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INVITED PAPER

# IT IS TOO LATE TO ACHIEVE SUSTAINABLE DEVELOPMENT, NOW LET US STRIVE FOR SURVIVABLE DEVELOPMENT

*Dennis L. Meadows*[1]

## Abstract

The most widely-used definition of sustainable development was coined originally by the Brundtlund Commission: "to meet the needs of the present without compromising the ability of future generations to meet their own needs." The effort to meet those lofty goals has lead to hundreds of books and thousands of meetings around the world - but little consensus or concerted action. The failure is easy to understand when you finally acknowledge that the definition is an oxymoron.

Put the definition into the context of two facts. First, there is no resource category, renewable or nonrenewable, that is being used sustainably today on a continental basis. Second, conventional wisdom, as exemplified, for example, by a recent World Bank report, projects that," By the year 2030, the world will have nearly 3 billion more people than now, 2 billion of them in countries where the average person earns less than $2 a day."

It is time to concede honestly that ecological, political, and economic realities make it impossible to meet the needs of either present or future generations except at population levels far below the current 5.6 billion. The level of global population that can be sustained at decent living standards without damage to the global ecosystem is not precisely calculable, but it is below current levels. Therefore we face one of two futures – a world with a few rich and many poor held in check and in place by poverty and by force or a population "die-back" which takes the population back down to sustainable levels. Either is still conceivable, one or the other will manifest before 2050. Once we are honest about our future, it becomes interesting and useful to begin exploring options and strategies for "Survivable Development."

**KEYWORDS:** *Sustainable Development, Survivale Development, Overshoot and Collapse, Global Simulation, Global Food Problem, Population Growth*

## 1. Preamble

It is extremely important to note at the outset of this paper, that several questions I pose towards the end of this talk have not been the focus of my objective research. The issues dealt with here do arise directly out of my research, and I have reflected on them extensively. But many of the thoughts I offer here are informed intuitions rather than research findings. So the following is certainly incomplete and probably full of errors. My only defense is that I consider the issues to be at the same time profoundly important and almost totally ignored by serious scientists. So the criticisms which I may provoke here should serve the useful purpose of stimulating others to do a much better job.

1 Ph.D., Institute for Policy and Social Science Research, University of New Hampshire, Durham, NH 03824, USA

My challenge to you is summarized nicely by a quote in the Satires of Quintus Horatius Flaccus, 35 B.C. "If you know better precepts than these, candidly tell me; if not, follow them as I do."

## 2. Introduction to Sustainable Development

The most widely-used definition of sustainable development was coined originally by the Brundtland Commission in their report, *Our Common Future:*

> to meet the needs of the present without compromising the ability of future generations to meet their own needs.

Everyone getting what they want, now and forever, is a wonderfully attractive notion, because it frees politicians from dealing very concretely with the problems associated with redistribution across space or time. As a consequence the phrase has become very popular; it has been the focus of hundreds of books and thousands of conferences over the past decade. Most nations have officially designated commissions or committees on sustainable development. The tenor of these can be judged by looking at the vision underlying the United States' President's Council on Sustainable Development.

> We are committed to the achievement of a dignified, peaceful, and equitable existence. We believe a sustainable United States will have an economy that equitably provides opportunities for satisfying livelihoods and a safe, healthy, high quality life for current and future generations.

Every politician and most industrial leaders enthusiastically support sustainable development, at least until someone finds a way of proving that its attainment would require them to give up any short-term advantage.

As an abstract goal, "sustainable development" is attractive. But until it incorporates explicit and well-founded notions of the globe's carrying capacity, it cannot serve as a concrete basis for planning. Worse, the enthusiasm for sustainable development diverts our attention from a set of issues that we need to address now.

## 3. Modes of Transition from Growth to Equilibrium

As illustrated in Figures 1, 2, and 3, global population, global industry, and global use of materials, for example metals, are all growing exponentially at rates that have produced doublings every 2-3 decades. These three illustrations and all of those that follow in this report are taken from our recent book, *Beyond the Limits* (Meadows *et al.*, 1992). These three are from (*BtL*, pp. 4,5, & 82).

There are only three possible futures for the exponential trends shown in the figures above. They are shown in Figure 4 (*BtL*, p. 108).

It was once assumed implicitly that physical growth on the planet could continue more or less indefinitely, that Figure 4a was our foreseeable future. Now the growing recognition of world-wide environmental stress has brought most analysts to acknowledge that the earth has a finite carrying capacity which we are already near. Thus sustainable development will require population growth essentially to end. And it will require that the flow of energy and materials through the environment come into balance with the productive and the assimilative capacities of natural systems.

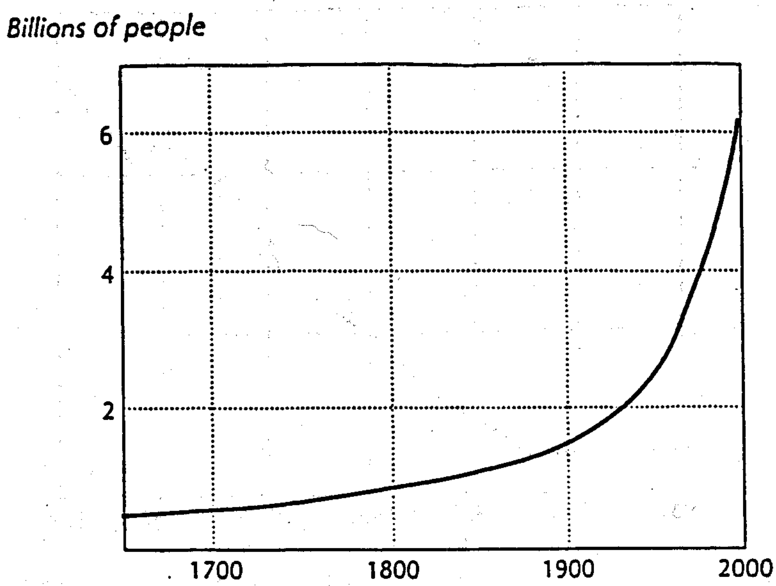



Figure 1. World population has been growing exponentially since the beginning of the Industrial Revolution. In 1991 the world population growth rate was estimated to be 1.7%, corresponding to a doubling time of 40 years.

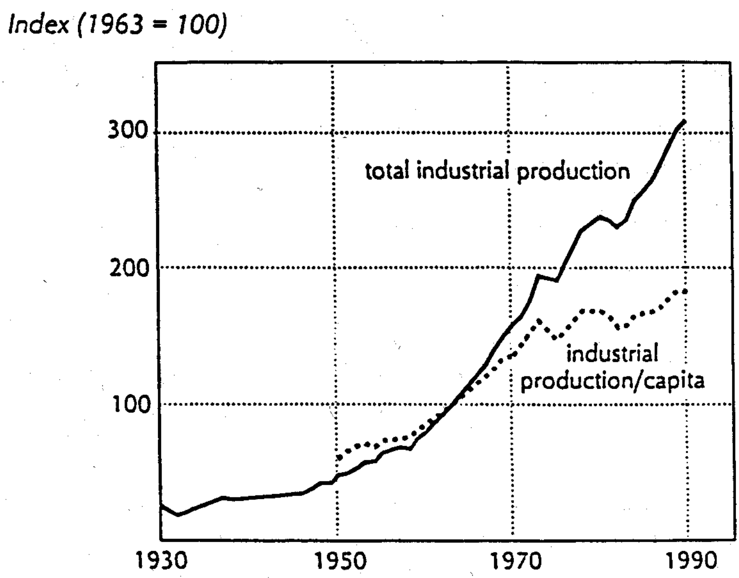



Figure 2. World industrial production, relative to the base year 1963, shows clear exponential increase, despite fluctuations due to oil price shocks. The 1970-1990 growth rate in total production has averaged 3.3% per year. The per capita growth rate has been 1.5% per year.

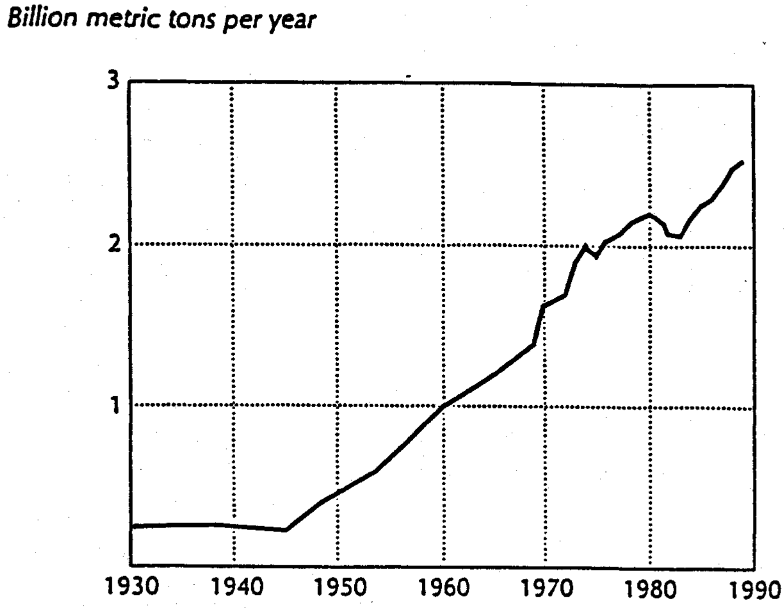
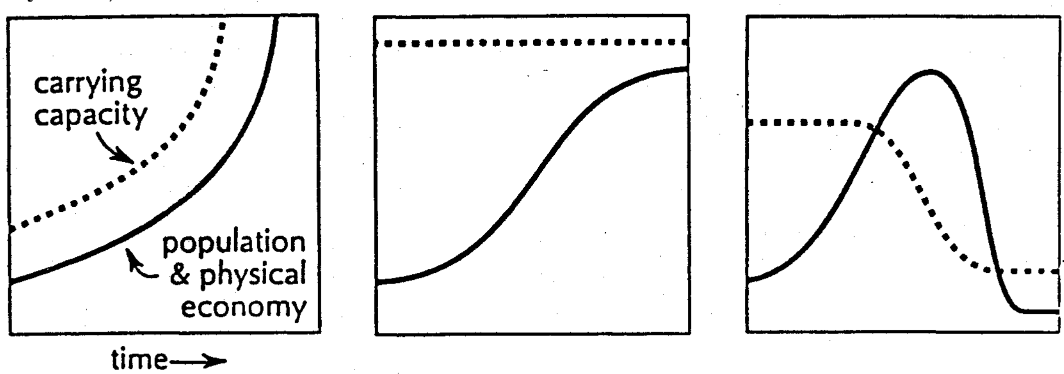



Figure 3. Total world metal consumption showed a slight downturn in the economic recession of the early 1980s, but then continued to rise.




4a– Continuous growth

4b– Sustainable development

4c– Overshoot & collapse

Figure 4. There are three possible paths through which a population can approach its carrying capacity: 4a– continuous growth, 4b– sustainable development, and 4c– overshoot and collapse.

But history has only shown us one way to stabilize population in an acceptable fashion - by raising the material well-being of the general populace. So efforts at sustainable development today mainly seek to stimulate (and sometimes redistribute) economic growth while reducing the environmental damage it entails. The image of the future that is now inherent in every discussion of sustainable development is Figure 4b. Population growth slows as birth rates fall to equal the low death rates enjoyed by a global population with a uniformly long average lifetime.

There is some historical basis for expecting population to quit growing; that has happened

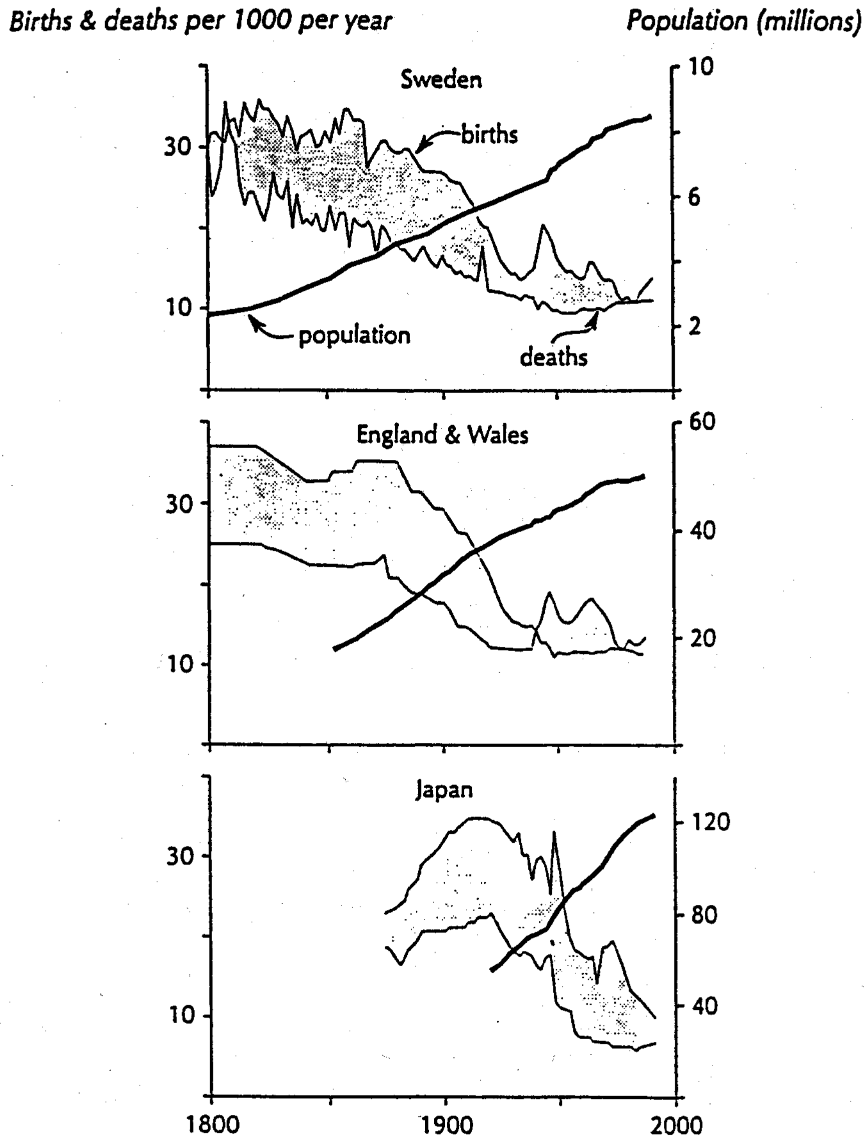



Figure 5. In the demographic transition a nation's death rate falls first, followed later by its birth rate. Sweden's demographic transition occurred over almost 200 years, with the birth rate remining rather close to the death rate; Japan took slightly more than a century.

already in many of the wealthy nations. Through a process called the *demographic transition* populations evolve through three stages. First, while the country is poor, the birth and death rates are both high and approximately equal; population growth is slow. Then economic growth occurs. It produces many social and economic changes that increase life expectancy, lowering the death rate. However, birth rates are still high and population growth is rapid. In

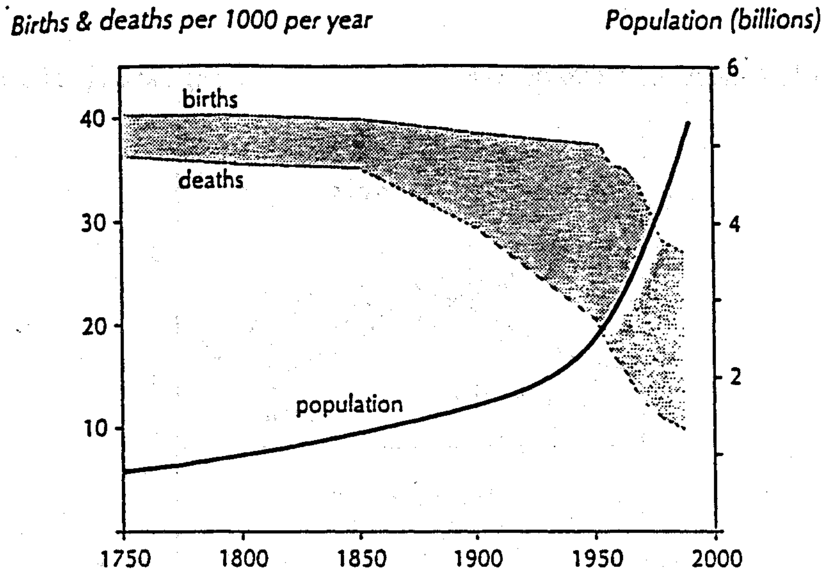



Figure 6. The shaded gap between births and deaths shows the rate at which the population grows. Until about 1970 the average human death rate was dropping faster than the birth rate, and the population growth rate was increasing. Since 1970 the average birth rate has dropped slightly faster than the death rate.

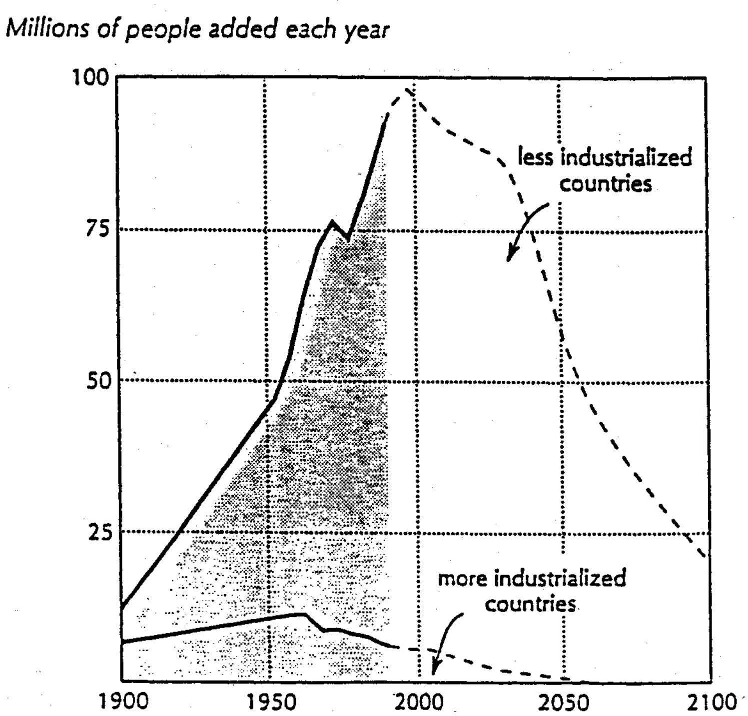



Figure 7. The number of people added to the world population each year has increased enormously and is projected to go on increasing for another decade under the World Bank's forcasts. These forecasts are very optimistic; they assume rapid drops in birth rates in the less industrialized countries.

the third stage, birth rates decline until they are approximately equal to the low death rates, and population growth is again slow or nonexistent. This process is illustrated in Figure 5 (*BtL*, p. 30) for three industrialized nations: Sweden, England & Wales, and Japan. Notice that it required well over 100 years to complete the transition in each of these lands.

Demographic statistics for the entire globe do show the first phase of the transition. As seen in Figure 6 (*BtL*, p. 25), the death rate (shown in persons/1000 people per year) did start to decline around 1850. Only after World War II did the birth rate start to show significant declines. However, even today, the death rate is falling about as fast as the birth rate. The results are shown in Figure 7 (*BtL*, p. 26), which indicates the number of people added to the global population (births-deaths) each year between 1900 and 2100. The current rate of increase is almost 100 million people per year. And conventional wisdom holds that the growth will stay near this level through the first several decades of the next century. United Nations experts expect that the global population will still be growing at the end of the next century, by which time global population will be 10-12 billion. And most of those added will be in the poorer nations.

Note that there is no comparable historical basis for expecting self-limitation in material consumption. We have a number of examples where important countries have achieved zero population growth through peaceful, internal means. I do not know of a single case where a major country has willingly stabilized its economic output and material standard of living.

Of course there are myriad examples of efforts to understand and to stabilize specific flows of energy, raw material, or pollution through the natural systems of a country. Some examples of effective efforts to reduce specific flows globally are even available - for example by the end of 1993 global production of chloro fluorocarbons had declined to just 40 percent of their peak levels in 1988 (Brown *et al.*, 1994). And the papers presented at this conference describe a very diverse variety of efforts to monitor and reduce environmentally-damaging flows. But there is no national effort to reduce all flows and no widespread to limit growth in material well-being for a population. Quite the contrary. Politicians everywhere are convinced that their constituents need much more growth in their standard of living.

Indeed most analysts urgently call for economic growth to continue long enough to give a decent living standard to the several billion people on the globe that live in poverty and to the new people who will be added to the global population. Sustainable development is therefore really used to mean sustainable growth - for an indefinitely long period during which we hope to continue getting all the goods from an expanding economy while somehow drastically reducing all the bads, meanwhile encouraging people to have lower birth rates. What would this really look like? What changes would we have to imagine, for this notion of sustainable development actually to be realized.

# 4. Dimensions of the "Sustainable" Transition

Over the past twenty years, I have worked intermittently with my colleagues on a global simulation model of population and economy, World3, that gives some answers to the above questions. By incorporating in the model a diverse, comprehensive, and profoundly optimistic set of assumptions about political, economic, cultural, and technological changes, World3 can give us a picture of the world in 2100 that has finally stabilized its population through pursuit of sustainable development with its reliance on sustained economic growth and the workings of the demographic transition. The outlines of that world are shown in Figure 8 (*BtL*, p. 121).

In Figure 8 curves for global aggregate population, unexploited nonrenewable resources,

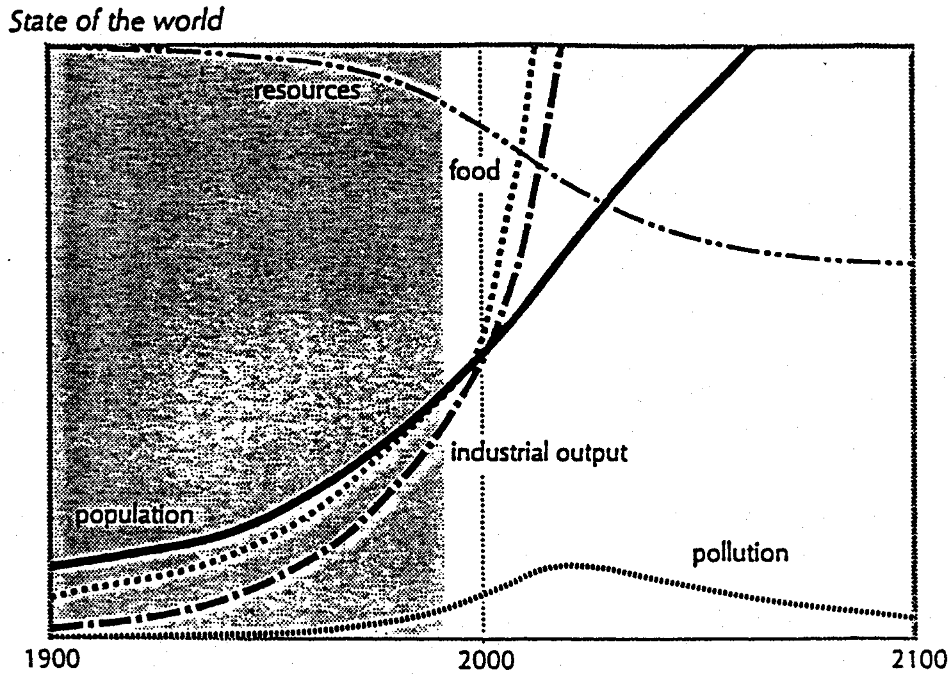



Figure 8. If all physical limits to the World3 system are removed, population grows to about 15 billion and levels off in a demographic transition. The economy grows until by the year 2100 it is producing 55 times the 1990 level of industrial output and 8 times the present level of food.

ambient levels of persistent pollution, food production, and industrial output trace out the gross physical dimensions of the future economy and society that are sought implicitly by the proponents of sustainable development.

World3 incorporates four different important physical limits on growth. Into the model we incorporated a limited stock of arable land, finite possibilities for yield from each hectare, a limited, though very large, stock of unexploited nonrenewable resources, and finite capacity of the global ecosystem to assimilate pollution.

When these physical limits in the World3 system are effectively removed, population grows to 15 billion and then levels off through the influence of a global demographic transition. The economy grows until in the year 2100 it is producing 55 times the 1990 level of industrial output and 8 times as much food as it did in 1990. This growth is achieved while using only 5 percent as many nonrenewable resources and producing only 15 percent as much pollution as today. In other words, the resource intensity of industrial growth is reduced by a factor over 1000. To achieve this outcome the world's economies would have to accumulate, site, and operate 60 times as much productive capital in the twenty-first century as they did during the whole of the twentieth century.

The current discussions about sustainable development are only useful to those who think the numbers and ratios cited above are feasible. I do not. As I will show, current food production levels are already stressing the ecosystem. And many of the papers presented at this meeting show that the current stock of capital is already deteriorating many important air, water, and soil resources. There is widespread evidence that we are already above the sustainable limits, that we have already overshot the carrying capacity.

# 5. Symptoms of Overshoot

When society and economy are burdening the environment above sustainable levels you would expect to see a variety of symptoms. For example you would detect wide-spread evidence of:

- falling stocks of ground waters, forests, fish, soils.
- rising accumulations of wastes and pollutants.
- growing amounts of capital, energy, materials, and labor devoted to exploitation of more distant, deeper, or more dilute resources.
- more and more capital, energy, materials, and labor required to compensate for what were once free natural services (sewage treatment, flood control, air purification, pest control, restoring soil nutrients, preserving species).
- capital, energy, materials, and labor diverted to defend or gain access to resources that are concentrated in a fewer and fewer places (such as oil in the Middle East).
- deterioration in physical capital, especially in long- lived infrastructure.
- reduced investment in human resources (education, health care, shelter) in order to meet consumption needs or to pay debts.
- increasing conflict over resources or pollution emission rights. Less social solidarity, more hoarding, greater gaps between haves and have-nots.

As the papers presented at this conference and the daily media make clear, all of those symptoms are evident today. If you accept this assessment, you are led to Figure 4c as a more appropriate vision of our future. Indeed, Figure 4c, which we label *overshoot and collapse* illustrates the dominant mode of behavior that has been observed in closed, natural systems when enough constraints are removed that one species can temporarily enter into a phase of uncontrolled exponential growth.

Overshoot and collapse is also the scenario that emerges from World3 when realistic assumptions about social delays, economic policies, and physical limits are reinserted in the model.

No single run of our model can be considered as a prediction of the future. Each simulation run illustrates general properties of a possible future. But a very typical example of what emerges in our model when society tries to sustain traditional policies related to economic and demographic growth is shown in Figure 9 (*BtL*, p. 135).

In this scenario the world society proceeds along its historical path as long as possible without major policy change. Technology advances in agriculture, industry, and social services according to established patterns.

The global population in this scenario rises from 1.6 billion in 1900 to over 6 billion in the year 2000. Total industrial output expands by a factor of 20 between 1900 and 1990, and it does so while using less than 15 percent of the earth's total stock of nonrenewable resources. In 1990 over 85 percent of these resources remain. Pollution in that year has just begun to rise significantly. Life expectancy is increasing, services and goods per capita are increasing, food production is increasing. But major changes are just ahead.

Just after the simulated year 2000 pollution rises high enough to begin to affect the fertility of the land. At the same time land erosion increases. Total food production quites rising after 2015. That causes the economy to shift more investment into the agriculture sector. But

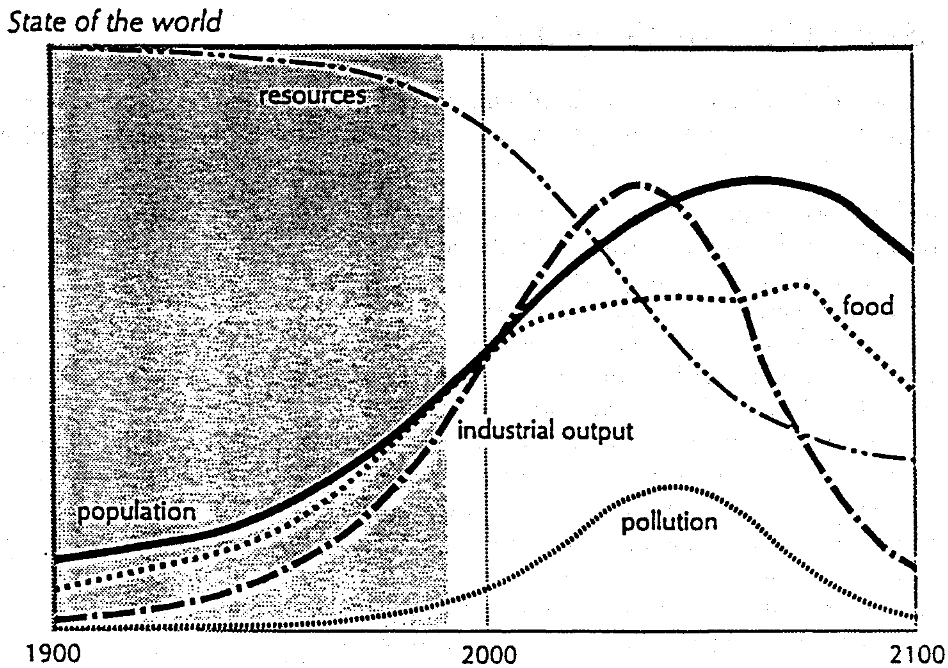



Figure 9. In this scenario population rises to more than 9 billion in 2040. These increased levels of demand generate much more pollution and soil erosion, which reduce land yield and forces much greater investment in agriculture. Eventually declining food raises the population death rate.

agriculture has to compete for investment with a resource sector that is also beginning to sense some limits.

As both food and nonrenewable resources become harder to obtain in this simulated world, capital is diverted to producing more of them. That leaves less output to be invested in capital growth. Next the industrial capital plant begins to decline, taking with it the service and agricultural sectors. Finally population too begins to decrease, as the death rate is driven upward by lack of food and health services.

In this graph the resources line can be viewed usefully as a general indicator of stress or pressure exerted by the environment on the processes that sustain industrial and demographic growth.

Notice that for the entire century 1900–2000, there is little deterioration in resources. Then "suddenly" they begin to decline rapidly. In 1990 the nonrenewable resources remaining in the ground would have lasted 110 years at the 1990 consumption rates. No serious resource limits would be obvious under those circumstances. But by 2020 the remaining resources constituted only a 30 year supply. Why did the shortage arise so fast? Because exponential growth rates increased the consumption while lowering the resources. Between 1990 and 2030 population increases by 50 percent and industrial output grows by 85 percent. The nonrenewable resource usage rate doubles. During the first 3 decades of the 21st century the rising population and industry use as many nonrenewable resources as the global economy used in the entire century

Table 1. Grain production and consumption for the world's 13 largest countries, 1950-2030

| | | | |
|---|---|---|---|
| United States, China, India, Former Soviet Union | | | |
| year | grain production | grain consumption | net trade |
| 1950 | 378 | 365 | 13 |
| 1990 | 959 | 926 | 33 |
| 2030 | 1099 | 1303 | -204 |
| Bangladesh, Indonesia, Iran, Pakistan, Egypt, Ethiopia & Etritrea, Nigeria, Brazil, Mexico | | | |
| year | grain production | grain consumption | net trade |
| 1950 | 57 | 59 | -2 |
| 1990 | 167 | 199 | -32 |
| 2030 | 273 | 420 | -147 |

Compiled from data presented in *Full House*, pp.168, 178, 179.

before.

This kind of precipitous decline might seem unlikely after decades of steady progress. However, a recent study of the globe's food production potential illustrates this effect exactly.

## 6. Overshoot of Global Food Demand

In *Full House* Lester Brown and Hal Kane summarize the world's experience in raising cereal output from 1950 to 1990 (Brown and Kane, 1994). They use the medium-level projections of country populations by the Center for International Research of the U.S. Bureau of the Census. They incorporate in their analysis assumptions about technological advance, potential for irrigation, soil erosion, and other environmental and social factors. Their data are summarized in Table 1 below for the 4 largest nations and the next 9 - together these 13 countries account for about 70 percent of the world's population

After four decades of growth that generally matched production to consumption, limits on food output produce a rapidly growing deficit. A key factor in this precipitous decline is diversion of crop land to other economic uses. This happened in Japan, South Korea, and Taiwan, for example. The result was that for Japan, between 1960, when grain production peaked, and 1992 grain production dropped 33 percent. But of course as production declined, demand continued to climb steadily as a result of population growth and growing affluence. The net effect is that by 1993, Japan was importing 77 percent of its grain, South Korea 68 percent, and Taiwan 74 percent. At 27 million tons, Japan is today the world's leading importer of grain. China, the major cause of the deficits projected above, is entering this same transition.

The problems are not limited just to these 13 countries nor to the distant future. United Nations statistics reveal that food production per person declined in 94 countries over the period 1985-1989 (U.N. Food and Agriculture Organization, 1990) .

## 7. Implications of Overshoot

Note that even after the decline in World3, our model still shows there to be more population, food, and industry than there were globally around 1950. So the scenario portrayed in Figure 9 does not imply the disappearance of our species - just an adjustment to the carrying capacity of the globe. We have witnessed and survived this adjustment in the past, but only on a national or regional scale. This time it will be global.

There have been various qualitative efforts to estimate what population could be supported globally from the income of the renewable energy and resource base. The sustainable population estimates that emerge from these efforts are generally around 2-3 billion. Our model results are consistent with that estimate.

Of course our model deals with global averages, and we all know that there will be great variation around the mean. Some countries might possibly pass through this period with little reduction in their standards of living. Others would suffer terribly.

It is possible that the end of growth will come through forces so sudden, so strong, and so pervasive that essentially all nations lose control of their future. But I believe it is much more likely that the countries that are clever, far-sighted, and nimble in their production patterns will retain substantial ability to control their own development and provide for their people.

The question here is in the timing and the identity of the the limiting factors. In this connection I find it useful to differentiate between Global and Universal Problems. Global problems affect everyone, and they can only be solved by concerted action of many nations. Examples are climate change, depletion of the ocean fisheries, and stratospheric ozone depletion. Universal problems affect everyone, but they can be solved locally through local initiative. Examples are soil erosion, ground water contamination, over-harvesting of the forests, and loss of local species. Japan can not save the ozone layer alone, but Japan has not had to enlist the help of India and other nations in its successful fight against soil erosion.

If growth is stopped by global problems, then most countries will be severely affected. If the principal pressure is exerted by universal problems, the richer countries can probably buy their way out, just as they have until now imported food to compensate for overshooting the capacity of their own agricultural soils.

## 8. New Ethics and Modes of Governance

So long as international relations can be based on the shared myth that all countries will pass through the demographic transition and achieve decent living standards, the ethical issues are relatively straightforward. But suppose it became generally accepted that many countries were going to experience population collapse through rising death rates? What then should be the stance of a responsible member of the international community? The question has many aspects.

I will pose a number of questions that occur to me. It is not a comprehensive list, nor do I know the correct answers. I just know that we will soon confront these questions either explicitly or by default.

What should be the policy related to immigration? There will be a greater supply of possible immigrants than can possibly be accommodated by any nation that wants to maintain something near to its current living standards for all its people. So some force will limit immigration. What will it be; what should it be? Quotas? Military force? Something else?

The Red Cross has estimated that the number of refugees displaced by environmental problems is about 500 million. This number is bound to increase. What mechanisms of international assistance and governance can be implemented to deal with a large and more or less permanently stateless population of people. What should be the long-term goals for assisting these people?

Supporting a population through periods of famine makes sense, if there is a prospect of the people quickly returning to self sufficiency in a world where population and food needs are roughly in balance. But what should be the policy, when the world has entered into a period of chronic food deficit, and some nations have no prospect of regaining self-sufficiency?

The effects of overshoot and collapse will be imposed and moderated within each nation by the diverse flows which cross its borders. These days any modern country is linked to many lands through flows of information, money, pollution, energy, natural resources, manufactured goods, food, and people. As we enter the period of the transition, there will be interruptions in some of these flows - either unintentionally or by those who hope to alter the terms of trade by embargoes and sanctions. What goals and ethical norms should govern these flows; what mechanisms of governance will we need to attain the goals?

The transition will see drastic shifts in equity. As shortages grow in a region, there is a basic tendency for the powerful to manipulate the system so as to retain what they have. If they succeed, as they generally do, the result is rapidly escalating gaps between the rich and the poor. Should that be a concern for the international community? Should it be a basis for intervention?

When a population has overshot its carrying capacity, one priority is to protect the fertility of the most crucial resources, so as to minimize the decline in the number of people and the standard of living that will be possible after the transition. What and where are those resources? What rights and responsibilities does the international community have to protect them from short-term destruction?

# 9. The Concept of Survivable Development

The current conversations about sustainable development are suited to a world that is moving through a transition in which population growth slows through declining birth rates to an orderly accommodation with its limits and in which the earth can support real economic growth for many decades into the future to raise the living standards of the present and the impending poor. For the reasons cited above, I do not believe that we live on such a world. I believe we live on a planet where population is already above the carrying capacity. Thus I expect death rates to rise above the birth rates until they are sufficient to reduce population significantly below current levels. I believe this transition will be obvious during my life time and will be essentially complete by the end of the next century.

Fifty to one hundred years seems like a long time. But the costs and benefits of many actions discussed at this meeting will unfold over that time period. So the transition from growth to overshoot and collapse is well within the interval that should have important effects on our current efforts related to the theme of this conference, "Toward Global Planning of Sustainable Use of the Earth."

Almost every one of the papers presented at this meeting has dealt with some aspect of the threats to productivity of the globe's natural ecosystems, that is with some aspect of the threats to or the protection of the planet's carrying capacity. If the work presented here is to have real effects, the knowledge you are generating through your research will have to become embedded in the policies that govern the actions of corporations, governments, and citizens. The actions we should propose in order to achieve the best possible future for our species depend profoundly on assumptions we make about the modes of governance, about international standards of ethical conduct, about the efficacy of international agreements, about the amount and the allocation of discretionary capital investments within the global society over the coming century.

It would be serious mistake to assume that the actions we propose now will be implemented within a political and economic system like those we have today. Because both will change dramatically, as society moves further along the path illustrated by Figure 4c.

Path 4b requires policies of sustainable development; path 4c requires something else. I call it policies for *survivable development.* I chose the term because of the alliteration with "sustainable" and because of the stark contrast it offers with the term sustainable. The phrase is inappropriate in some ways. It implies the need for a kind of bunker mentality, and it paints the future in much more negative terms than I think are justified. Maybe *flexible*, *adaptive*, or *resilient development* would be technically better. But *survivable development* is easier to associate with the special perspectives discussed here.

We need policies for our cities, nations, and international organizations that can address the real and pressing needs of people today while simultaneously providing ethics, technologies, capital, and governance that can survive the period of population collapse. They should be designed to minimize the potential for catastrophic discontinuities during the transition and leave us with the maximum possible set of options after balance has been reestablished.

We will not find those policies nor develop those technologies, if we remain preoccupied with the myths that underlie the ideas of sustainable development -if we continue to pretend that the whole world is going to move through the demographic transition that we have witnessed in a few rich countries. We will only find them, if we devote at least a portion of our resources to understanding implications of a future that is much less attractive and politically popular, one that explicitly acknowledges the probability of overshoot and collapse.

In our studies of alternative scenarios for population and industrial growth through the end of the next century, perception delays were shown to be a major factor governing the likelihood and the intensity of population and economic collapse. The shorter the delays in recognition and response, the less damage is done to the global ecosystem during the period of overshoot. Let us shorten the delays and quickly acknowledge our realistic options. It is too late now to strive for sustainable development; let us begin to understand the nature of a strategy geared instead to survivable development.

It is time to concede honestly that ecological, political, and economic realities make it impossible to meet the needs of either present or future generations except at population levels far below the current 5.6 billion. The level of global population that can be sustained at decent living standards without damage to the global ecosystem is not precisely calculable, but it is below current levels. Inevitably the population will decline until it is again below the support capacity of the globe. What mechanisms will produce the decline? What quality of political, cultural, and economic well-being will we have after? We have inadequate scientific tools for dealing with these questions, and they involve very troubling ethical issues. But our future as a species is likely to be more attractive if we start to face them honestly.

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