in our natural environment in most inhabited areas. Paradoxically, it is largely because of this that we are beginning to place a greater value on protecting wildlife and natural areas. In this cultural context, we look to our natural environment to provide us with opportunities not simply to “get away from it all,” but also to experience some sense of what Canada *was* like long ago.

In addition, increasing knowledge of the evolution of natural systems and of genetic resources is drawing our attention to the importance of maintaining genetic diversity for our own survival and the continued improvement of our lives. The protection of wildlife and of our natural habitats thus becomes increasingly important for such varied activities as timber production and cattle breeding.

Futhermore, we are slowly becoming conscious of the interests of animals, if not plants. There is a small, but we sense growing, interest on the part of humans on letting wildlife live as wildlife. Conflicts over how humans should regard the rest of nature will doubtless never disappear. However, we do sense that industrial societies are again beginning to recognize that people are a part of nature. This does not mean that there will be an easy transition from a world characterized by the exploitation of our environment to one in which there is a real respect for it, let alone a sense of symbiosis. We do not expect this.

The first steps, however, are to recognize the areas of conflict between human activity and wildlife and natural areas, and to attempt to maintain the sizeable and varied types of habitat required for a healthy natural ecosystem. Clearly, as our population increases in size and has improved access to areas remote from large settlements, it becomes more difficult to maintain such habitats. At the same time, as the population increases, the demand for such maintenance will intensify.

The Issues

Development: the development of natural areas for economic use, including tourism, forestry and cottages;

Recreation: the use of natural areas for recreational purposes, including hunting, fishing, camping and hiking;

Long-range transport of air pollutants: the impact of industrial pollution from sources removed from the natural area; and

Inflow of water-borne pollutants: the inflow of contaminants from neighbouring industries and communities.

Each of the above sources of pressure on wildlife and natural areas is due to increases in population. Any further increase in population will only exacerbate the situation. Natural ecosystems and species require a diverse and abundant supply of natural area lands, including wetlands, forests, grass plains, and tundra.

An increase in human population in certain parts of the country naturally affects some species of wildlife more than it does others. Diversity is threatened. In time, both our economy and our heritage also suffer. In the absence of a complete natural heritage strategy, including both a parks system and guidelines for integrating natural areas with agriculture, urban and industrial uses, we can expect to see increased pressure on natural areas. In particular, those areas adjacent to urban areas, or near major access routes, will be particularly vulnerable to incremental development.

Waste Management

Overview

One of the major roles the environment plays in our development is as a sink for our wastes. Its absorptive capacities in this regard are, however, limited. If Canada is to keep its options open for development in any region, then it will have to take measures to ensure that this absorptive capacity is not unduly stressed. It is possible to present a long list of the unacceptable threats to the environment resulting from our current waste disposal practices — from litter to bio-medical waste. In general, these threats arise from: (a) very large quantities of waste; (b) highly toxic wastes; or (c) wastes harmful to economic productivity or efficiency.

The Issues

Litter: the improper disposal of waste associated with the consumption of material goods;

Hazardous wastes: chemical wastes from industrial processes, which are released into the air and water;

Household toxics: consumer products containing hazardous materials;

Long-range transport of air pollutants: in particular, sulphur and nitrogen compounds which cause acidic precipitation;

Municipal solid wastes: those wastes requiring collection and disposal; and
Municipal sewage effluent: the inadequacy of existing treatment facilities to dispose of sewage adequately.

All of the above will be adversely affected both by a concentration of the population and by a general increase in population levels. They represent problems related directly both to the individual and to our economy in general.

Land Use Conflicts

Overview

The dispute over how we should utilize our land is a dispute over values. Conservation places great value on keeping options open for the future use of our land. This implies retention of certain productive capacities in a state similar to that which we regard as the natural state. Economics views land in terms of its development potential, which generally results in the closing of options under our current approach to development.

Land use conflicts arise out of a combination of overcrowding and excessive demands. Were there sufficient room, there would be no conflict. Canada may be a vast land in terms of its overall size, but the availability of prime land for specific activities — both economic and ecological — is at a premium. For this reason, the task of promoting conservation and environmental protection is not just one of modifying management practices, but also one of assessing the priorities for land use when the demand exceeds the available supply.

The Issues

Urban Expansion: the outward growth of major urban areas;

Agricultural area development: the development of prime agricultural land for non-farming uses, including severances for residential dwellings and industry;

Small community development: the expansion of smaller, semi-rural communities, usually in conjunction with major urban centres; and

Conversion of natural areas: the development of natural areas for recreational use as a replacement for land lost through other developments.

Land use conflicts will likely arise in areas of highest population density. Therefore, we can anticipate the greatest tension in those areas where an increase in overall population is supplemented by an internal migration. The

Fraser Valley in British Columbia, Southern Ontario and the St. Lawrence region are three areas where these conflicts are already intense. With population increase and concentration in these areas, the immediate pressure will result from housing and industrial expansion into outlying agricultural and natural areas.

Farm subdivisions for small-scale development presents yet another threat to agriculture land. The practice of severing lots for retirement homes, for example, gradually erodes the available acreage on each farm. The expansion of rural communities is being promoted as a means of relieving the development pressures on the larger urban areas. This is leading to increased pressure for standard services such as sewers, water supply, energy and transportation corridors. The development of natural lands for recreational purposes is an inevitable consequence of population increases. From the increased use of distant wilderness parks to the development of recreational facilities – including local parks, camps, cottages and amusement parks – residential development has a domino effect on all types of natural areas.

Conclusions

We cannot overemphasize the causal linkages that now exist between changes in demography and the depletion of our environmental capital. Similarly, we see this causal chain extending to link the changes in environmental health with the economic and social well-being of our society. Thus, any consideration of Canada's demographic future must consider the impacts on the environment. Although each of us individually has an impact on the environment, our greatest impacts arise indirectly, through the broad economic activity required to meet our collective demands.

One of the most important steps towards improving our economic and social well-being is to improve the management of our environment and natural resource base. Similarly, one of the most important steps to improving environmental conditions lies in controlling our rate of population expansion and relating population distribution to carrying capacities of our natural ecosystems. Our concern is that even a moderate increase in population levels (as outlined in scenario 3) will work to counter the efforts to clean up existing problems. Economic sectors which are already drawing upon the environmental capital – agriculture, forestry, fisheries, and mining, for example – will find an increased overall demand, magnified by exploitive ways, working against efforts to conserve a dwindling resource.

With regard to the concentration of the population in specific regions, we can expect that this concentration will further exacerbate those environmental problems which are localized — in particular, water quality and flow, waste management, and land use conflicts. We do not expect an aging population to cause any significant increase in environmental disruption, although an aging population in rural communities will undoubtedly have an impact on the traditional farming lifestyle. In addition, we do not rule out the possible effects of changing consumption and recreation patterns associated with an aging population.

In summary, it is our conclusion that policy changes designed to influence demographic factors should be closely related to our ability to control environmental problems and conserve natural resources.

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