THE CASCADING OF

ENVIRONMENTAL CONSEQUENCES:

ARE WE RUNNING OUT OF TIME?

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WE HAVE BEEN VERY PLEASED at Yale's environment school to have had both Bill Clark and Bob Kates join us to talk about the excellent National Academy of Sciences report they co-chaired, *Our Common Journey: A Transition Toward Sustainability*. In my talk today I will try to return the favor and cover some of the same territory. (I'm pleased to see that that did not immediately clear the room!)

When Bob Dates spoke at Yale he reminded us what Senator Ed Muskie said about the need for one-armed scientists. After hearing hours of scientific testimony on the Clean Air Act, Muskie asked, with frustration, "Aren't there any one-armed scientists?" The panel looked perplexed. Muskie continued, "We had too much of 'on the other hand, on the other hand!'"

I'm afraid my talk today will have a little of that two-armed flavor, because I want to begin, on the one hand, by reviewing some disturbing trends in three areas - environmental trends, policy trends, and political trends. On the other hand, I will conclude on a hopeful note, reviewing some recent developments that are indeed very encouraging.

First, the distressing global environmental trends. My personal introduction to them began in 1980 when a group I led in the Carter Administration produced the *Global 2000 Report to the President*. Our mission was to sketch what trends might unfold between 1980 and 2000 if societies stuck with a business-as-usual approach. Well, here we are in 2001, and we can look back and see what actually happened.

First, we projected that population would grow from 4 billion to 6.3 billion by 2000. The actual number was 6 billion, so we were more or less on target.

We predicted that deforestation in the tropics would occur at rates in excess of an acre a second, and for twenty years, an acre a second, that is what happened.

We predicted that 15 to 20 percent of all species could be extinct by 2000, mostly due to tropical deforestation. Pimm and Raven have recently estimated conservatively that there are about seven million species of plants and animals. Two-thirds of these species are its the tropics, largely in the tropical humid forests. They estimated that half the humid tropical forests have been lost and, with them, that about 15 percent of the species they contain have already been doomed. So there is evidence that our species loss estimate was not far off the mark.

We predicted that about 6 million hectares a year of drylands, an area about the size of Kates' Maine, would be rendered barren by the processes we describe as desertification. And that continues to be the best estimate today.

We predicted, and I quote, that

Rising CO_2 concentrations are of concern because of their potential for causing a warming of the earth ... If the projected rates of increase in fossil fuel combustion (about 2 percent a year) were to continue, the doubling of the CO_2 content of the atmosphere could be expected after the middle of the next century... The result could be significant alterations of precipitation patterns around the world, and a 2 degree to 3 degree Celsius rise in temperatures in the middle latitudes of the earth.

Twenty years later, this description still falls neatly within the range of current estimates.

In other words, the basics about emerging global-scale environmental concerns were known more than 20 years ago. Some projections, like those on food prices, our report just got wrong, but on most of the big issues of environment and development, *Global 2000* pointed squarely at the trend and alerted us to the problem. Other reports-from UNEP, from the Worldwatch Institute, from the National Academy of Sciences and elsewhere - were saying much the same around this time. So, the public and political leaders were on notice twenty years ago that there was a new environmental agenda, more global, more threatening and more difficult than the agenda that spurred the environmental awakening of the late 1960's and early 1970's.

Today, our information on global environmental trends is far more complete and sophisticated, but it is not more reassuring.

? Half the tropical forests are gone, and non-OECD countries are projected to lose another 10 percent of their forests by 2020. But this data gives an unduly rosy picture. The cumulative impacts of fire, El Nino-driven drought, and fragmentation in major forest areas, such as those in Brazil and Borneo, exacerbate the effects of deforestation. And much of what's left is under contract for logging. Eighty percent of Borneo's forest cover is now allocated to commercial logging and plantations.

? A fourth of bird species are extinct, and another 11% are listed as threatened. Also threatened are 25% of mammals, 20% of reptiles and amphibians, and 25% of fish species. The rate of extinctions today is estimated at 100-1000 times the background rate.

? We are now appropriating, wasting, or destroying about 40% of nature's net photosynthetic product annually. We are consuming half the available fresh water. Most people will soon live in water stressed areas. We are fixing

nitrogen at rates that exceed nature's, and among the many consequences of the resulting overfertilization are fifty dead zones in the oceans, one in the Gulf of Mexico the size of New Jersey.

? In 1960 5% of marine fisheries were either fished to capacity or overfished. Today70% of marine fisheries are in this condition.

? Half of the world's mangroves and wetlands have been destroyed.

? Hardest hit of all are freshwater ecosystems around the globe.

Now, on top of these processes of biotic impoverishment comes the biggest threat of all, global climate change. While the public here and especially abroad is increasingly awake to this issue, few Americans appreciate how close we now are to the widespread devastation of the American landscape. The best current estimate is that climate change will make it impossible for about half the American land to sustain the types of plants and animals now on that land. A huge portion of our protected areas - everything from wooded lands held by community conservancies to our national parks, forests, and wilderness - is now profoundly threatened. In one projection, the much-loved maple-beech-birch forests of New England simply disappear. In another, much of the Southeast becomes a huge grassland savannah unable to support forests because it is too hot and dry.

We know what is driving these global trends. The recent exchange by Kates and John Holdren in *Environment* reviewed again the IPAT factors: IMPACT is a product of the growth of human POPULATIONS, Our AFFLUENCE and consumption patterns, the TECHNOLOGY we deploy to meet our perceived needs. What this useful IPAT formulation can obscure, in addition to the impacts of poverty, is the vast and rapidly growing scale of the human enterprise. It took all of history for the world economy to grow to $5 trillion in 1950. Today, it grows by more than that every five years. Since I came to Yale in 1960, gross world product has doubled, and then doubled again. The scale of human activity — economic production — is doubling every 20-25 years.

Let's take a look at the last 20 years —

?	Global population	up 50%
?	World output	up 100%
?	Energy use	up 40%
?	Meat consumption	up 65%
?	Auto fleet	up 75%

? Paper use up 75%

? Advertising up 100%

Today the world economy is poised to double and then double again in the lifetimes of today's students. We could not stop this growth if we wanted to, and most of us would not stop it if we could. Half the world's people live on less than $2 per day. They both need and deserve something better. Economic expansion at least offers the potential for better lives, though its benefits in recent decades have been highly skewed.

There are good reasons to believe that the next doubling of economic activity will differ in some respects from the growth of the past. But there are equally good reasons to believe that the next doubling of the world economy could, from an environmental perspective, look a lot like the last.

The U.S. Energy Information Agency predicts a 70 percent increase in global CO_2 emissions between 2000 and 2020. The OECD estimates that its members' $C0_2$ emissions will go up by 33 percent during this period. Motor vehicle use in OECD countries is expected to rise by 40 percent by 2020, just when you thought that folks were driving to the maximum possible extent.

The implications of all this is very profound. Let me put it this way: we've got a helluva problem on our hands.

We are entering the endgame in our relationship with the natural world. The current Nature Conservancy campaign has an appropriate name: they are seeking to protect The Last Great Places. One senses that we are in a rush to the finish. Soon, metaphorically speaking, whatever is not protected will be paved. I mentioned earlier the work of Pimm and Raven on declining biodiversity. The loss of half the forests cost us 15 percent of the species, they estimate, but further forest destruction will be disproportionately costly. More generally, attacks on the environment will be increasingly consequential. Whatever slack nature cut us is gone.

We dominate the planet today as never before. We impact hugely on the great life support systems of the planet. Human influence is pervasive and deep. Nature as something before and beyond us is dead. We are in a radically new moral position because we are at the controls.

Looking back, it cannot be said my generation did nothing in response to *Global 2000* and similar alerts. Progress has been made on some fronts, but not nearly enough. There are outstanding success stories, but rarely are they scaled up to the point that they are commensurate

with the problem. For the most part, we have analyzed, debated, discussed, negotiated these issues endlessly. My generation is a generation, I fear, of great talkers, overly fond of conferences. If only we could talk these problems to death. But on action, we have fallen far short. As a result, the threatening global trends highlighted 20 years ago are still very much with us, ozone depletion being the notable exception.

But if we have not actually done much, perhaps we have in these 20 years laid a good foundation for rapid and effective action today. Perhaps all the international conferences, treaties and action plans have given us the policies and programs we now need, and we can at last get on with it. And thus we arrive at the second set of distressing trends, those in the area of policy and institutional development.

The two basic things we've done for these 20 years are research and negotiate. Once again, it has been scientists and lawyers and diplomats. The scientific outpouring of these twenty years has been remarkable, and I have no complaints with the scientists, except perhaps to suggest that they go on strike until what they have already produced receives some respectful acknowledgement and use by policymakers.

But the results of twenty years of international negotiations are, if truth be told, pretty dismal. It is not that what has been agreed, for example, in the framework conventions on climate, desertification and biodiversity, is wrong or useless. But the problem is that these agreements are mostly frameworks for action: they do not compel the actions that will be needed. And the same can be said for the extensive international discussions on world forests, which have never reached the point of a convention. In general, international environmental law is plagued by vague agreements, lax enforcement and underfunded support. We still have a long, long way to go to make these treaties effective. A deeper question is whether we are even on the right track with this convention/treaty approach. Were we, mesmerized by the Montreal Protocol, launched on the wrong track altogether? I honestly do not know. But, right track or wrong track, it is a frightening thought to consider that either way we have wasted much of the 20 years we could have spent preparing for action. It would be comforting to think that we have spent these 20 years getting ready and are now prepared to act - comforting but wrong.

All of which brings us to the Kyoto Protocol, for here there is an effort to step beyond the framework and reach a binding, action-forcing agreement on climate change.

There are three things one can say in favor of the Kyoto Protocol:

? A bird in the hand is worth two in the bush;

? The sooner the world gets a clear signal that the industrial nations have capped CO_2 emissions, the better;

? The developing countries are correct in wanting to see the industrial countries act first and most, and the Kyoto Protocol takes this approach.

That said, what is troubling about Kyoto is, first, that it is deflecting attention from addressing the real long term challenge of holding cumulative global emissions of carbon dioxide and other greenhouse gases below certain levels. And second, even if the Kyoto Protocol could command wide support today, we would still have a long way to go to make its flexibility mechanisms, land use provisions and other difficult and complex provisions actually work effectively in the real world.

On balance, I am not among those who believe that President Bush's abandonment of the Kyoto Protocol may be a blessing in disguise. Europe seems ready to get on with it, and we should be working to keep the Kyoto process alive and active.

The bottom line, in any case, is that however one looks at the matter, we are in sad shape when it comes to climate policy. The twenty years have not been put to very good use.

Depression III is brought on by the fact that, starting at the top, the U.S. does not have political leadership today that cares about these issues at all, while the public seems to have forgotten much that we learned in the 1970's.

In sum, the problems are going from bad to worse, we are unprepared to deal with them, and, right now, we lack the leadership to get prepared.

Now, at this point, the quicker I turn to something on the other hand, to something hopeful, the better. To do this I want to sketch seven dimensions where progress, indeed transformation, is necessary and ask whether there are signs of hope in each area. I believe that there are.

The first of these transitions to sustainability will not surprise you. It is the need for an early demographic transition to a stable world population. Here there is definite progress. The mid-range projection for 2050 was recently 10 billion people; now it is 9 billion. One projection of developing country population in 2100 was 10.2 billion. Analyses suggest that an escalation of proven approaches could reduce this number to 7.3 billion, with global population leveling off at 8.5 billion. The main need here is adequate funding for the Cairo Plan of Action.

The second transition is the human development transition to a world without mass poverty, a world of greater social and economic equity. We need this transition not only because

over much of the world poverty is a great destroyer of environment, but also because the only world that works is one in which the aspirations of poor people and poor nations for fairness and opportunity are being realized. Developing country views in international negotiations on environment are powerfully shaped by preoccupation with their own economic and social conditions, fear of high environmental regulatory costs, and distrust of industrial country intentions and policies. Sustained and sustainable human development provides the only context in which there is enough confidence, trust, and hope to ground the difficult measures needed to realize environmental objectives.

There is good news to report on the human development front. Since 1960 life expectancy in developing regions has increased from 46 years to 62. Child death rates have fallen by more than half. Adult literacy rose from 48 percent in 1970 to 72 percent in 1997. The share of people enjoying at least medium human development in the UNDP Human Development Index rose from 55 percent in 1975 to 66 percent in 1997.

On the policy front, a wonderful thing has happened. The international development assistance community- bilaterals and multilaterals - have come together with a concerted commitment to the goal of halving the incidence of absolute poverty by 2015, and their goals were endorsed by all governments in the Millennium Assembly of the United Nations. Eliminating large-scale poverty is not a crazy dream. It is within our reach.

Again, as with population, the principal threat to achieving these goals is declining development assistance.

The third transition is a transition in technology to a new generation of eco-efficient technologies - to technologies that sharply reduce the consumption of natural resources and the generation of residual products per unit of prosperity.

We need a worldwide environmental revolution in technology - a rapid ecological modernization of industry and agriculture. The prescription is straightforward but immensely challenging: the only way to reduce pollution and resource consumption while achieving expected economic growth is to bring about a wholesale transformation in the technologies that today dominate manufacturing, energy, transportation, and agriculture. We must rapidly abandon the twentieth century technologies that have contributed so abundantly to today's problems and replace them with twenty-first century technologies designed with environmental sustainability in mind.

The good news here is that across a wide front, technologies that would bring about a vast improvement are either available or soon can be. From 1990 to 1998, when oil and natural

gas use grew at a rate of 2 percent annually, and coal consumption grew not at all, wind energy grew at an annual rate of 22 percent and photovoltaics at 16 percent. I use an energy example because transformation of the energy sector must rank as the highest priority.

The fourth transition is a market transition to a world in which we harness market forces and in which prices reflect the full environmental costs. The revolution in technology just discussed will not happen unless there is a parallel revolution in pricing. The corrective most needed now is environmentally honest prices. Doing the right thing environmentally should typically be cheaper, not more expensive, as it so often is today.

Here one of the most hopeful developments is the tax shift idea adopted in Germany. Moving in four stages starting in 1999, the policy is to shift the tax burden from something one wants to encourage - work and the wages that result - to something one wants to discourage - energy consumption and the pollution that results.

The fifth transition is a transition in consumption from unsustainable patterns to sustainable ones. Here one very hopeful sign is the emergence of product certification and green labeling and public support for it. This trend started with the certification of wood products as having been produced in sustainably managed forests and has now spread to fisheries. Consumers care, and that is driving change.

The sixth transition is a transition in governance to responsible, accountable governments and to new institutional arrangements, public and private, that focus new energies on the transition to sustainability. UNDP estimates that today about 70 percent of the people in the developing world live under relatively pluralistic and democratic regimes. Progress on this front is sine qua non.

At the international level, there are governance regimes that have worked: the Montreal Protocol for protecting the ozone layer, CITES for regulating trade in endangered species, MARPOL, for pollution from ships. International regulatory processes can be made to work!

And at the local level there is a remarkable, flourishing outpouring of initiatives: the smart growth movement, sustainable cities and the "new urbanism," state and local greenplans, innovative state regulatory approaches, environmental design in buildings, even the greening of the Ivies one day soon.

The certification movement mentioned above is an example of still another pathbreaking phenomenon: the rise of information-rich, non-regulatory governance, even non-governmental governance. The whole forest certification movement is occurring with governments watching from the sidelines. A long list of techniques - the U.S. Toxics Release Inventory and other "right

to know" disclosures, third-party auditing, market creation by government entities and consumers - coupled with the Internet and an increasingly sophisticated international NGO community, can make a powerful combination, as Mitsubishi learned when it tried to do salt mining in whale calving waters in Mexico. An unprecedented outpouring of opposition from Mexican and international NGOs and consumers forced the industrial giant to withdraw.

Meanwhile, in the area of corporate governance and leadership, we are seeing some extraordinary developments:

- Seven large companies - Dupont, Shell, BP Amoco, Alcan among them - have agreed to reduce their CO_2 emissions 15 percent below their 1990 levels by 2010.
- Today, more than $2 trillion resides in socially and environmentally screened funds. The number of screened mutual funds has grown from 55 to 175 in last five years.
- Eleven major companies -DuPont, GM, IBM among them - have formed Green Power Market Development Group and committed to develop markets for 1000 megawatts of renewable energy over next decade.
- Home Depot, Lowes, Andersen and others have agreed to sell wood (to the degree it's available) only from sustainably managed forests certified by an independent group against rigorous criteria. Unilever, largest processor of fish in the world, has agreed to the same regarding fish products.

These are among the most hopeful, optimism-generating things I've seen lately.

We are thus far beyond the old days of environment as pollution control compliance. Environment is becoming central to business strategic planning. Companies are beginning to develop sustainable enterprise strategies that are leading to new processes and new products. The war between business and environment should be over. Both sides won.

Finally, there is the most fundamental transition of all - a transition in culture and consciousness. Paul Ehrlich recently wrote that, "Our global civilization had better move rapidly to modify its cultural evolution and deal with its deteriorating environmental circumstances before it runs out of time." He notes that the potential for conscious evolution is evident in great social movements that societies have already experienced, such as the abolition of slavery and the civil rights movement. It seems to me at least possible that we are seeing the birth of something new - a change of consciousness - in the young people in the streets of Seattle, in the far-reaching and unprecedented initiatives being taken by some private corporations, in the

growth of NGOs and their innovations, in scientists speaking up and speaking out, in the increasing prominence of religious and spiritual leaders in environmental affairs. We must certainly hope that something new and vital is afoot. And, ironically, what may drive this consciousness more than anything else is the reality of anthropogenic climate change.

These are all hopeful signs, but to be honest we must conclude that we are at the early stages of the journey to sustainability. Meanwhile, the forward momentum of the drivers of environmental deterioration is great. We are moving rapidly to a swift, pervasive, and appalling deterioration of our natural world. Time is the most important variable in the equation of the future. What we will do tomorrow we should have done yesterday. Only a response that in historical terms would come to be seen as revolutionary is likely to avert these changes.

Thank you.

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