Looking back over the twenty-first century, future historians may well see it as even more tumultuous than the century that preceded it. In the twentieth century the human population more than tripled, average life expectancy at birth more than doubled, and real gross domestic product increased nearly forty times. Huge numbers of people experienced very real improvements in living standards as economic growth spread around the world, yet huge numbers were living in extreme poverty when the century ended. Political systems from Nazism to Communism rose and fell, while democracy in its various forms survived. Well over 200 million people died in wars and conflicts, and nuclear energy was unleashed with the specific purpose of annihilating many tens of thousands in a flash. Seemingly magical technologies in transportation, communication, entertainment, and computation proliferated, as did enormous cities and corporations with global reach. Societies were transformed for better and worse, as was the planet itself.

Despite claims to the contrary, nature was not conquered. Instead, human societies and economies became ever more dependent on increasing quantities of materials, energy, and wastes (i.e., increasing “throughput”), as well as transformation of land as more and more was brought into direct use by humans. Toward the end of the twentieth century, attempts to gain a quantitative picture of these environmental changes yielded new indicators such as the ecological footprint, the human appropriation of the net products of photosynthesis (HANPP), and various measures of direct and total material throughput—all of which, with some local exceptions, point in the same threatening direction. In the second decade of the twenty-first century, humanity’s impact on the rest of nature is on the rise and shows little sign of reversing. In the language of planetary boundaries, we are exceeding the safe operating capacity of the planet to sustain us.\(^2\)

At the same time as we are being constrained by what earth systems can tolerate, incomes and wealth are becoming more unequally distributed, the global financial system is faltering, economies are struggling, and confidence in political systems to address these problems is in decline. These trends are more than disturbing; they portend catastrophe. But their continuation is not given. A brighter and genuinely more prosperous future may still be possible: one in which everyone lives well without depleting and degrading natural systems and where all humans and all nature flourish. However, such a future will only come to pass if we think hard about our predicament, examine a wide range of possibilities, and strive for what we want rather than just accepting what comes our way.

Among these possibilities, there needs to be a reconsideration of the priority given to the pursuit of economic growth, especially in developed countries, where, arguably, the costs of economic growth have...
begun to outweigh the benefits. Biophysical constraints to continued growth are becoming more apparent. There is mounting evidence indicating that higher incomes do not make people happier beyond a level of per capita incomes far surpassed by many in developed countries, and, despite decades of substantial economic growth, many social and environmental problems remain. If adopted, a thoughtful strategy in
tigate how achieving the ecological benefits of lower growth is compatible with social justice and social welfare/equality objectives.

EXPLORING ALTERNATIVES TO ECONOMIC GROWTH

There are many ways of thinking about alternative futures. One that I have found fruitful is to develop empirically based simulations of national economies so that we can examine key trends and identify ways of strengthening desirable ones and of turning undesirable ones around. My work has been focused on national economies because most of the necessary data for analyzing economies is most readily available at that level. Having said that, it is clear that we also need to understand likely and possible futures at the sub- and super-national levels, a demanding agenda indeed.

The purpose of scenario analysis is not to develop a specific prescription for the future. Rather it is to see if the future—which will be very different from the past whether we decide to make it that way or not—could be attractive even in the absence of continued economic growth. Not that zero economic growth should replace continuous economic growth as the overarching objective of economic policy. But the prospect of reduced, zero, or even negative economic growth should not stand in the way of the increasingly urgent measures required to reduce the burden of our economies on nature. If we fail to reduce this burden, then the possibility of a good life for all will disappear.

THE LOWGROW MODEL

When I was a Ph.D. student at the University of British Columbia in the 1960s, I was most fortunate to be supervised by the distinguished progressive economist Gideon Rosenbluth. Under his guidance, I developed and applied a methodology for estimating the material “throughput” of an economy, based on the law of conservation of matter. The fundamental principle, which applies to all monetized economies, is that associated with each expenditure in the economy, there is a direct and indirect flow of material inputs, and ultimately, a disposal of an equal amount of wastes. This is true for all expenditures, whether they be on goods or services or for current consumption or investment, though the difference between throughput for equal expenditures varies tremendously according to what is purchased. For example, energy-intensive products such as transportation result in much greater
emissions of greenhouse gases than the services provided by hairdressers.

Over the years, I kept in touch with Gideon. Still, I was pleasantly surprised when, about ten years ago, he suggested that we collaborate on the “growth question.” I had just completed my term as dean of the Faculty of Environmental Studies at York University, having resumed my academic career in the mid-1990s, and I was ready to embark on a substantive research project. It was an opportunity and a privilege to work with Gideon again. Even in his eighties he was an intellectual force to be reckoned with.

Although it was not our original intention to build a macroeconomic simulation model, we found a common interest in doing so. We were skeptical of the mainstream view that endless economic growth was feasible, desirable, and essential for full employment, eradication of poverty, and significantly reduced impacts on the environment. We were also unsatisfied by critiques of such a view that did not also provide an account of how an economy might function in a radically different way. So we set ourselves the task of answering the following question: is it possible to have full employment, no poverty, fiscal balance, and reduced greenhouse gas emissions without relying on economic growth? We developed LowGrow, a simulation model of the Canadian economy specifically designed to answer this question. Our results suggested the possibility that an attractive set of social, economic, and environmental objectives could be met in the absence of economic growth. This led us to the conclusion that economic growth could and should be relegated to its proper secondary place as a policy objective.

All models are simplifications of whatever they represent. This is as true of computer models as it is of model aeroplanes and model villages. Whether they are satisfactory simplifications depends on their intended uses. A model plane may be designed to closely resemble a particular commercial or military jet but rest on a stand, unable to fly. Another model might be designed to fly powered by hand, an elastic band, or an onboard engine. Yet it may only vaguely resemble a full-size aircraft. Which of these two model planes is better depends on whether you want a visual replica of a real plane or something that flies. Building simulation models of an economy is not that different.

The overview of LowGrow that follows may appear tedious, but it is necessary to give some idea of what lies behind the scenarios that it generates. Figure 1 shows the simplified structure of LowGrow. Macro demand is determined in the normal way as the sum of consumption expenditure, investment expenditure, government expenditure, and the difference between exports and imports. Their sum total is GDP (gross domestic product) measured as expenditure. There are separate equations for each of these components in the model, estimated with Canadian data from about 1981 to 2005, depending on the variable. Production in the economy depends on employed labor and employed capital (i.e., buildings, equipment, software, and infrastructure). Changes in productivity from improvements in technology, labor skills, and organization are captured depending on time. Macro supply is shown at the bottom of figure 1, and it determines and is determined by employment and capacity utilization shown in the center of figure 1.

There is a second important link between macro demand and production. Investment expenditures (net of depreciation), which are part of macro demand, add to the economy’s stock of capital, increasing its productive capacity. Also, capital and labor tend to become more productive over time. It follows that, other things equal, without an increase in macro demand, these increases in capital and productivity reduce employment: as labor becomes more productive over time, less is required to produce any given level of output. On this basis, economic growth (i.e., increases in GDP) is needed to prevent unemployment rising as capacity and productivity increase.

Population is determined exogenously in LowGrow, which offers a choice of three projections from Statistics Canada. Population is also one of the variables that determines consumption expenditures in the economy. The labor force is estimated in LowGrow as a function of GDP and population.

“A brighter and genuinely more prosperous future may still be possible: one in which everyone lives well without depleting and degrading natural systems and where all humans and all nature flourish.
LowGrow includes features that are particularly relevant for exploring possibilities for an economy that is not growing. It includes emissions of carbon dioxide and other greenhouse gases, a carbon tax, a forestry sub-model, and provision for redistributing incomes. It measures poverty using the United Nations’ Human Poverty Index (i.e., HPI-2 for selected Organisation for Economic Co-operation and Development, or OECD, countries). LowGrow allows additional funds to be spent on health care and on programs for reducing adult illiteracy (both included in HPI-2) and estimates their impacts on longevity and adult literacy with equations from the literature.

Expenditures on anti-poverty and environmental programs are automatically added to government expenditures in LowGrow. Other changes in the level of government expenditures can also be simulated in LowGrow through a variety of fiscal policies, such as an annual percentage change in government expenditure that can vary over time and a balanced budget. LowGrow keeps track of the overall fiscal position of all three levels of government combined (federal, provincial, and municipal) by calculating total revenues and expenditures and by estimating debt repayment based on the historical record. As the level of government indebtedness declines, the rates of taxes on personal incomes and profits in LowGrow are reduced endogenously, which is broadly consistent with government policy in Canada.

In LowGrow, as in the economy that it represents, economic growth is driven by: net investment, which adds to productive assets, growth in the labor force, increases in productivity, growth in the net trade balance, growth in government expenditures, and growth in population. Low- and no-growth scenarios can be examined by reducing the rates of increase in each of these factors singly or in combination.

A BUSINESS-AS-USUAL SCENARIO

It is convenient to start analyzing low- and no-growth scenarios by establishing a base case with no new policy interventions. This is the “business-as-
usual” case illustrated in figure 2 and describes what would happen in the Canadian economy if the trends in the years before 2005 were to continue for another thirty years. It is not a prediction of the future, but rather a benchmark against which to compare alternative scenarios.

In the business-as-usual scenario, between the start of 2005 and 2035, real GDP per capita more than doubles; the unemployment rate rises, then falls, ending above its starting value; the ratio of government debt to GDP declines by nearly 40 percent as Canadian governments continue to run budget surpluses; the Human Poverty Index rises, largely due to the projected increase in the absolute number of unemployed people; and greenhouse gas emissions increase by nearly 80 percent.

A LOW-OR NO-GROWTH SCENARIO

A wide range of low- and no-growth scenarios can be examined with LowGrow. One promising scenario is shown in figure 3. Compared with the business-as-usual scenario, GDP per capita grows more slowly, leveling off around 2028, at which time the rate of unemployment is 5.7 percent. The unemployment rate continues to decline to 4.0 percent by 2035. By 2020 the poverty index declines from 10.7 to an internationally unprecedented level of 4.9, where it remains, and the debt-to-GDP ratio declines to about 30 percent, to be maintained at that level to 2035. Greenhouse gas emissions are 31 percent, lower at the start of 2035 than in 2005, and 41 percent lower than their high point in 2010.

What does it take to achieve the kind of outcomes illustrated in figure 3? One advantage of a simulation model like LowGrow is that it helps answer this question. The scenario is based on a number of key changes in the model which could come about by the cumulative changes in autonomous behavior of individuals and organizations, by policy measures introduced by government, or, most likely, by some combination of the two.

The scenario in figure 3 results from a variety of changes, some more controversial than others, that would be required to transform the business-as-usual scenario in figure 2 into an attractive scenario in which economic growth is not required to meet economic, social, and environmental objectives. These changes include:

CONSUMPTION

Consumption is one of the main driving forces of the economy. In a successful economy not geared to growth, we would expect the pattern and level of consumption to be very different from a growing economy. For example, well-being would be enhanced with a greater emphasis on public goods, which includes the environment; on shared provision of private goods, as we are already seeing with cars and bicycles in many cities; and on services, rather than commodities. More controls on the content and placement of advertising would be helpful.

INVESTMENT

In economic terms, investment refers to the purchase of new infrastructure, buildings, and equip-
ment. Some of this investment replaces what has been worn out. The rest adds to the stock of built capital and is a major source of economic growth since it increases the productive capacity of the economy. A viable low- or no-growth scenario requires major changes in the quantity and type of investment. These changes will transform the capital stock so that environmental impacts are reduced, degraded ecosystems are restored, renewable materials and energy are substituted for non-renewables, and people are better served in terms of housing, transportation, education, health care, and other social services.

EMPLOYMENT

One aspect of the dilemma of growth is that with an expansion of the capital stock, labor becomes more productive. Unless there is economic growth, an inevitable consequence is unemployment, since fewer and fewer people are required to produce any given level of output. A complicating factor is that in most economies, paid employment is the primary source of income for most adults, so higher rates of unemployment threaten an increase in poverty. This aspect of the dilemma can be overcome by several changes. First, in a more socially just economy—especially one with an aging population—there would be more jobs in human services sector where increases in labor productivity are likely to be less than in the production of goods. Second, by strengthening the social safety net and establishing a guaranteed minimum income, we would rely less on income from employment for distributing the output of the economy via wages. Any concern that this might reduce the incentive to work is less problematic in an economy in which growth is no longer regarded as an imperative. Third, a reduction in average hours spent in paid employment provides a means by which people can benefit from increases in labor productivity other than through an expansion of economic output. Beyond some level of material well-being—different for each person, but likely within the range already surpassed on average in developed economies—more leisure makes a greater contribution to well-being than a higher income.

POVERTY

The idea that poverty can be eradicated through the trickle-down effects of economic growth has been shown wanting. Poverty is more than a matter of inadequate income. It is also about social exclusion, which is closely related to the distribution of income and wealth and not just their amount. Recent experience in many developed countries has shown little or no increase in real living standards for the majority of people despite economic growth, the gains from which have been enjoyed by a relatively small proportion of the population. It is clear that more focused anti-poverty programs that address the social determinants of illness and provide more direct income support are required to eliminate poverty. Such measures are included in the scenario shown in figure 3.

TECHNOLOGICAL CHANGE

Technological change has been an important aspect of human progress ever since the Stone Age. Today’s seemingly magical technologies in areas such as communications, entertainment, medicine, and transportation represent a rapid acceleration of trends that have been in play for millennia. To say that new technologies are often a double-edged sword is a cliché, itself a metaphor based on a technology that in
of better measures of success than growth in GDP to drive policy. There are several candidates, such as the UN’s Human Development Index and the Genuine Progress Indicator, both of which show that prosperity and economic growth are only loosely related. Climate change is only one of several environmental problems facing humanity in the twenty-first century. A comprehensive approach will require limits on throughput, comprehensive ecological fiscal reform where, for example, taxes are shifted from labor to activities that cause environmental damage and space is used less aggressively through better land-use planning and habitat protection.

LowGrow is a modest first step in the development of tools grounded in economics for describing alternative futures in which economic growth is not given priority. Numerous other models have been created with the clear intention of showing how economic growth can be sustained, even accelerated, while the burden on nature is reduced. And yet other models—such as World 3, which was used to develop the famous scenarios in The Limits to Growth—provide interesting, even inspirational scenarios without economic growth, but they were not designed according to established principles of economics. Furthermore, LowGrow was built with data for Canada and, while the broad conclusions that emerge from it apply to other developed economies, national differences would no doubt yield rather different numerical results. Since its publication a few years ago, there has been considerable interest in LowGrow in many parts of the world, and a few researchers in other countries (Sweden, New Zealand, Germany) have adapted LowGrow with mixed results.

During the past two years, Tim Jackson and I have been collaborating on GEMMA, a new macroeconomic model of a national economy designed to address the following questions:

1. Is growth in real economic output still required in advanced economies in order simultaneously to maintain high levels of employment, reduce poverty, and meet ambitious ecological and resource targets?

2. Does stability of the financial system require growth in the “real” economy?

3. Will restraints on demand and supply—for example, in anticipation of or in response to
ecological and resource constraints—cause instability in the real economy and or financial system?11

These important questions require better answers than are currently available, but for which credible answers are needed if we are to make the thoughtful, deliberate transformation of our economy that the mounting evidence of environmental degradation, financial instability, and increasing social and economic inequality indicates is necessary. We hope that GEM-MA will provide insights into these problems and will produce more comprehensive and detailed scenarios showing that we can live well in an economy that does not depend on economic growth. Most important of all, we will be able to free ourselves to think more broadly and more imaginatively as we contemplate the end of growth.

Peter Victor is a Professor in Environmental Studies at York University. In 2011 his work on ecological economics and managing without growth was recognised through the award of the Molson Prize in the Social Sciences by the Canada Council for the Arts. He is currently serving as Senior Scholar with the Center for Humans and Nature.

NOTES