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FOIA MARKER

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Record Group/Collection: George H.W. Bush Presidential Records
Collection/Office of Origin: Science and Technology Policy, Office of (OSTP)
Series: Bromley, D. Allan, Files
Subseries: Global Climate Change Files - Conferences/Meetings

OA/ID Number: 62055
Folder ID Number: 62055-001

Folder Title:
Global Warming: NOORDWIJK [1989]

Stack:	Row:	Section:	Shelf:	Position:
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Global Warming Becomes Hot Issue for Bromley

A disagreement within the Administration over plans for an international meeting on global change was aired in the press and on Capitol Hill last week

PRESIDENTIAL SCIENCE ADVISER D. Allan Bromley last week found himself in the hot seat when he was called before a Senate subcommittee to explain his views on global warming. The Senators were angered by press reports that Bromley had opposed sending a U.S. delegation to an international ministerial meeting on global change, to be held in The Hague next week.

Bromley was recently appointed by President Bush to chair a Domestic Policy Council working group on global change, a position that gives him a prominent role in formulating U.S. policy. According to Administration sources, at the working group's first meeting on 20 October, Bromley and White House chief of staff John Sununu opposed a recommendation by Environmental Protection Agency administrator William Reilly and the State Department that the United States attend The Hague conference, which will be held on 6 and 7 November.

At the meeting, which will draw together environment ministers from some 60 countries, the Netherlands is expected to propose that carbon dioxide emissions be stabilized at present levels by the year 2000 and that the feasibility of a 20% cut worldwide by 2005 be studied.

The Netherlands is hoping that the meeting will produce a consensus statement on global warming. But Bromley, Sununu, and others are reportedly worried that the United States, which produces one-fifth of the world's carbon dioxide emissions, could suffer economic damage if stabilization levels or reductions are agreed to.

Administration officials are also divided over whether the United States should honor a pledge made by Bush last year to host an international conference in 1990 on global change. At the 20 October meeting, Bromley, Sununu, and others opposed the proposal while Reilly and the State Department pushed for it. On 30 October, 40 U.S. senators, all Democrats, signed a letter to Bush, urging him to keep his commitment to convene the conference.

At the congressional hearing last week, Bromley dodged, for the most part, repeated questioning by Senators Albert Gore (D-

TN) and John Kerry (D-MA) about his views on global warming and whether he approved of U.S. participation at The Hague meeting. Bromley would only say, "My belief is that we should not move forward on major programs until we have a reasonable understanding of the scientific and economic consequences of those programs."

Asked by Gore whether the scientific evidence is inadequate to justify curbs on

New responsibility. Bromley now chairs a global change working group.



greenhouse emissions, Bromley responded that recent adjustments to climatic models by British climate modeler John Mitchell have made him uneasy about the reliability of predictions that the earth is warming up significantly.

Mitchell's model of the climate system previously predicted that the earth's temperature would rise 5°C when greenhouse gases double sometime in the next century. But he recently halved this figure after he added a new factor to his model—the effects of ice crystals. Bromley said, "That such simple and obvious changes in [Mitchell's] model can make major changes in predictions underscores my own feeling and many of my colleagues in the scientific community that, we have a substantial distance to go yet."

Gore asked, "Do you believe that the doubling of carbon dioxide in the atmosphere, which will occur in the next 40 years or so, is likely to result in global warming?" Bromley replied, "It's certainly possible, and probable to some degree, but that's as far as I can say on the basis of the evidence." Given the changes in the Mitchell model, he said, "my answer is that I simply don't know."

Steven Schneider of the National Center for Atmospheric Research and many other atmospheric scientists have said that while current models are relatively crude and flawed in some ways, their predictive reliability has been validated to a substantial degree. Moreover, they point out that the fundamental theories of how greenhouse gases trap heat have been substantiated by billions of observations of the atmosphere.

Thomas Lovejoy, an ecologist and assistant secretary for external affairs of the Smithsonian Institution, said in an interview that the Administration "could be taking a

San Andreas fault approach" in formulating national policy on global warming. "It's resisting change until it's catastrophic."

Lovejoy, whom Bromley has nominated as a member of the White House science council, last week wrote a letter to Bromley himself, urging that the President and the Cabinet be given a full briefing by scientists on global warming. "There are a lot of actions associated with cutting greenhouse gases that will make us more competitive," Lovejoy says.

At the congressional hearing, Bromley also repeatedly stressed the importance of allowing a United Nations group, the Intergovernmental Panel on Climate Change, or IPCC, to finish a report on evaluating greenhouse effects. The report could lead to an international framework convention acknowledging the problem of global warming and then to a protocol with specific goals to cut emissions of greenhouse gases. This process is similar to the one that led to an international agreement on a phaseout of chlorofluorocarbon gases.

But a few other countries, including the Netherlands, together with environmentalists and some members of Congress, contend that the IPCC process is moving too slowly. Although the IPCC report is due out at the end of next year, they say that the IPCC may take several years to arrive at specific goals for emission reductions.

As for The Hague meeting, Reilly has won a partial victory: the United States will be sending a delegation, which Reilly will head. But an Administration source says that Reilly "is going with a bare portfolio." Bromley will be part of the delegation.

■ MARJORIE SUN

The Global Environmental Challenge:
Japanese Initiative for Technological Breakthrough

Ministry of International Trade and Industry
The Government of Japan

November 1989

1. Initiative

1) The Need for Technological Breakthrough

Unprecedented levels of economic activity have raised such environmental issues as global warming, depletion of the ozone layer, deforestation and others which pose a major threat to the continued existence and well-being of mankind. Current and future efforts to ensure energy efficiency, and introduce alternative energy sources, reforestation and other measures will not be enough to combat global environmental problems. "Sustainable Development" as advocated by the World Commission on Environment and Development (Report: Our Common Future) and by the UNEP Governing Council will require unprecedented technological breakthroughs in a wide array of fields including energy and biotechnology, as recommended by the "Tokyo Conference on the Global Environment and Human Response toward Sustainable Development" in September 1989.

2) The Development of a New Industrial Technology

As part of the global response to this technological challenge, the Ministry of International Trade and Industry of Japan (MITI) intends to launch a series of research and development projects to push forward the frontiers of technology, and create a new environmentally friendly industrial technology. This new industrial technology will reconcile the apparent dichotomy between economic growth and environmental protection by integrating the production and consumption processes into the ageless cycle of energy and matter in the geo-biosphere. Such efforts must be undertaken now if the 21st century is to be a century of sustainable development.

3) The Role of the New Institute

In order to provide a strong and effective institutional base for these research projects, MITI intends to establish a new research and development center called "The Institute of Industrial Technology for the Global Environment." The Institute will work closely with major research and development institutions, both foreign and domestic.

2. New Projects for "Environmentally Friendly" Technology

1) Development of Full Carbon Cycle Technology

(CO₂ fixation and reutilization)

CO₂ emissions from industrial activities is currently the major source of greenhouse gases. The objective of this project is to develop industrial technology for converting CO₂ from industrial sources into useful products such as methanol and other hydrocarbon compounds. Both chemical and biological methods will be studied.

2) Development of Environmentally Benign Materials

a) Development of advanced substitutes for CFCs

In this project, advanced CFC substitutes will be developed, not only to protect the stratospheric ozone layer, but also to reduce the potential greenhouse effect of CFC substitutes.

b) Development of biodegradable plastics

Various biodegradable plastics will be developed in order to reduce the accumulation of environmentally burdensome conventional plastics.

3) Development of Environmentally Benign Production Processes

Biological reactions, which occur under low-temperature and low-pressure, will be developed to replace energy intensive chemical reactions in production processes. This will result in enormous energy savings.

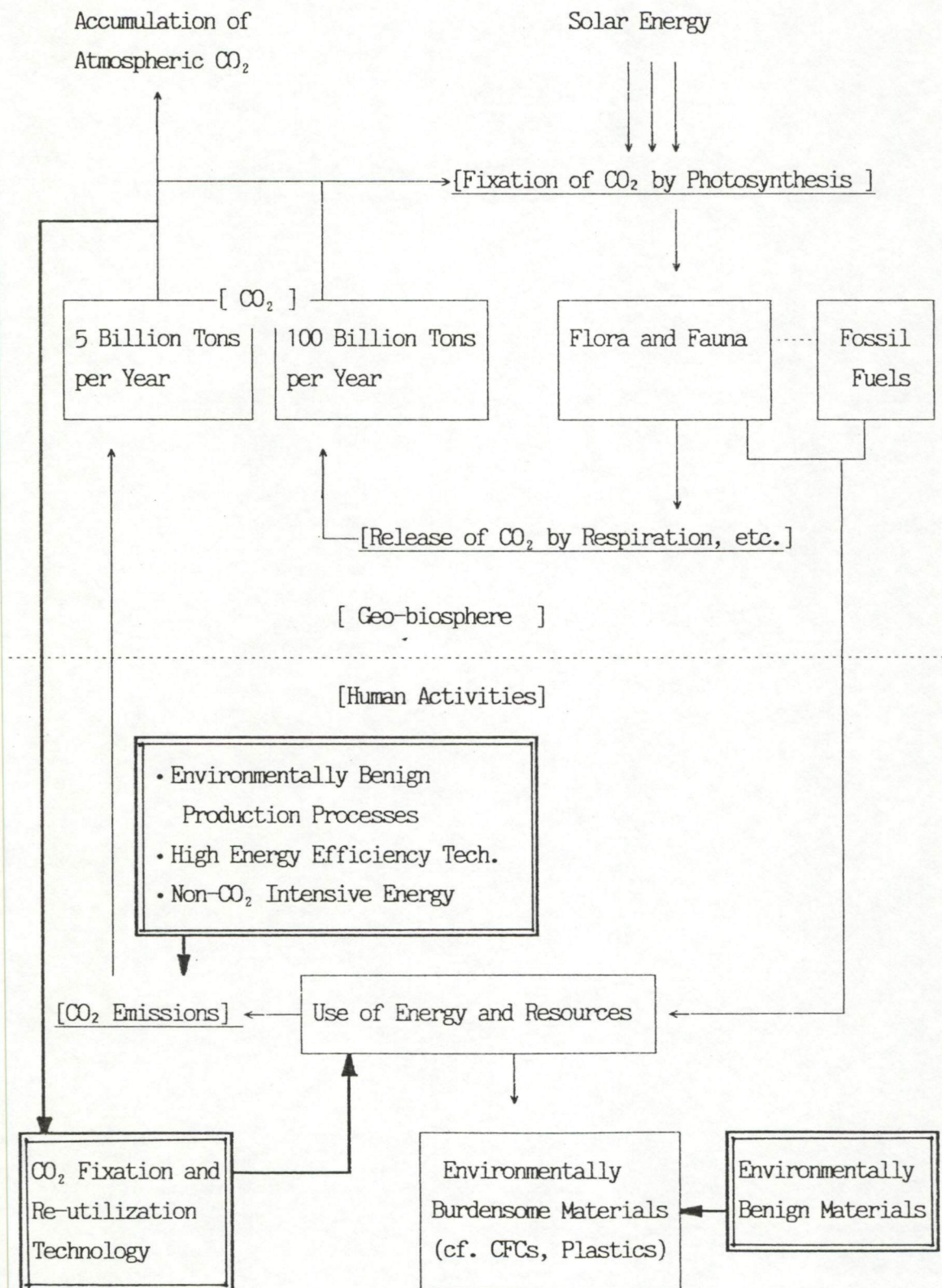


Figure 1. The Global Carbon Cycle and the Technological Response

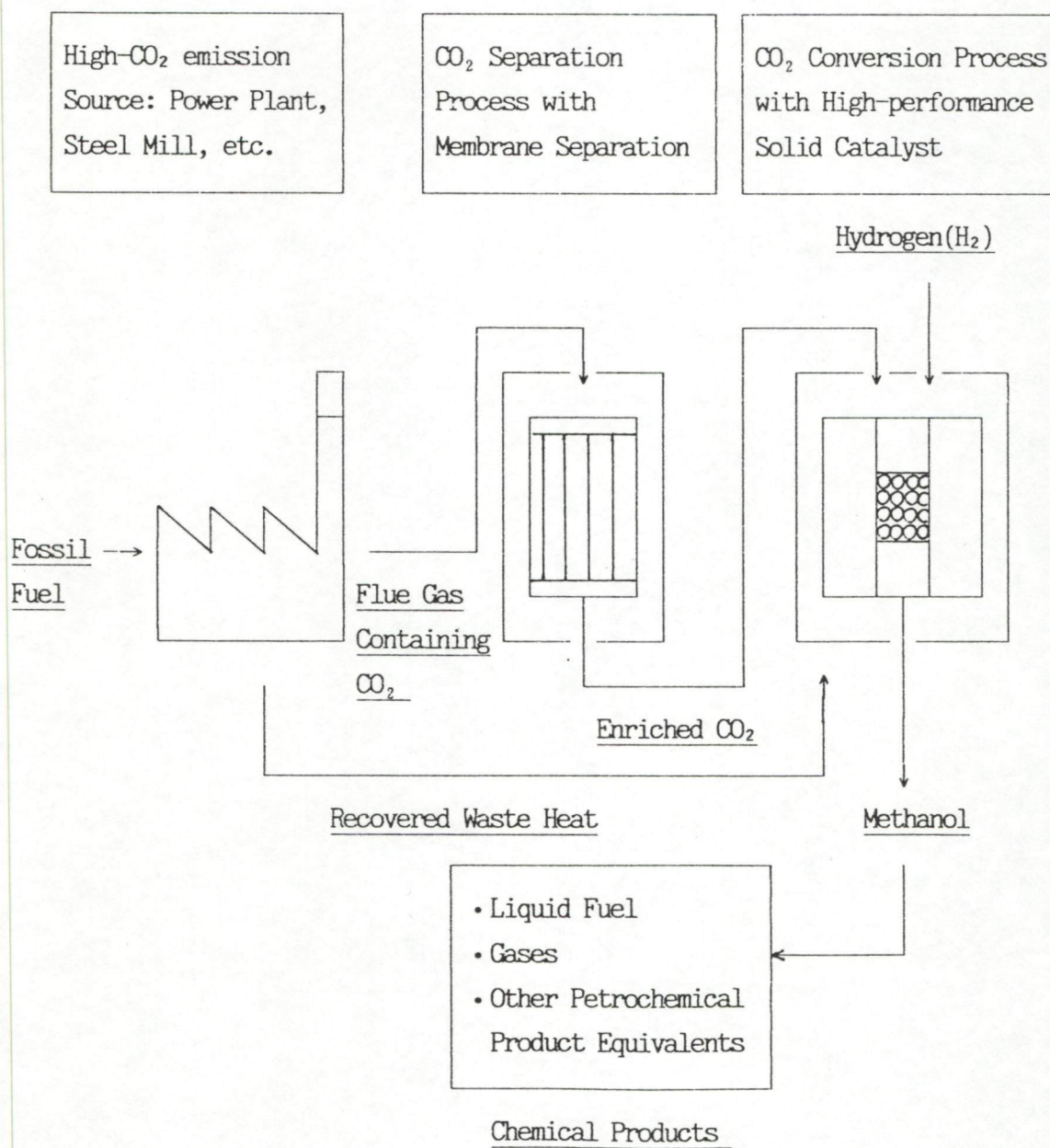


Figure 2. CO₂ Fixation and Re-utilization Technology
- Catalytic Hydrogenation -

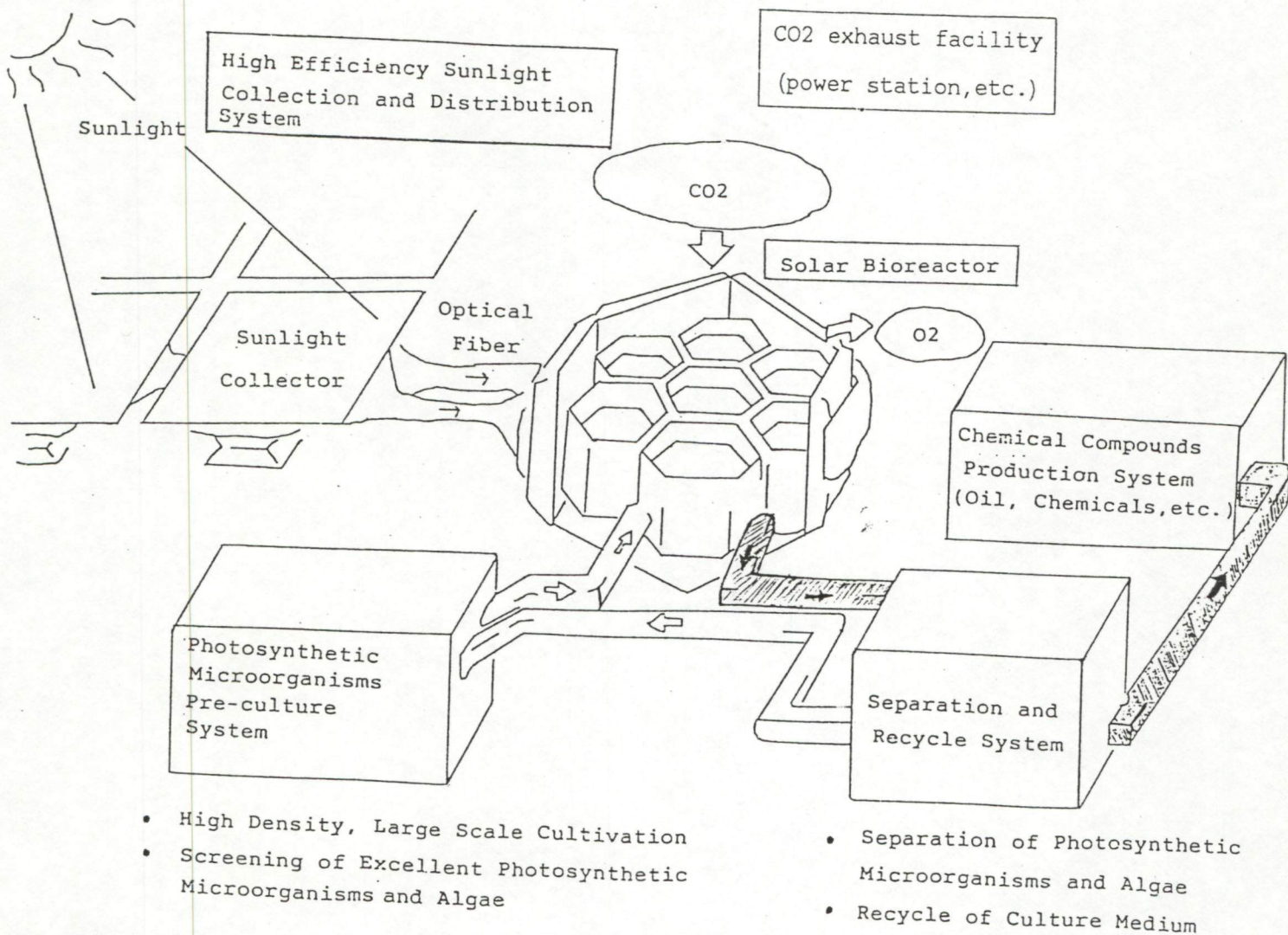


Figure 3. CO₂ Fixation and Re-utilization Technology
- Photosynthetic Microorganisms and Algae -

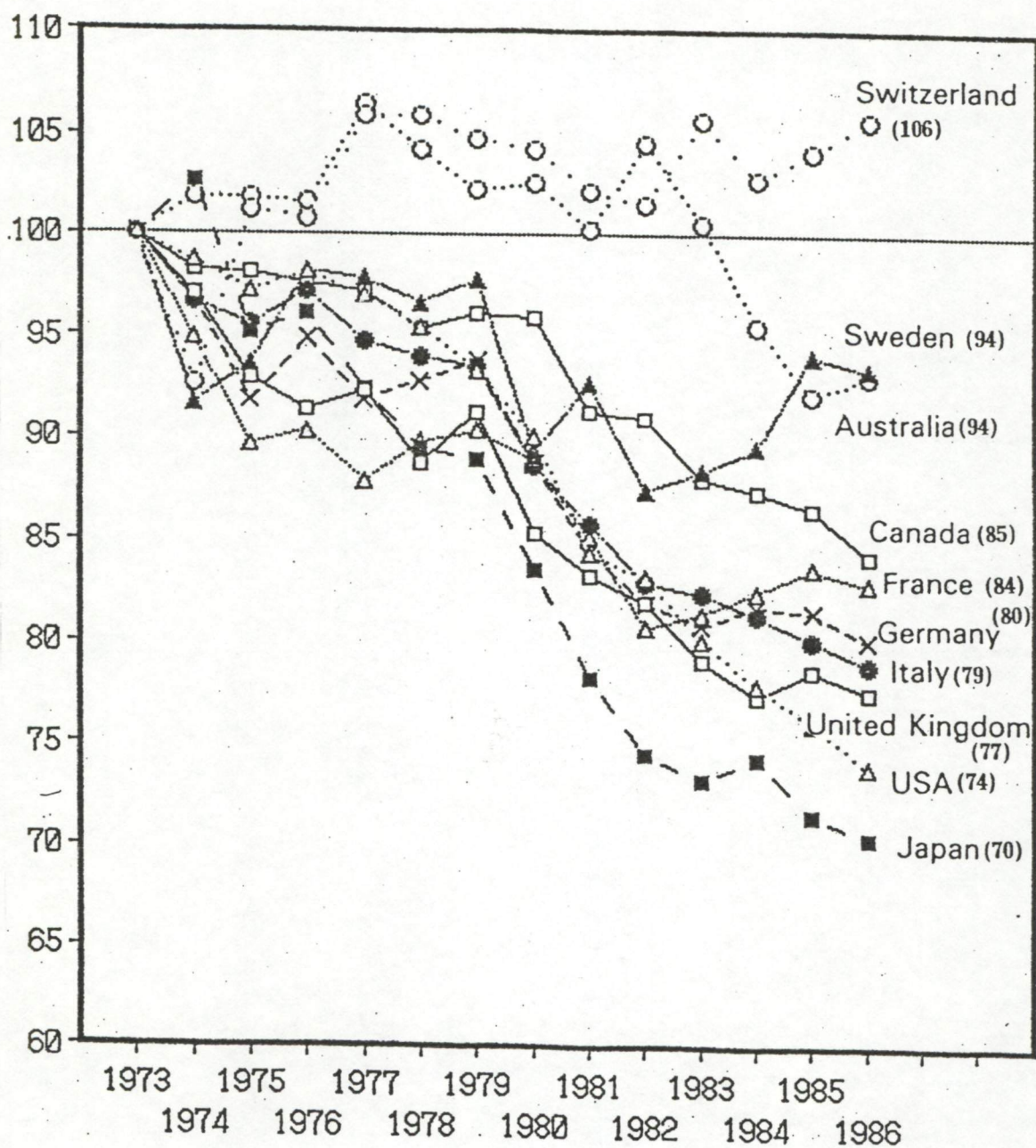


Figure 4. Changes in Index of Energy Consumption/GDP Rate
in Principal OECD Countries

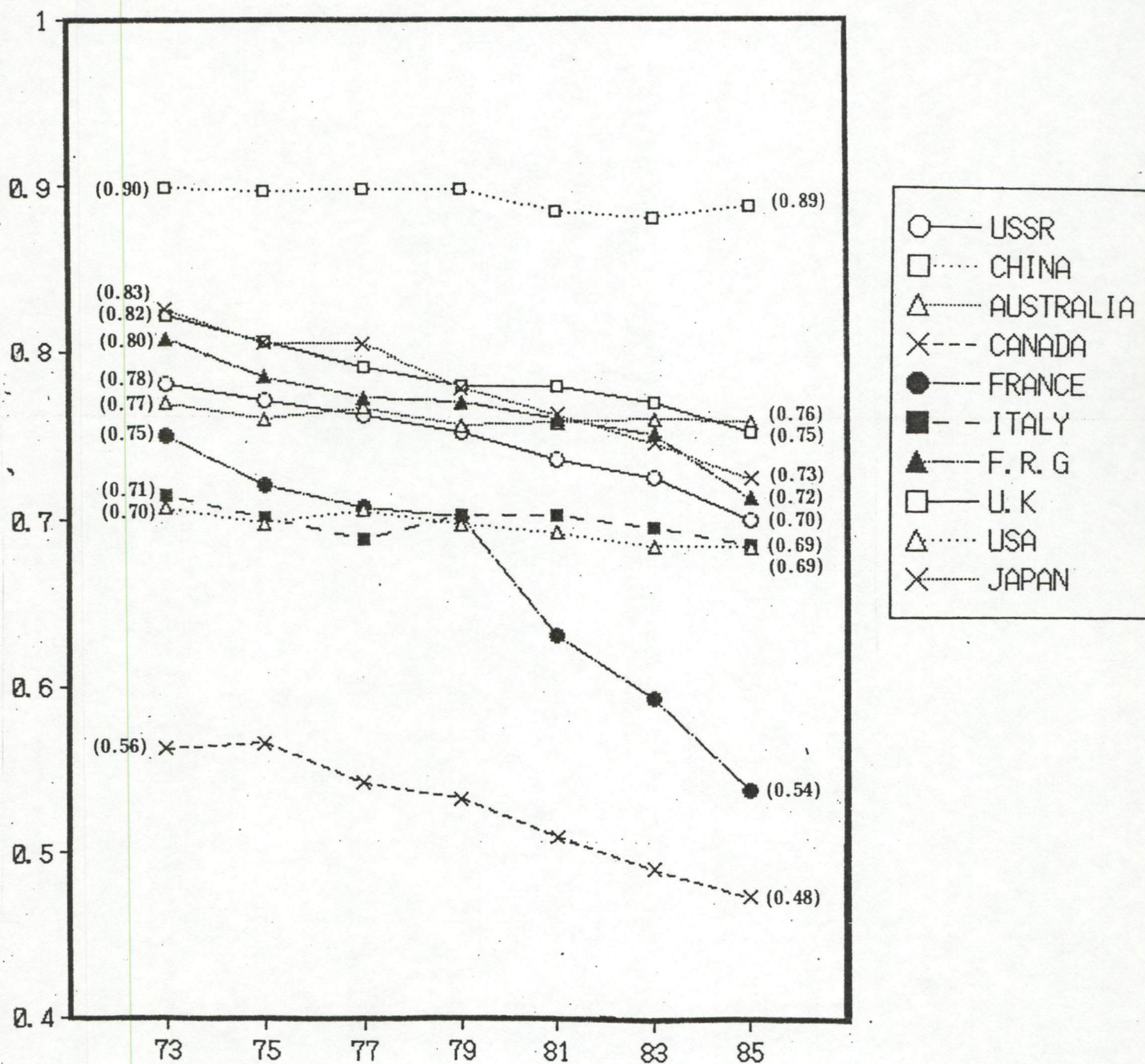


Figure 5. Changes in the CO₂ Emission/Energy Rate in Major Countries (tonnes of carbon/ toe)

Marian,
and Damar,

For future use/reference, this press
release (following Hague ministerial)
is apparently what is meant by the
"joint Reilly/Bromley statement."

SS

THE WHITE HOUSE
Office of the Press Secretary

For Immediate Release

November 7, 1989

UNITED STATES JOINS 70 NATIONS IN UNANIMOUS DECLARATION ON
GLOBAL CHANGE

President Bush announced today that the United States has agreed with other industrialized nations that stabilization of carbon dioxide (CO₂) emissions should be achieved as soon as possible. The U.S. also agreed that it is timely to investigate quantitative targets to limit or reduce carbon dioxide emissions. The U.S. was joined by over 70 countries attending the Ministerial Conference on Atmospheric Pollution and Climate Change in Noordwijk, The Netherlands.

In joining the Declaration at the Ministerial Conference, the United States recommended that international funding be directed towards funding a chlorofluorocarbons (CFCs) phase-out in developing countries and promoting efficient use of energy. In addition, the Declaration:

- Urges all countries to take steps individually and collectively to promote greater energy conservation and efficiency.
- Recognizes the need to stabilize the emissions of carbon dioxide and some other greenhouse gases, while ensuring sustainable development of the world economy.
- Agrees that developing countries will need to be assisted financially and technically.
- Urges all countries to join and intensify the ongoing work in the Intergovernmental Panel on Climate Change (IPCC) with respect to a framework convention.

The President said, "I asked my EPA Administrator Bill Reilly and my Science Advisor Allan Bromley to continue the leadership role which the U.S. has performed since the Intergovernmental Panel on Climate Change (IPCC) was formed in 1988."

- more -

The President also praised the Conference for providing the United States an excellent opportunity for useful consultations, both informally and formally, with many of the participating countries, including many countries that have not previously been active in the IPCC process. President Bush also noted that such conferences contribute substantially to the growing consensus among policy makers with respect to global climate change.

William Reilly, the Administrator of the Environmental Protection Agency, and Dr. Allan Bromley, Science and Technology Advisor to President Bush, emphasized during the Conference that the United States currently devotes \$500 million to the study of issues related to climate change and plans to increase this to about \$1 billion in FY 1991. Additionally, through such measures as the Clean Air Act, more stringent fuel efficiency standards for automobiles, aggressive energy conservation, and reforestation programs, among others, the United States is already playing a leading role in reducing CO2 emissions. The President announced in March that the United States was committed to total phase-out of CFCs by the year 2000. CFCs account for about 25 percent of United States greenhouse emissions.

The United States delegates emphasized their support for the IPCC process in which it chairs the Response Strategies Working Group, one of three such working groups. The IPCC will hold a plenary meeting in Washington, D.C. in February, 1990. Special reports on the Science, Effects and Responses to global warming will be available later in 1990.

In parallel with this work, a Working Group of the Domestic Policy Council, chaired by Dr. Allan Bromley, is undertaking an intensive program examining the potential impacts of climate change and their associated economic consequences.

With the results of these Working Groups and the IPCC report in the fall of 1990, the United States expects to play a leading role negotiating the framework convention anticipated to be called for by the IPCC process. The United States is currently developing policies based on sound analyses to guide national and international actions directed toward eventual solutions to greenhouse problems.

#

Withdrawal/Redaction Sheet

(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
01. Report	General Conclusions from the Noordwijk Meeting (7 pp.)	11/8/89	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Science and Technology Policy, Office of (OSTP)
Series: Bromley, D. Allan, Files
Subseries: Global Climate Change Files
WHORM Cat.:
File Location: Global Warming: NOORDWIJK [1989]

Date Closed:	4/8/2010	OA/ID Number:	62055-001
FOIA/SYS Case #:	2005-0336-F	Appeal Case #:	
Re-review Case #:		Appeal Disposition:	
P-2/P-5 Review Case #:		Disposition Date:	
AR Case #:		MR Case #:	
AR Disposition:		MR Disposition:	
AR Disposition Date:		MR Disposition Date:	

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

P-1 National Security Classified Information [(a)(1) of the PRA]
P-2 Relating to the appointment to Federal office [(a)(2) of the PRA]
P-3 Release would violate a Federal statute [(a)(3) of the PRA]
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P-5 Release would disclose confidential advice between the President and his advisors, or between such advisors [(a)(5) of the PRA]
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(b)(9) Release would disclose geological or geophysical information

THE WHITE HOUSE
WASHINGTON

November 15, 1989

MEMORANDUM FOR JAMES W. CICCONI

FROM:

D. ALLAN BROMLEY

Dman

SUBJECT:

MEMORANDUM TO THE PRESIDENT RE GLOBAL CHANGE
CONFERENCE IN NOORDWIJK, THE NETHERLANDS

The enclosed memorandum and attachment are self-explanatory.
I would much appreciate your getting it to the President.

Many thanks.

Enclosures

THE WHITE HOUSE
WASHINGTON

November 15, 1989

MEMORANDUM FOR THE PRESIDENT

FROM: D. ALLAN BROMLEY *Alan*
SUBJECT: THE NOORDWIJK CONFERENCE ON ATMOSPHERIC
POLLUTION AND CLIMATE CHANGE

I thought that you might be interested in the enclosed list of conclusions that I jotted down following my participation in last weeks conference in Noordwijk, The Netherlands.

I believe that our delegation had a very positive impact on the outcome of the conference -- despite some media comments to the contrary. Should you wish further information on any of the points listed I would be happy to provide it.

Enclosure

Withdrawal/Redaction Sheet

(George Bush Library)

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02. Report	General Conclusions from the Noordwijk Meeting (7 pp.)	11/8/89	(b)(1)	

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THE WHITE HOUSE
WASHINGTON

DATE: 11-16-89

FROM THE PRESIDENT

TO: Alan Bromley cc John S., Jim C

Re: Your Memo on Noordwijk.

Good Memo!

We must take lead. I hope you and bill
Reilly remain in close touch. I agree
we need a leadership statement by State
of Union at Latest.

GB

Presidential memo file

RECEIVED
89 NOV 20 AIO : 32
OFFICE OF THE
DIRECTOR

THE WHITE HOUSE
WASHINGTON

November 15, 1989

MEMORANDUM FOR THE PRESIDENT

FROM: D. ALLAN BROMLEY *Alan*
SUBJECT: THE NOORDWIJK CONFERENCE ON ATMOSPHERIC
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03a. Report	General Conclusions from the Noordwijk Meeting (7 pp.)	11/8/89	(b)(1)	

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Withdrawal/Redaction Sheet

(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
03b. Memorandum	To: James Baker From: Allan Bromley Re: Frederick Bernthal (1 pp.)	11/15/89	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Science and Technology Policy, Office of (OSTP)
Series: Bromley, D. Allan, Files
Subseries: Global Climate Change Files
WHORM Cat.:
File Location: Global Warming: NOORDWIJK [1989]

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"CORRESPONDENCE TRACKING"

TYPE: Information

DOCUMENT NUMBER: 8920434

FROM: ROBERT E. GRADY
OMB

TO: BROMLEY

DATE OF
CORRESPONDENCE: 11/19/89

SUBJECT: ENCLOSING A COPY OF A RECENT SPEECH BY MRS. THACHER
ON GLOBAL WARMING.

ASSIGNED TO:

ACTION REQUIRED: NONE

SENDER'S DUE DATE:

OSTP DUE DATE:

DATE COMPLETED: 11/20/89

COPIES TO: D. Allan Bromley
Nancy Maynard
Thomas Ratchford
Sara Bowden

James Wyngaarden

REMARKS:

DATE RECEIVED: 11/20/89

FILE: NEOB



EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET

DATE:

11/19/89

TO:

FROM: ROBERT E. GRADY
ASSOCIATE DIRECTOR
NATURAL RESOURCES, ENERGY AND SCIENCE

To Gov. Sununu
Dale Darman
Allan Bromley
Steve Danzansky
Bayden Gray
David Demarest

I thought you might find
Mrs. Thatcher's recent speech to the UN
re: Global Warming of interest. It was
pretty well received. What I found striking
however, is that the President could easily
have given this speech & taken credit for
an aggressive posture (see pp. 7 & 8) with very
little change in current policy required.
Bob G.



UNITED KINGDOM MISSION TO THE UNITED NATIONS

845 THIRD AVENUE, NEW YORK, N.Y.

Check Against Delivery

8 November 1989

ADDRESS BY THE RT HON MARGARET THATCHER, FRS, MP

PRIME MINISTER OF THE UNITED KINGDOM OF

GREAT BRITAIN AND NORTHERN IRELAND

TO THE 44TH SESSION OF THE UNITED NATIONS GENERAL ASSEMBLY

Mr President,

It gives me great pleasure to return to the podium of this Assembly. When I last spoke here four years ago, on the 40th Anniversary of the United Nations, the message that I and others like me gave was one of encouragement to the Organisation to play the great role allotted to it.

Of all the challenges faced by the world community in those four years, one has grown clearer than any other in both urgency and importance - I refer to the threat to our global environment. I shall take the opportunity of addressing the General Assembly to speak on that subject alone.

Introduction

During his historic voyage through the South Seas on the Beagle, Charles Darwin landed one November morning in 1835 on the shore of Western Tahiti.

After breakfast he climbed a nearby hill to find a vantage point to survey the surrounding Pacific. The sight seemed to him like "a framed engraving", with blue sky, blue lagoon, and white breakers crashing against the encircling coral reef.

As he looked out from that hillside, he began to form his theory of the evolution of coral; 154 years after Darwin's visit to Tahiti we have added little to what he discovered then.

What if Charles Darwin had been able, not just to climb a foothill, but to soar through the heavens in one of the orbiting space shuttles?

What would he have learned as he surveyed our planet from that altitude? From a moon's eye view of that strange and beautiful anomaly in our solar system that is the earth?

Of course, we have learned much detail about our environment as we have looked back at it from space, but nothing has made a more profound impact on us than these two facts.

First, as the British scientist Fred Hoyle wrote long before space travel was a reality, "Once a photograph of the earth, taken from the outside is available ... a new idea as powerful as any other in history will be let loose".

That powerful idea is the recognition of our shared inheritance on this planet. We know more clearly than ever before that we carry common burdens, face common problems, and must respond with common action.

Second, as we travel through space, as we pass one dead planet after another, we look back on our earth, a speck of life in an infinite void. It is life itself, incomparably precious, that distinguishes us from the other planets.

It is life itself - human life, the innumerable species of our planet - that we wantonly destroy. It is life itself that we must battle to preserve.

For over 40 years, that has been the main task of this United Nations.

To bring peace where there was war.

Comfort where there was misery.

Life where there was death.

The struggle has not always been successful. There have been years of failure.

But recent events have brought the promise of a new dawn, of new hope. Relations between the Western nations and the Soviet Union and her allies, long frozen in suspicion and hostility, have begun to thaw.

In Europe, this year, freedom has been on the march.

In Southern Africa - Namibia and Angola - the United Nations has succeeded in holding out better prospects for an end to war and for the beginning of prosperity.

And in South East Asia, too, we can dare to hope for the restoration of peace after decades of fighting.

While the conventional, political dangers - the threat of global annihilation, the fact of regional war - appear to be receding, we have all recently become aware of another insidious danger.

It is as menacing in its way as those more accustomed perils with which international diplomacy has concerned itself for centuries.

It is the prospect of irretrievable damage to the atmosphere, to the oceans, to earth itself.

Of course major changes in the earth's climate and the environment have taken place in earlier centuries when the world's population was a fraction of its present size.

The causes are to be found in nature itself - changes in the earth's orbit: changes in the amount of radiation given off by the sun: the consequential effects on the plankton in the ocean: volcanic processes.

All these we can observe and some we may be able to predict. But we do not have the power to prevent or control them.

What we are now doing to the world, by degrading the land surfaces, by polluting the waters and by adding greenhouse gases to the air at an unprecedented rate - all this is new in the experience of the earth. It is mankind and his activities which are changing the environment of our planet in damaging and dangerous ways.

We can find examples in the past. Indeed we may well conclude that it was the silting up of the River Euphrates which drove man out of the Garden of Eden.

We also have the example of the tragedy of Easter Island, where people arrived by boat to find a primeval forest. In time the population increased to over 9,000 and the demand placed upon the environment resulted in its eventual destruction as people cut down the trees. This in turn led to warfare over the scarce remaining resources and the population crashed to a few hundred people without even enough wood to make boats to escape.

The difference now is in the scale of the damage we are doing.

We are seeing a vast increase in the amount of carbon dioxide reaching the atmosphere. The annual increase is three billion tonnes: and half the carbon emitted since the Industrial Revolution still remains in the atmosphere.

At the same time as this is happening, we are seeing the destruction on a vast scale of tropical forests which are uniquely able to remove carbon dioxide from the air.

Every year an area of forest equal to the whole surface of the United Kingdom is destroyed. At present rates of clearance we shall, by the year 2000, have removed 65 per cent of forests in the humid tropical zones.

The consequences of this become clearer when one remembers that tropical forests fix more than ten times as much carbon as do forests in the temperate zones.

We now know, too, that great damage is being done to the ozone layer by the production of halons and chlorofluorocarbons. But at least we have recognised that reducing and eventually stopping the emission of CFCs is one positive thing we can do about the menacing accumulation of greenhouse gases.

It is of course true that none of us would be here but for the greenhouse effect. It gives us the moist atmosphere which sustains life on earth. We need the greenhouse effect - but only in the right proportions.

More than anything, our environment is threatened by the sheer numbers of people and the plants and animals which go with them. When I was born the world's population was some 2 billion. My grandson will grow up in a world of more than 6 billion.

Put in its bluntest form: the main threat to our environment is more and more people, and their activities:

- the land they cultivate ever more intensively;
- the forests they cut down and burn;
- the mountain sides they lay bare;
- the fossil fuels they burn;
- the rivers and seas they pollute.

The result is that change in future is likely to be more fundamental and more widespread than anything we have known hitherto. Change to the sea around us, change to the atmosphere above, leading in turn to change in the world's climate, which could alter the way we live in the most fundamental way of all.

That prospect is a new factor in human affairs. It is comparable in its implications to the discovery of how to split the atom. Indeed, its results could be even more far-reaching.

The Latest Scientific Evidence

We are constantly learning more about these changes affecting our environment, and scientists from the Polar Institute in Cambridge and the British Antarctic Survey have been at the leading edge of research in both the Arctic and the Antarctic, warning us of the greater dangers that lie ahead.

Let me quote from a letter I received only two weeks ago, from a British scientist on board a ship in the Antarctic Ocean: "In the Polar regions today, we are seeing what may be early signs of man-induced climatic change. Data coming in from Halley Bay and from instruments aboard the ship on which I am sailing show that we are entering a spring ozone depletion which is as deep as, if not deeper, than the depletion in the worst year to date. It completely reverses the recovery observed in 1988. The lowest recording aboard this ship is only 150 Dobson Units for ozone total content during September, compared with 300 for the same season in a normal year." That's a very severe depletion.

He also reports on a significant thinning of the sea ice. He writes that, in the Antarctic, "Our data confirm that the first-year ice, which forms the bulk of sea ice cover, is remarkably thin and so is probably unable to sustain significant atmospheric warming without melting. Sea ice" he continues "separates the ocean from the atmosphere over an area of more than 30 million square kilometres. It reflects most of the solar radiation falling on it, helping to cool the earth's surface. If this area were reduced, the warming of earth would be accelerated due to the extra absorption of radiation by the ocean".

"The lesson of these polar processes", he goes on, "is that an environmental or climatic change produced by man may take on a self-sustaining or 'runaway' quality ... and may be irreversible."

These are sobering indications of what may happen and they led my correspondent to put forward the interesting idea of a world Polar Watch, amongst other initiatives which will observe the world's climate system and allow us to understand how it works.

We also have new scientific evidence from an entirely different area, the tropical forests. Through their capacity to evaporate vast volumes of water vapour, and of gases and particles which assist the formation of clouds, the forests serve to keep their regions cool and moist by weaving a sunshade of white reflecting clouds and by bringing the rain that sustains them.

A recent study by our Meteorological Office on the Amazon rainforest shows that large-scale deforestation may reduce rainfall and thus affect the climate directly. Past experience shows us that without trees there is no rain, and without rain there are no trees.

The Scope for International Action

Mr President, the evidence is there. The damage is being done. What do we, the international community, do about it?

In some areas, the action required is primarily for individual nations or groups of them to take.

I am thinking of action to deal with pollution of rivers - and many of us now see the fish back in rivers from which they had disappeared.

I am thinking of action to improve agriculture methods - good husbandry which ploughs back nourishment into the soil rather than the cut-and-burn which has damaged and degraded so much land in some parts of the world.

I am thinking of the use of nuclear power which - despite the attitude of so-called Greens - is the most environmentally safe form of energy.

But the problem of global climate change is one that affects us all and action will only be effective if it is taken at the international level.

It is no good squabbling over who is responsible or who should pay. Whole areas of our planet could be subject to drought and starvation if the pattern of rains and monsoons were to change as a result of the destruction of forests and the accumulation of greenhouse gases.

We have to look forward not backward. We shall only succeed in dealing with the problems through a vast international, co-operative effort.

Before we act, we need the best possible scientific assessment: otherwise we risk making matters worse. We must use science to cast a light ahead, so that we can move step by step in the right direction.

The United Kingdom has taken on the task of co-ordinating such an assessment within the Inter-Governmental Panel on Climate Change, an assessment which will be available to everyone by the time of the second World Climate Conference next year.

But that will take us only so far. The report will not be able to tell us where the hurricanes will strike; who will be flooded; or how often and severe the droughts will be. Yet we will need to know these things if we are to adapt to future climate change.

That means we must expand our capacity to model and predict climate change. We can test our skills and methods by seeing whether they would have successfully predicted past climate change for which historical records exist.

Britain has some of the leading experts in this field and I am pleased to be able to tell you that the United Kingdom will be establishing a new Centre for the Prediction of Climate Change, which will lead the effort to improve our prophetic capacity.

It will also provide the advanced computing facilities scientists need. And it will be open to experts from all over the world, and especially from the developing countries, who can come to the United Kingdom and contribute to this vital work.

But as well as the science, we need to get the economics right. That means first we must have continued economic growth in order to generate the wealth required to pay for the protection of the environment. But it must be growth which does not plunder the planet today and leave our children to deal with the consequences tomorrow.

Second, we must resist the simplistic tendency to blame modern multinational industry for the damage which is being done to the environment. Far from being the villains, it is on them that we rely to do the research and find the solutions.

It is industry which will develop safe alternative chemicals for refrigerators and air-conditioning. It is industry which will devise bio-degradable plastics. It is industry which will find the means to treat pollutants and make nuclear waste safe - and many companies already have massive research programmes.

The multinationals have to take the long view. There will be no profit or satisfaction for anyone if pollution continues to destroy our planet.

As people's consciousness of environmental needs rises, they are turning increasingly to ozone-friendly and other environmentally safe products. The market itself acts as a corrective: the new products sell and those which caused environmental damage are disappearing from the shelves.

And by making these new products and methods widely available, industry will make it possible for developing countries to avoid many of the mistakes which we older industrialised countries have made.

We should always remember that free markets are a means to an end. They would defeat their object if by their output they did more damage to the quality of life through pollution than the well-being they achieve by the production of goods and services.

On the basis of sound science and sound economics, we need to build a strong framework for international action.

It is not new institutions that we need. Rather we need to strengthen and improve those which already exist: in particular the World Meteorological Organisation and the United Nations Environment Programme.

The United Kingdom has recently more than doubled its contribution to UNEP. We urge others, who have not done so and who can afford it, to do the same.

The central organs of the United Nations, like this General Assembly, must also be seized of a problem which reaches into virtually all aspects of their work and will do so still more in the future.

The most pressing task which faces us at the international level is to negotiate a framework Convention on climate change - a sort of good conduct guide for all nations.

Fortunately we have a model in the action already taken to protect the ozone layer. The Vienna Convention in 1985 and the Montreal Protocol in 1987 established landmarks in international law. They aimed to prevent rather than just cure a global environmental problem.

I believe we should aim to have a Convention on global climate change ready by the time the World Conference on Environment and Development meets in 1992. That will be among the most important conferences the United Nations has ever held. I hope that we shall all accept a responsibility to meet this timetable.

The 1992 Conference is indeed already being discussed among many countries in many places. I draw particular attention to the very valuable discussion which members of the Commonwealth had under the Prime Minister of Malaysia's chairmanship at our recent Commonwealth Heads of Government Meeting in Kuala Lumpur.

But a framework is not enough. It will need to be filled out with specific undertakings, or protocols in diplomatic language, on the different aspects of climate change.

These protocols must be binding and there must be effective regimes to supervise and monitor their application. Otherwise those nations which accept and abide by environmental agreements, thus adding to their industrial costs, will lose out competitively to those who do not.

The negotiation of some of those protocols will undoubtedly be difficult. And no issue will be more contentious than the need to control emissions of carbon dioxide, the major contributor - apart from water vapour - to the greenhouse effect.

We can't just do nothing. But the measures we take must be based on sound scientific analysis of the effect of the different gases and the ways in which these can be reduced. In the past there has been a tendency to solve one problem at the expense of making others worse.

The United Kingdom therefore proposes that we prolong the role of the Inter-Governmental Panel on Climate Change after it submits its report next year, so that it can provide an authoritative scientific basis for the negotiation of this and other protocols.

We can then agree targets to reduce the greenhouse gases, and how much individual countries should contribute to their achievement. We think it important this should be done in a way which enables all our economies to continue to grow and develop. We agreed yesterday at the Dutch Ministerial Conference on Climate Change that the Inter-Governmental Panel would examine the basis on which carbon dioxide and other greenhouse gases would be stabilized.

The challenge for our negotiators on matters like this is as great as for any disarmament treaty. The Inter-Governmental Panel's work must remain on target, and we must not allow ourselves to be diverted into fruitless and divisive arguments. Time is too short for that.

Before leaving the area where international action is needed, I would make a plea for a further global Convention, one to conserve the infinite variety of species - of plant and animal life - which inhabit our planet.

The tropical forests contain a half of the species in the world, so their disappearance is doubly damaging. It is astonishing but true that our civilisation, whose imagination has reached the boundaries of the universe, does not know, to within a factor of ten, how many species the earth supports.

What we do know is that we are losing them at a reckless rate - between three and fifty each day on some estimates - species which could perhaps be helping us to advance the frontiers of medical science. We should act together to conserve this precious heritage.

Britain's Contribution

Every nation will need to make its own contribution to the world effort. I want to tell you how Britain intends to contribute, either by improving our own national performance in protecting the environment, or through the help which we give to others.

First, we shall be introducing over the coming months a comprehensive system of pollution control to deal with all kinds of industrial pollution whether to air, water or land.

We are encouraging British industry to develop new technologies to clean up the environment and minimise the amount of waste it produces - and we aim to recycle fifty per cent of our household waste by the end of the century.

Secondly, we will be drawing up over the coming year our own environmental agenda for the decade ahead. This will cover energy, transport, agriculture, industry - everything which affects the environment.

With regard to energy, we already have a £2 billion programme of improvements to reduce acid rain emissions from our power stations. We shall be looking more closely at the role of non-fossil fuel sources, including nuclear, in generating energy. And our latest legislation requires companies which supply electricity positively to promote energy efficiency.

On transport, we shall look for ways to strengthen controls over vehicle emissions and to develop the lean-burn engine which offers a far better long term solution than the three-way catalyst, in terms of CO2 and the greenhouse effect.

We have already reduced the tax on lead-free petrol to encourage its use. This is an example of using market-based incentives to promote good environmental practice. We shall see whether there are other areas where this same principle can be applied.

With regard to agriculture, we recognise that farmers not only produce food - which they do with great efficiency - they need to conserve the beauty of the priceless heritage of our countryside. We are therefore encouraging them to reduce the intensity of their methods and to conserve wild-life habitats.

We are planting new woods and forests - indeed there has been a fifty per cent increase in tree planting in Britain in the last ten years.

We also aim to reduce chemical inputs to the soil and are bringing forward measures to deal with the complex problems of nitrates in water.

Third, we are increasing our investment in research into global environmental problems. I have already mentioned the Climate Change Centre that we are establishing.

In addition we are supporting our own scientists', and in particular the British Antarctic Survey's crucial contribution to the World Ocean Circulation experiment, as well as the voyages of our aptly-named research ship, the 'Charles Darwin'.

We have also provided more money for the climate and environment satellite monitoring programmes of the European Space Agency.

Fourth, we help poorer countries cope with their environmental problems through our aid programme.

We shall give special help to manage and preserve the tropical forests. We are already assisting in twenty countries and have recently signed agreements with India and Brazil.

As a new pledge, I can announce today that we aim to commit a further £100 million bilaterally to tropical forestry activities over the next three years, mostly within the framework of the Tropical Forestry Action Plan.

Conclusion

Mr President, the environmental challenge which confronts the whole world demands an equivalent response from the whole world. Every country will be affected. No-one can opt out.

We should work through this great Organisation and its Agencies to secure world-wide agreements on ways to cope with the effects of climate change, the thinning of the ozone layer, and the loss of precious species.

We need a realistic programme of action and an equally realistic timetable.

Each country has to contribute, and those countries who are industrialised must contribute more to help those who are not.

The work ahead will be long and exacting. We should embark on it hopeful of success, not fearful of failure.

I began with Charles Darwin and his work on the theory of evolution and the origin of the species. Darwin's voyages were among the high-points of scientific discovery. They were undertaken at a time when men and women felt with growing confidence that we could not only understand the natural world but master it, too.

Today, we have learned rather more humility and respect for the balance of nature. But another of the beliefs of Darwin's era should help to see us through - the belief in reason and the scientific method.

Reason is humanity's special gift. It allows us to understand the structure of the nucleus. It enables us to explore the heavens. It helps us to conquer disease. Now we must use our reason to find a way in which we can live with nature, not dominate nature.

At the end of a book which has helped many young people to shape their own sense of stewardship for our planet, its American author quotes one of our greatest English poems, Milton's "Paradise Lost".

When Adam in that poem asks about the movements of the heavens, Raphael refuses to answer. "Let it speak", he says,
"The Maker's high magnificence, who built
So spacious, and his line stretcht out so far,
That man may know he dwells not in his own;
An edifice too large for him to fill,
Lodg'd in a small partition, and the rest
Ordain'd for uses to his Lord best known."

We need our reason to teach us today that we are not, that we must not try to be, the lords of all we survey.

We are not the lords, we are the Lord's creatures, the trustees of this planet, charged today with preserving life itself - preserving life with all its mystery and all its wonder.



THE NOORDWIJK DECLARATION ON ATMOSPHERIC POLLUTION
AND CLIMATIC CHANGE

(1) The composition of the earth's atmosphere is being seriously altered at an unprecedented rate due to human activity. Based on our current understanding, society is being threatened by man-made changes to the global climate.

(2) While there are still uncertainties regarding the magnitude, timing and regional effects of climate change due to human activity, there is a growing consensus in the scientific community that significant climate change and instability are most likely over the next century.

Predictions available today indicate potentially severe economic and social dislocations for future generations.

Assuming these predictions, delay in action may endanger the future of the planet as we know it.

(3) Fortunately, there is a growing awareness among the world population and their political leaders that action is needed. The basic principle of ecologically sustainable development has gained wide currency following the report of the World Commission on Environment and Development. This principle should be fundamental to efforts to tackle the problem of climate change and atmospheric pollution. The protection of the ozone layer is being addressed by the 1985 Vienna Convention on the Protection of the Ozone Layer and the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer. Further strengthening of control measures contained in the Protocol was called for at the London Conference on Saving the Ozone Layer in March 1989 and the first meeting of the parties to the Montreal Protocol at Helsinki in May 1989. A decision will be taken by the second meeting of the contracting parties to be held in London in 1990. The process aims at phasing out the production and consumption of chlorofluorocarbons (CFCs) controlled under the Montreal Protocol by the year 2000 by the developed countries. They should also phase out other controlled substances which deplete the ozone layer as soon as feasible. Developing countries should also phase out these substances as soon as possible after their technology and resource needs are met.

(4) Global warming is being addressed by the Intergovernmental Panel on Climate Change (IPCC), which was established by UNEP and WMO, and recognized by UN General Assembly Resolution 43/53 on Protection of global climate for present and future generations of mankind. The Hague Declaration of March 1989 put forward

challenging ideas for international co-operation, and legal and institutional measures. The 15th session of the UNEP Governing Council and the XLI session of the WMO Executive Council in 1989 requested their executive heads to begin preparations for negotiations on a framework convention on climate; these negotiations should be initiated as soon as possible after the interim report of the IPCC is adopted. This interim report will be reviewed at the Second World Climate Conference in November 1990. The 1989 Economic Summit agreed that a framework convention on climate change setting out general principles was urgently required and that specific protocols containing concrete commitments could be fitted into the framework as scientific evidence requires and permits. The Economic Summit also strongly advocated common efforts to limit emissions of carbon dioxide and other greenhouse gases. The July 1988 declaration of the states, parties to the Warsaw Treaty, and the meeting of non-aligned countries in Belgrade in September 1989 also addressed the issue of climate change. The Tokyo Conference on Global Environment and Human Response Towards Sustainable Development was held in September 1989. The Langkawi Declaration on Environment issued by the Commonwealth Heads of Governments in October 1989 stated the need to take new action to address the serious deterioration in the environment, including climate change. Given this base it is now time for governments of all countries to commit themselves to the IPCC, to strengthen and to extend the process of addressing climate change.

(5) Measures to limit climate change will have other significant benefits such as reducing acidification, protecting the ozone layer, preserving biodiversity and other natural resources, preventing mean sea-level change and promoting sustainable development.

(6) The Conference recognizes the principle of the sovereign right of States to manage their natural resources independently. The Conference also reaffirms that global environmental problems have to be approached through international co-operation. Solving the external debt problem of developing countries, and establishing fair economic and commercial relationships between industrialized and developing countries would assist developing countries in creating appropriate conditions to protect the environment.

(7) Climate change is a common concern of mankind. All countries should now, according to their capabilities and the means at their disposal, initiate actions and develop and maintain effective and operational strategies to control, limit or reduce emissions of greenhouse gases. As a first step, they should take those actions which are beneficial in their own right. Industrialized countries, in view of their contribution to the increase of greenhouse gas concentrations, and in view of their capabilities, have specific responsibilities of different kinds: i) they should set an example by initiating domestic action, ii) they should support, financially and otherwise, the action by countries to which the protection of the atmosphere and adjustment to climate change would prove to be an excessive burden and iii) they should reduce emissions of greenhouse gases, also taking into account the need of the developing countries to

have sustainable development. Developing countries establishing industrial facilities for the first time have a unique opportunity to include up-to-date technologies for controlling the emissions of greenhouse gases.

(8) For the long term safeguarding of our planet and maintaining its ecological balance, joint effort and action should aim at limiting or reducing emissions and increasing sinks for greenhouse gases to a level consistent with the natural capacity of the planet. Such a level should be reached within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and permit economic activity to develop in a sustainable and environmentally sound manner. Stabilizing the atmospheric concentrations of greenhouse gases is an imperative goal. The IPCC will need to report on the best scientific knowledge as to the options for containing climate change within tolerable limits. Some currently available estimates indicate that this could require a reduction of global anthropogenic greenhouse gas emissions by more than 50 per cent. These estimates should be the subject of further examination by the IPCC.

(9) While striving to preserve the global environment, it is important to work at the same time to ensure stable development of the world economy, in line with the concept of "sustainable development". Effort and action should include: i) the phasing-out of CFCs controlled by the Montreal Protocol, which are responsible for about one fifth of projected global warming, by national action and international co-operation in the context of the Montreal Protocol. This includes financial assistance and transfer of technology and information. In this connection, it is important that the substitutes for CFCs also should not contribute significantly to the global warming problem, ii) action especially by industrialized countries to limit or reduce CO₂-emissions, iii) action to reduce deforestation, prevent soil erosion and desertification; increase afforestation, and sound forest management in the temperate as well as the tropical zones, iv) action to limit or reduce the emissions of all greenhouse gases other than CO₂ and their precursors and to increase the sinks for such substances and v) intensified efforts for technological breakthroughs, for example with regards to renewable energy and removal and re-utilization of CO₂.

(10) The conference recommends that appropriate fora, including the IPCC, consider the necessity and efficiency of the introduction of the concept of CO₂-equivalence. This would provide a single parameter to describe the radiative effects of the various greenhouse gases, including CFCs. Such a concept, after taking into account other environmental considerations, creates a basis for negotiations in response measures for different greenhouse gases in the most cost-effective manner. The Conference further recommends the development of common definitions and the harmonization of methods to calculate CO₂-emissions.

(11) All countries should increase co-operation in developing new, environmentally sound technologies, to improve existing technologies and increasingly to use these technologies in order

to limit climate change or adapt to it. Maximum use should be made of existing international organizations, institutions and mechanisms, governmental and non-governmental, for technology co-operation with and transfer to interested countries, especially developing countries. Factors that impede effective transfer of appropriate technologies should be identified and measures implemented to overcome these impediments.

(12) Progress in reducing atmospheric pollution depends not only on technical and economic issues but also on attitudinal and conceptual changes. All countries, especially industrialized countries, should recognize the need to make their socio-economic activities and life-styles environmentally sound. Improved dissemination of information and better training of personnel is needed, both at the national and international level. Public awareness programmes, including school curricula, should include the issue of climate change and its connection with the way individuals use energy and other natural resources. Wider public awareness can be supported by increased scientific evidence arising from systematic research and monitoring activities. The Conference calls upon the non-governmental organizations to participate, in co-operation with international, regional and national authorities, in the efforts that are needed to respond to the problems of global warming, more specifically in the field of education and awareness building.

(13) Many countries, especially developing countries will require assistance in identifying the causes of anthropogenic climate change, in establishing its extent and effect and also in responding to it. They will need help in acquiring, using, developing and maintaining technologies that are appropriate to their industrial, energy, transport, forestry and agricultural infrastructure. Industrialized countries will take steps to facilitate the transfer to developing countries of technologies to limit the global climate change through financial assistance and other mechanisms to overcome the incremental costs of acquiring and using these technologies. Furthermore, the capabilities of these countries should be increased so that they can develop appropriate technologies themselves. In this context the concept of assured access to appropriate technologies in relation to proprietary rights needs to be explored.

Given this stage of development of the issue of climate change, the Conference more specifically:

CARBON DIOXIDE (CO₂)

- (14) Urges all countries to take steps individually and collectively, to promote better energy conservation and efficiency and the use of environmentally sound energy sources, practices and technologies with no or minimum environmentally damaging characteristics. These policies should be reflected in short and long term energy policies and be pursued by all relevant sectors, including industry and transport, taking into account the need of developing countries for an adaptation period in order to enable them to meet their technological and other developmental needs. One direct means of allowing markets to incorporate the risk of climate change could be to ensure that the prices of all

fuels reflect their full social, long run marginal and environmental costs and benefits.

- (15) Agrees that it is timely to investigate quantitative emission targets to limit or reduce CO₂ emissions and encourages the IPCC, in their interim report due in 1990, to include an analysis of target options.
- (16) Recognizes the need to stabilize, while ensuring stable development of the world economy, CO₂ emissions and emissions of other greenhouse gases not controlled by the Montreal Protocol. Industrialized nations agree that such stabilization should be achieved by them as soon as possible, at levels to be considered by the IPCC and the Second World Climate Conference of November 1990. In the view of many industrialized nations such stabilization of CO₂ emissions should be achieved as a first step at the latest by the year 2000.
 Urges all industrialized countries to support the process of IPCC through the investigation of the feasibility of achieving targets to limit or reduce CO₂ emissions including e.g. a 20 per cent reduction of CO₂ emission levels by the year 2005 as recommended by the scientific World Conference on the Changing Atmosphere in Toronto 1988.
 Urges all industrialized countries to intensify their efforts in this respect, while ensuring sustainable development and taking into account the specific circumstances of individual countries.
- (17) Agrees that industrialized countries with, as yet, relatively low energy requirements, which can reasonably be expected to grow in step with their development, may have targets that accommodate that development.
- (18) Calls on the IPCC to present the analysis and conclusions referred to above to the Second World Climate Conference in November 1990.
- (19) Agrees that developing countries endeavour to meet future targets for CO₂-emissions and sinks, with due regard to their development requirements and within the limits of their financial and technical capabilities. International co-operation, whenever available, would be a contributing factor for greater action. New processes or industries to be introduced should, as far as possible, incorporate technologies which are more energy-efficient and produce less pollution than present technologies.
- (20) Agrees that developing countries will need to be assisted financially and technically, including assistance with training, i.e. by strengthening relevant mechanisms to ensure that they will be in a position to manage, develop, and conserve their forest resources in a sustainable and environmentally sound manner. This will also contribute to combatting erosion and desertification. Recognition by the market of the total value of forests, including non-wood values, is a precondition for developing countries' being able to successfully use such financial and technical

assistance for sustainable forest management.

- (21) Agrees to pursue a global balance between deforestation on the one hand and sound forest management and afforestation on the other. A world net forest growth of 12 million hectares a year in the beginning of next century should be considered as a provisional aim. Requests the IPCC to consider the feasibility of achieving this aim. To this end; the world deforestation rate should be slowed inter alia through the suppression of acid rain and other pollutants and of fires and through the reduction of pressures on biota. Sound forest management practices should be encouraged and at the same time vigorous forestry programmes should be developed in both temperate and tropical zones; biological diversity should be maintained; strategies addressing climate change issues through forest management and afforestation should be integrated with strategies addressing the sustainability of other forest based values resulting in full multiple-use plans where appropriate, but with due consideration of the people living in or dependent on forest land. Welcomes the work of the Tropical Forestry Action Plan and the International Timber Trade Organisation in pursuit of these goals.

CHLOROFLUOROCARBONS (CFCs)

- (22) Welcomes the commitment of the industrialized countries to amend the Montreal Protocol and to phase out the production and consumption of controlled chlorofluorocarbons by the year 2000, and of other controlled ozone depleting substances as soon as feasible. Urges all countries to become Parties to the Vienna Convention for the Protection of the Ozone Layer and to the Montreal Protocol. To facilitate this broad participation suitable amendments of the Montreal Protocol should be considered urgently by the Parties to the Protocol. Urges industrialized countries to use financial and other means to assist developing countries in phasing out their production and consumption of controlled substances as soon as possible, by providing them with sufficient means to enable them to meet their target date. The development of alternative technologies and products in developing countries should be promoted.

OTHER GREENHOUSE GASES

- (23) Recommends that the development and implementation of specific means of limiting the atmospheric concentrations of greenhouse gases other than CO₂ and CFCs should be energetically pursued, taking into consideration the special situation of developing countries.

MINISTERIAL MEETING

- (24) Recognizes the need to convene a Ministerial Conference to review the interim report of the IPCC. The conference endorses the plan of the organization by WMO, UNEP, UNESCO and ICSU of such a meeting as part of the Second World Climate Conference in November 1990.

FUNDING

- (25) *Recommends* that existing institutions for development and financial assistance including the Multilateral Development Banks, Bilateral Assistance Programmes, the relevant United Nations organisations and specialized agencies, and scientific and technological organisations should give greater attention to climate change issues within their environmental and other relevant programmes by providing expanded funding including concessional funding. In addition, regional and subregional co-operation should be reinforced and funded so as to address and implement the required action at that level.

- (26) *Recommends* that additional resources should, over time, be mobilized to help developing countries take the necessary measures to address climate change and that are compatible with their development requirements. Further *recommends* that the scope of resources needed must be assessed. Such assessments should include inter alia country studies and the capabilities of existing institutions and mechanisms to meet the financing needs identified, similar to the approaches developed under the Montreal Protocol. Further consideration should be given to the need for funding facilities including a clearinghouse mechanism and a possible new international fund and their relationship to existing funding mechanisms, both multilateral and bilateral. Such funding should be related to the implementation of a future climate convention and associated protocols. In the meantime the donor community is urged to provide assistance to developing countries to support actions addressing climate change.

- (27) *Recommends* that, initially, international funding be directed towards
 - (i) funding of a CFC phase-out in developing countries in the context of the Montreal Protocol;
 - (ii) promoting efficient use of energy, including appropriate end use technologies, increasing the use of non-fossil fuels and switching to energy sources with lower greenhouse gas emissions, and the use of renewable energy sources;
 - (iii) increased financial support for forest protection and forest management improvement, for example through the Tropical Forestry Action Plan (TFAP), the Plan of Action to Combat Desertification, the International Tropical Timber Organization (ITTO) and other relevant international organizations;
 - (iv) assisting developing countries in planning how to address problems posed by climate change;
 - (v) supporting developing countries to enable their participation in the IPCC process and the other international meetings on this subject;
 - (vi) conducting research and monitoring;
 - (vii) arranging for technology transfer to and technology development in developing countries;
 - (viii) promoting public awareness, education and institutional and manpower development.

The use of financial resources could subsequently be extended inter alia to major energy sources with little or no environmentally damaging characteristics and for steps to reduce other global man-made emissions of greenhouse gases.

RESEARCH AND MONITORING

- (28) Urges all countries and relevant organizations to increase their climate change research and monitoring activities and to provide for adequate data bases on emissions. Also urges states to co-operate in, and provide increasing support for, international co-ordination of these activities building on international programmes such as the World Climate Programme and the International Geosphere Biosphere Programme, and on the present roles of the UNEP, WMO, ICSU, IEA, UNESCO, IOC, IGBP and other competent international organizations and bodies. The enhancement and strengthening of operational aspects of their work should be examined.

Recommends that more research should be carried out by 1992 into the sources and sinks of the greenhouse gases other than CO₂ and CFCs, like methane (CH₄), nitrous oxide (N₂O) and tropospheric ozone (O₃), including further research on the effect of the ocean on the concentration of radiatively active gases in the atmosphere.

CLIMATE CHANGE CONVENTION

- (29)
 1. Urges all countries to join and intensify the ongoing work within UNEP and WMO through the IPCC with respect to the compilation of elements for a framework convention on climate change so that negotiations upon it can start as soon as possible after the adoption of the interim report of the IPCC.
 2. *Recommends* that such convention will be framed in such a way as to gain the adherence of the largest possible number and most suitably balanced spread of countries.
 3. Agrees that to this end the framework convention and associated protocols should commit the parties inter alia to:
 - enhancement of research and systematic observation of climate, aimed at detecting and monitoring climate variations and change;
 - action to deal with greenhouse gas emissions and the effects of global warming;
 - address the particular financial needs of the developing countries in the access to and transfer of technology; and
 - strengthen sustainable forest management.
 4. Agrees further that in developing the framework convention on climate change special attention should be given to ensuring that provision is made for appropriate decision making procedures and powers.
 5. Urges all involved or to be involved in the negotiations to do their utmost to conclude these negotiations to ensure adoption of the convention as early as 1991 if possible and no later than at

the Conference of the United Nations on Environment and Development in 1992.

6. Considers that in the preparation of the framework convention and protocols the relevant aspects of the Vienna Convention on the Protection of the Ozone Layer should be taken into account, as well as innovative approaches as may be required by the complex character of the problem.
- (30) Recommends that this declaration and the supporting papers be conveyed to the IPCC at the conclusion of this Conference for further consideration and action.

For Dr. Bromley's
meeting (DPC)
tomorrow ~ noon

We need 20 clean
copies, please

(by 11am)

thx NM

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04. Report	General Conclusions from the Noordwijk Meeting (7 pp.)	11/8/89	(b)(1)	

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Record Group: Bush Presidential Records
Office: Science and Technology Policy, Office of (OSTP)
Series: Bromley, D. Allan, Files
Subseries: Global Climate Change Files
WHORM Cat.:
File Location: Global Warming: NOORDWIJK [1989]

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 (b)(9) Release would disclose geological or geophysical information

SCIENCE AND THE CITIZEN

Not So Hot

New studies question estimates of global warming

When editors and newscasters routinely bandy about the term "global warming" without bothering to explain it, then the idea could be said to have entered the body of public knowledge, accepted by most as immutable fact.

Yet the public's acceptance of global warming caused by the greenhouse effect belies the fluid nature of the science. The conclusion that the buildup of carbon dioxide and other greenhouse gases might lead to catastrophic warming of the earth's climate continues to generate debate among scientists. As investigators refine the computer models on which global climate projections are based, some estimates of probable warming are being lowered. Moreover, new data suggest that human activity may influence the climate in ways that have previously been neglected.

Few climatologists doubt that the rapid increase of trace gases in the atmosphere resulting from human activity will produce some warming, with potentially severe consequences. Estimates of how much and how soon are made with climate models run on supercomputers. Earlier models projected that global temperature would increase from three to 5.5 degrees Celsius during the next century, but they included only crude estimates of the roles cloud cover and oceans play in mediating climatic change.

Clouds seem to have a net cooling effect, so if cloud cover increased it might, other things being equal, partly offset any warming brought on by the buildup of carbon dioxide and other greenhouse gases. Oceans, for their part, act as a vast heat sink, dissipating and circulating heat.

Two recent climate-model studies have incorporated more sophisticated representations of clouds and oceans than previous models. One such model, described in *Nature* by John F. B. Mitchell and his colleagues at the British Meteorological Office, accounts for the fact that ice clouds have different properties than water clouds do. According to the model, even if levels of carbon dioxide and other gases effectively double by the middle of the next century, the atmosphere will warm by



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only 1.9 degrees C, as opposed to the 5.2 degrees C predicted by a comparable model that does not distinguish between ice and water clouds.

The second model, described in *Climate Dynamics* by Warren M. Washington and Gerald A. Meehl of the National Center for Atmospheric Research in Boulder, Colo., includes more sophisticated calculations of ocean circulation and heat exchange. Their findings suggest that 30 years after an instantaneous doubling of carbon dioxide in the atmosphere (an admittedly unrealistic scenario) the earth would have warmed by only 1.6 degrees C, substantially less than models with a simpler ocean would predict.

Human activity may also affect climatic change in a way that has been previously unrecognized. Analyses of satellite data suggest that sulfate aerosols formed from pollutants (such as the sulfur dioxide that rises from urban centers) can significantly increase the earth's albedo (the light and heat that the earth and its atmosphere reflect back into space). Robert D. Cess of the State University of New York at Stony Brook says his analysis of satellite data indicates a significant increase in the albedo of stratocumulus clouds over the ocean for thousands of miles downwind of major population centers such as Southeast Asia and the east coast of North America. It is thought that the sulfate particles provide nuclei around which cloud droplets form and so increase cloud reflectance.

Similarly, Philip A. Durkee of the Naval Postgraduate School in Monterey, Calif., has found threefold increases in the reflectance of stratocumulus clouds over the ocean hundreds of miles downwind from San Francisco and Los Angeles. Such results suggest that anthropogenic in-

creases in albedo caused by greater numbers of droplets might be large enough to affect the global radiation balance. Thomas M. L. Wigley of the University of East Anglia in England has even suggested that an increase in albedo in the Northern Hemisphere might explain why the warming trend in this century has been smaller than was predicted by earlier and more simplistic climate models.

Patrick J. Michaels of the University of Virginia, a vocal critic of what he sees as premature policy responses to global warming, points out that studies by Thomas R. Karl of the National Climatic Data Center in Asheville, N.C., show that in the U.S. and Canada during the period from 1941 to 1980 there was a marked decrease in the daily temperature range, attributable mainly to an increase in nighttime and early-morning temperatures. Michaels thinks the finding supports the notion that global cloud cover may be increasing. An increase in cloudiness would increase nighttime temperatures by trapping heat emitted by the earth but decrease temperatures during the day by increasing cloud reflectance. According to Michaels, the greenhouse effect might therefore be more benign than has been supposed—or perhaps even beneficial. Growing seasons might be lengthened and the frequency of droughts reduced. Michaels's views are not widely shared: Kevin E. Trenberth of the National Center for Atmospheric Research counters that the decreasing daily temperature range might be a consequence of urban development near measuring stations.

Another participant in the debate is the Marshall Institute in Washington, D.C. Founded in 1984 and privately funded, the institute's most notable previous contribution to public policy discussion was a stout defense of the Strategic Defense Initiative. Now under the Marshall banner, Frederick Seitz, a past president of the National Academy of Sciences, Robert Jastrow, the founder of the Goddard Institute for Space Studies and William A. Nierenberg, director emeritus of the Scripps Institution of Oceanography, have seized on another weak link in current climate models. They suggest (with no firm evidence) that fluctuations in the sun's brightness during the past 100 years may be responsible for the uneven course of global warm-

ing in this century. If so, they argue, the planet's response to the buildup of greenhouse gases has been smaller than climate models suggest, and expectations of warming should be scaled back accordingly.

Michaels thinks projections of global warming will become even more moderate as models become increasingly sophisticated and incorporate more climate feedbacks. Cess, for one, disagrees: he believes improvements to models are as likely to make projections worse as they are to make them better. Only more research is likely to settle the arguments. —Tim Beardsley

Ningún Nombre ***Identifying Argentina's*** ***desaparecidos***

In late September Argentina's new president, Carlos Saúl Menem, bowed to pressure to pardon some 20 police and military officers accused of killing dissidents during the 1970's. But some of the victims—the *desaparecidos*, or "disappeared

ones"—are emerging from anonymity to bear silent witness against their executioners, if not in court then in history. The Argentine Forensic Anthropology Team, a group of seven investigators working out of a small office in Buenos Aires, is quietly extending its efforts to identify the remains of persons murdered during the military regime. In collaboration with colleagues in the U.S., the Argentine workers are developing ways to apply DNA-fingerprinting techniques to the identification of badly decomposed corpses. The team is also exporting its expertise to other countries where political repression has been widespread.

The National Commission on the Disappeared, established by President Raúl Alfonsín in 1983, has estimated that more than 9,000 Argentines were illegally detained and killed under military rule, most of them between 1976 and 1978. Although many bodies were cremated or dumped at sea, others were buried in graves marked "N.N."—*ningún nombre* ("no name"). The forensic anthropology team, which was spawned by a workshop given in Bue-

nos Aires by the American Association for the Advancement of Science, has so far exhumed some 120 bodies and has positively identified 30; some of the identifications have already served as evidence in trials that produced convictions.

The team gathers data by examining skeletal remains and also by studying records of prisoner transfers from illegal detention centers and burial records from cemeteries. Clyde C. Snow, an American forensic anthropologist based in Norman, Okla., taught the Argentine workers many of their techniques: how to determine age, sex, stature, handedness, race—even a woman's childbearing history—from fragmentary remains. Frequently, dental records or details of healed fractures will clinch an identification.

According to Mercedes Doretti, one of the team's founding members who visited Washington, D.C., in September, brain tissue has recently been found in skulls exhumed from a mass grave near Buenos Aires. The team hopes to extract DNA from the brain tissue or from the cranial bones to obtain DNA fingerprints—detailed analyses of the victims' DNA that can then be compared with the DNA of living relatives. By doing so, the team thinks it can identify the *desaparecidos* with a high degree of certainty. Cellmark Diagnostics in Germantown, Md., has offered to help by analyzing bone samples. Karen R. Rubenstein says the company is cautiously optimistic that it will be able to obtain DNA fingerprints from samples sent by the Argentine team. Immunologists at the Hospital Duran in Buenos Aires are already using specific genetic markers in the blood to identify children of *desaparecidos* who were kidnapped and secretly adopted by military families.

Laws passed in 1987 and 1988 by the Alfonsín government—which operated under the constant threat of military rebellion—reduced the number of trials of those who allegedly authorized the killings, from about 300 to 17. When President Menem announced his intention to pardon the accused, he also said he would consider granting pardons to some of the senior officers and junta leaders who were previously convicted. Nonetheless, the forensic anthropology team intends to continue its investigations, Doretti says, both for the sake of the families of the *desaparecidos* and for the historical record. Interest in the team's work is spreading: members have visited human-rights groups in the Philippines and Chile and are cur-

Most of the scores of exhumed Argentine victims ***are impossible for investigators to identify***



REMAINS of an unidentified male, estimated to have been 40 to 45 years of age, were unearthed by the Argentine Forensic Anthropology Team. Six bullets were found in the skull and elsewhere in the skeleton. The official death certificate records the cause of death as "acute hemorrhage."

DRAFT

Statement

William K. Reilly

Administrator

U.S. Environmental Protection Agency

Ministerial Conference

Atmospheric Pollution and Climatic Change

Noordwijk, The Netherlands

November 6, 1989

Mr./Mme. Chairman, Colleagues and Friends

Throughout the world, awareness is growing of the need to preserve the earth's ecological balance. This includes awareness that changes in the atmosphere could alter our planet's climate. (Economic Summit, paragraph 33, slightly rephrased)

The potential for global climate change forces all of us to look at this earth as an integrated system. Addressing this issue therefore requires a multilateral commitment from the community of nations. It also requires an integrated approach in policy , for global climate change involves science, energy, economics, and foreign affairs as well as the environment.

There is also a growing consensus in the scientific community that global warming due to manmade greenhouse gas emissions is possible if current trends in these emissions continue. Yet significant uncertainties exist regarding the magnitude and timing and regional variations of global warming. The United States has played and will continue to play a leading role in efforts to develop and improve our scientific understanding of climate change. We will insist that there be a solid scientific foundation for all programs that we undertake. Moreover, the U.S. is creating, for the first time, a partnership among the private sector, the research universities,

and our own governmental laboratories to ensure that we have the best understanding of climate change issues from all sources available in our country.

To address the remaining uncertainties, the United States is substantially increasing its budget for scientific research into the causes and consequences of climate change. President Bush has proposed a ^{dramatic} [43 percent] increase in expenditures for basic research and monitoring to resolve critical scientific questions related to climate change. For this purpose, the United States expects in the coming budget year to spend about \$500 million, which includes expenditures for remote sensing and other activities related to monitoring and understanding the earth's natural systems. President Bush, at the G-7 Economic Summit, invited other nations to participate with us in these research activities. I reiterate his invitation today to the countries represented ^{here}.

But we cannot afford to wait until all the uncertainties have been resolved before we act. That's why the United States has begun to take several steps which we believe will contribute to addressing the global climate change problem. ^{To start} ~~First~~, earlier this year, President Bush proposed the first major rewrite of our nation's clean air laws in over a decade. The proposal will

sharply reduce sulfur dioxide emissions from electric generating stations, as well as pollution from automobiles and various kinds of factories and commercial establishments. By placing a cap on the amount of allowable SO₂ emissions[^] a level far below today's[^] emissions, President Bush has crafted a program which provides a strong incentive for energy conservation -- since conservation is one method that utilities can choose to meet the standard. One study shows that his kind of acid rain reduction initiative alone could help reduce emissions nationally by over 2% of current levels.

Second, the President approved a decision to increase the corporate average fuel economy standards for automobiles in the ^{United States} ~~U.S.~~ By making the entire fleet more efficient, this will both reduce U.S. dependence on imported oil and reduce CO₂ emissions.

Third, the President has announced U.S. support for a worldwide phaseout of chloroflourocarbons by the year 2000, ~~if safe substitutes can be found.~~ The President also proposed a system of fees on CFC production which will substantially reduce production and use of these chemicals. The ^{U.S.} congress is now on the verge of accepting the proposal, ~~it has passed both the House and the Senate as part of this year's budget bill.~~

Fourth, the President has directed the establishment of a broad National Energy Strategy, ~~for the future~~. The strategy, being developed under the leadership of our Secretary of Energy, will undoubtedly lead to conservation playing a greater role in our energy future.

Finally, as mentioned above, the United States is prepared to continue its commitment to global change research. I expect that the 1/2 billion dollars we spent on research last year will increase in the year ahead.

As we look forward, the United States is actively considering further initiatives in such areas as energy conservation and reforestation. In our view, all nations should pursue those actions that make sense even as we learn more about global climate conditions. ~~Because~~ a prudent course today is to provide insurance against possible adverse impacts tomorrow from the greenhouse effect.

As President Bush and the other leaders at the Economic Summit agreed in July, we need common efforts to limit emissions of carbon dioxide and other greenhouse gases. The United States agrees with the broad need for action to limit emissions of all greenhouse gases in order to slow global warming. While it is necessary for all countries to work toward these goals, leadership by the industrialized countries is particularly important.

The United States firmly supports the work of the Intergovernmental Panel on Climate Change, established under the auspices of the United Nations Environment Programme and the World Meteorological Organization. We expect it to provide a solid foundation for international action, including subsequent agreements on control measures. This forum is the one in which we in the United States intend to address the issue internationally.

We expect the IPCC to lead to a framework convention on climate change. The United States lends it full support to the work of the IPCC in this regard.

The United States believes that an agreement setting out general principles or guidelines is the best, most sensible way to start dealing with the issue before us. Such an approach will provide a forum for fostering a worldwide consensus on appropriate responses to global change. To begin this discussion, the United States recently hosted, in our capacity as chair of the Response Strategies Working Group of the IPCC, a workshop ~~convention~~ to address the likely elements of a framework convention on global climate change. This workshop provides over 30 nations their first opportunity to try to reach a common understanding of the myriad issues to be confronted in a framework convention.

In addition to the multilateral IPPC effort, each country now needs to take stock of its own domestic situation and to identify and assess the possible costs and economic effects, as well as the environmental benefits, of measures to limit greenhouse gas emissions or adapt to climate change. The United States is committed to exploring all possible policy options, including the examination of their benefits, their technical feasibility, and their economic implications. The United States is committed to employing market-based approaches to limiting greenhouse gases, as we have done in our pioneering domestic clean air legislation. It is our hope that this legislation will be a model of market incentives for environmental protection. We are currently analyzing cost-effective emission sinks in the near term in the energy, forestry, and other sectors. For longer term emission reductions, we are also assessing our priorities for research and technological development. We expect to have out initial assessments ready by next Spring.

I wish to make it absolutely clear that the United States recognizes the special problems of developing countries in participating in the effort to address global environmental problems. We fully endorse, and even share, the aspirations of the developing world for economic improvement. To this end, we participate in and support a broad spectrum of bilateral and multilateral financial and technical assistance efforts -- many of which we helped initiate. We also recognize the need to reconcile global economic development with a global environment capable of sustaining this growth.

The unique circumstances of developing world will be taken into account. We have just launched, for example, a high-level study on how to ~~best~~ make environmental technologies ^{available} to developing countries. We are also investigating the possibilities of debt-for-nature swaps and other innovative financing approaches.

In addition, the U.S. ^{Agency for International Development} ~~AID~~ has developed an aggressive plan to integrate environment and sustainable growth ⁱⁿ ~~for~~ its programs for developing countries.

We believe further that the World Bank and other multilateral development banks have a particularly important role to play in promoting sustainable development, a role which we expect will increase as the world community organizes itself to respond to climate change under a framework convention and supporting protocols. We strongly support the movement to have the development banks incorporate environmental assessments into their decision making and to take account of the greenhouse effect when evaluating natural resource projects.

In conclusion, the United States recognizes that we all are as one with respect to global climate change. In the words of President Bush, as he spoke with respect to the problem of global warming in his recent address to the United Nations, "The United States will do its part." The President believes strongly that success will require the cooperation of all countries. Agreeing on a sound set of international strategies ~~is no simple task.~~

Thank you very much.

will require the best
efforts of us all.

Policy Options Available to Address Global Warming

Responses of human societies to global warming can take several approaches. Prevention strategies can be employed to reduce the quantities of greenhouse gases being emitted in the first place. Mitigation strategies can attempt to compensate for emissions that do occur, for example through reforestation policies that increase the uptake of CO₂ from the air by trees and other plants. Lastly, strategies can be employed that seek to help communities and nations adapt to changes in climate and its consequences. In practice, all three types of policies are likely to be important. Here we discuss a range of prevention and mitigation policies.

In assessing potential policies, it makes sense to discuss them not gas by gas but rather on the basis of economic sectors of human activity. This is because energy and agricultural policies, rather than CO₂ policies, will inevitably be the foci for action. Sectoral analysis also makes the interrelationships between and among the greenhouse gas emissions of different sectors much more visible. Table 2.6 translates our knowledge of the science of greenhouse emissions into the categories of human activities through which policy can actually be brought to bear on the problem of global warming.

Although there are substantial uncertainties underlying several of the individual numerical estimates in Table 2.6, the data provide a clear sense of where policy leverage is likely to be the greatest. The greatest potential lies with policies targeted at the energy and industrial sectors. Nevertheless, virtually all elements of human activity contribute to greenhouse gas emissions. The fact that nearly one quarter of the potential warming arises from the forestry and agriculture sectors suggests that each sector should be examined on a country by country basis to determine which strategies are most readily implementable at the local and national levels. By the very nature of the patterns of greenhouse gas emissions, reducing those emissions will be an incremental process.

It is worth noting that the problem of global warming is intimately linked to other serious environmental problems involving the atmosphere, in particular those of acid precipitation, urban smog, and the depletion of stratospheric ozone layer. The problems are linked chemically because, once released, many of the pollutants that cause them interact in complex and synergistic ways within the atmosphere or play a role in more than one problem. They are linked economically, because it is often the same human activities that release the pollutants responsible for all four problems. And they are linked in a policy sense, because policies designed to attack one problem--by altering an economic activity to reduce emission of the pollutant responsible, for example--will

inevitably affect other problems as well. [(1)UNEP and the Beijer Institute, The Full Range of Response to Anticipated Climatic Change, 1989, p. 39-40.] A policy designed to produce automobiles that use less fuel, for example, would not only reduce CO2 emissions but also the NOx emissions that contribute to acid precipitation, urban smog, and global warming.

Prevention: Reducing the Risk of Global Warming

While work should proceed on mitigation and adaption strategies as well, prevention deserves the highest priority. Preventing the emission of greenhouse gases that would otherwise be released into the atmosphere not only delays the onset of significant global warming but slows its advance and reduces its ultimate magnitude.

To reduce greenhouse gas emissions or even to slow their rate of growth on a global scale will require an extraordinary degree of political consensus. As the greenhouse gas indicators discussed earlier in this chapter make clear, no one country or even one region can by itself alter global trends significantly. To be broadly acceptable, prevention policies should ideally confer other, local benefits on adopting countries in addition to the global benefit of reducing the risk of a global warming.

A wide range of policies have been proposed and are under study. It seems clear, however, that any successful prevention strategy will include five key elements. These include: 1) increasing the efficiency of energy production and use; 2) switching where possible from carbon-intensive fuels such as coal to hydrogen-intensive fuels such as natural gas; 3) encouraging the rapid development and utilization of solar and other carbon-free energy sources; 4) eliminating the production of the most ozone-destructive CFC's and developing the means to recapture those now in use; and 5) reducing the rate of deforestation.

Energy Efficiency

Increased energy efficiency appears to be the single most promising option for reducing the risk of global warming [(2) UNEP op. cit., p. 128]. Higher efficiency in energy production and in a wide range of energy uses is the fastest and most cost-effective method for reducing emissions of carbon dioxide and other energy-related greenhouse gases. The replacement of just a single 75W incandescent bulb with an 18W fluorescent bulb, for example, provides the same light but prevents the emission of over 100 kg of carbon as CO2 over the life of the new bulb. Replacing a car that burns 10 liters of gasoline per 100 kilometers with one that is twice as efficient would prevent more than five tons of carbon emissions over a 10 year period. Experience during the last fifteen years in the United States, Western Europe, Japan, the Soviet Union, the People's Republic of China, Korea, Taiwan, and many other countries has shown that large improvements in energy efficiency are possible, without a significant effect on the rate of economic growth. The evidence suggests that economic growth is

not inexorably tied to increasing energy consumption, as was once thought. In fact, two recent studies published by the World Resources Institute (WRI) suggest that an energy strategy based on increased energy efficiency can sustain economic growth in both developing and industrialized countries [(3)ref.TK].

One way to characterize the prevention potential is to compare the energy efficiency of different national economies, which vary markedly. The United States, for example, is only half as energy efficient as Western Europe or Japan in generating a unit of gross domestic product. On the other hand, it is twice as efficient as China and more efficient than the Soviet Union and most of Eastern Europe. Many newly industrializing countries are the least efficient of all. Although a large and geographically heterogeneous country is unlikely to ever match the energy efficiency achievable in some smaller countries, the current variation is still remarkable and suggests the scope of the energy and CO2 savings that are possible.

Policies that promote higher efficiency are particularly timely for consideration by international development agencies, because many developing countries are just now planning major expansion and modernization of their energy sectors. It will prove much cheaper in the long term to account for the threat of global warming when making these investments, rather than having to retrofit or replace these infrastructures once installed. A recent study by the World Bank and the Compagnia Energetica da Sao Paulo (the world's largest electric utility) suggested that a \$2 billion investment in cost-effective improvements in electricity efficiency could offset the need for 22 gigawatts of new generating capacity costing at least \$44 billion by the year 2000 [(4)ref. TK].

End-use efficiency options range from the introduction of more efficient cooking stoves, the installation of more efficient light bulbs in homes and commercial buildings, the construction of better-insulated buildings, and the manufacture of more fuel-efficient vehicles. In each area, the best technology available today consumes at least 50 percent less energy (and emits at least 50 percent less CO2) than the technology most commonly used. For example, new jet engines and composite materials for aircraft construction offer the promise of advanced planes which can fly longer distances while burning half of the fuel per ton-km of current models. New car designs by various Japanese and European manufacturers show that cars which use less than 4 liters per 100 km can deliver safe, attractive and efficient transportation for four or five passengers--compared to the 9 liters/100 km efficiency of the average new American auto.

On the supply side, new power generation technologies offer significantly higher energy conversion efficiencies than have been available in the past. The spread of cogeneration offers some of the greatest savings potentials. Cogeneration systems convert primary energy in the fuel to electricity and then use the otherwise wasted heat to make steam or hot water for local

processes requiring thermal energy. Such systems can thus deliver between 60-80 percent of the heat in the fuel to useful purposes, compared to about 33 percent for conventional steam-electric technologies. This technology has many important applications in industry. In the United States paper industry, for example, almost all process steam and heat requirements are now met through the use of cogeneration systems. In Brazil, cogeneration systems in alcohol distilleries now provide revenue from electricity sales as well as heat for distillation and purification processes. In Germany and Scandinavia, cogeneration systems are now widely used to supply steam or hot water to heat nearby buildings as well as provide power.

A additional approach that may be important is to increase the efficiency in the use of biomass, which now provides more than half the energy demands of developing countries. Inefficient use of these biomass resources is denuding forests, increasing soil erosion, and adding to global emissions of greenhouse gases. Conversion of wood or charcoal to more efficient energy carriers such as natural gas for urban heating and cooking or conversion of the gas to electricity could stretch fuel supplies, reduce emissions, and fuel the industrialization of developing countries that are rich in biomass resources. New combined cycle gas turbines, for example, offer the promise of heat to electricity conversion efficiencies approaching 50 percent, and their small modular sizes may be a perfect fit for the decentralized demands of rural electrification far from a central power grid. For such improvements in energy efficiency to be widely adopted, the developed countries must assure that developing nations have access to the most efficient technology.

Improvements in energy efficiency would also have a significant effect on emissions of other greenhouse gases. Combustion of fossil fuels is a major source of N_2O , itself a greenhouse gas, and NO_x , which contributes to the formation of tropospheric ozone, another greenhouse gas. Combustion of fossil fuels also produce carbon monoxide (CO), which reacts with and depletes the atmosphere of a reactive chemical known as the hydroxyl radical, which would otherwise break down and remove methane molecules. Thus carbon monoxide emissions lengthen the atmospheric lifetime of methane, an extremely potent greenhouse gas. Reductions in fuel use through more efficient energy technologies would reduce emissions of N_2O , NO_x , and CO , resulting in less tropospheric ozone and slower growth of methane levels. Greater care and efficiency in the extraction and transport of natural gas (with is 90 percent methane) to reduce leaks into the atmosphere would also slow the growth of methane levels.

By pursuing the efficiency opportunities discussed above, it appears possible to continue economic growth and maintain high standards of living while eventually reducing per capita energy use by as much as 50 percent in industrialized countries. Such a strategy would also allow economic growth in developing countries to proceed vigorously without significantly increasing greenhouse

gas emissions. This approach would also have significant local benefits for participating countries, including reductions in acid rain, urban smog, and, in many countries, a reduction in dependence on oil or other energy imports. At the same time, of course, such policies may exacerbate other problems, such as radon levels in energy-efficient buildings and passenger safety in accidents involving light weight, energy efficient automobiles, although means exist to address these concerns.

Fuel Switching

Because the carbon content of fossil fuels varies over a wide range, one option for reducing CO₂ emissions is to emphasize reliance on the less carbon-intensive fuels. Coal, for example, produces nearly twice as much CO₂ per unit of energy produced as natural gas, and 1.5 times as much as oil. If gasified prior to combustion, coal emissions of CO₂ can be three times as high as natural gas due to the energy requirements of the gasification process.

If combined with a move to the more efficient technologies described above, fuel-switching can provide major benefits in reducing CO₂ emissions. By shifting electricity production from conventional coal-fired steam turbines to advanced turbines fueled with natural gas, CO₂ emissions per electrical kWh can be reduced by 60 percent (50 percent from the coal to gas conversion and an additional increment due to the higher conversion efficiencies offered by advanced gas turbines). Care must be taken to reduce leakage of natural gas from production facilities and pipelines, however, for the benefits of fuel switching can be negated by a methane leakage rate as seemingly modest as 3-4 percent. This is because methane is 30 times as powerful a greenhouse gas as CO₂ on a molecule-per-molecule basis.

Switching from oil-based fuels such as gasoline to methanol or ethanol made from biomass or from natural gas can also reduce CO₂ emissions. Just such a policy has been pursued in Brazil, where the majority of cars burn alcohol-based fuels made from sugar cane, and has been proposed on a limited basis in the United States. Fuel switching policies must be carefully evaluated, however, to ensure that adequate long-term supplies exist or can be provided without creating additional environmental problems. If a significant portion of the U.S. auto fleet were to be converted to methanol fuels, it is likely that the methanol would eventually be made from coal rather than natural gas--which would increase rather than reduce CO₂ emissions compared to present fuel sources.

Fuel switching is a useful near-term strategy. But the world's resources of natural gas and oil are small compared to coal deposits and may be largely consumed before the end of the next century. That would leave coal--the most damaging fuel from a global warming perspective--as the primary fossil energy source. For countries with large coal deposits and little gas or oil--including China, Poland, and India--the option of switching to other fossil fuels will not be very feasible. For these

countries in the near future and for virtually all countries when readily-available sources of oil and natural gas have been consumed, the only realistic alternative to coal will be biomass or carbon-free energy sources.

Carbon-Free Energy Sources

Energy sources and fuels that produce no CO₂ are ideally suited to reduce the risk of global warming. To the extent that biomass energy is produced in a renewable manner--with growth of new biomass equally that which is burned--it too adds no net CO₂ to the atmosphere and is effectively carbon-free. Such technologies are already in operation in many applications around the world, although in many cases they are not yet economically competitive with fossil fuels. Some--such as hydroelectric dams and conventional nuclear power stations--raise serious environmental questions of their own. Nonetheless, hydroelectric, wind, solar thermal, photovoltaic, and nuclear technologies deserve additional attention. As the eventual alternative to coal-based energy, carbon-free energy sources occupy a unique strategic role.

Encouragingly, significant progress is being made in developing these energy sources. Hydropower is already a major energy source and can be expanded further, although the environmental costs of large dams are appropriately receiving more careful scrutiny. Wind turbines both large and small are in use in Denmark, California, Australia and the United Kingdom. Prototype solar thermal plants to provide electricity are in operation in a number of countries and solar thermal installations for heating water are widespread. As the costs of production decline and costs of conventional fuels rise, these technologies can make a larger and larger contribution to global energy. Solar thermal electricity and wind machines are already cost-competitive in some parts of the United States. These developments should be encouraged.

Solar photovoltaic systems are finding application in remote areas but are still too costly for central station applications. Technical progress is rapid, however, and may lead to photovoltaic power becoming economically competitive with conventional electricity sources within a decade (see Chapter 9). If sufficient investments in research and development are made in the next decade, these small modular systems could become a major energy source in the early part of the next century. Policies that promote research and early commercialization therefore deserve wide support.

Nuclear power's future in the global energy picture remains quite uncertain. Commercial nuclear power plants produce a substantial portion (although still less than 10 percent) of the world's electricity. But because of public concern about safety and radioactive waste disposal and commercial concern with high capital costs, long construction times, and financial risks, construction of nuclear plants has slowed or halted in all major markets outside of France. There is growing interest, however, in a new generation

of "inherently safe" nuclear technologies, some of which also offer the benefits of small-scale, modular units of standardized design that can be factory-produced under controlled conditions (see Chapter 9). Because of the long-term importance nuclear power as a potential alternative to coal for baseload power generation, these new nuclear technologies deserve careful attention and increased research and development efforts.

Eventually, hydrogen may prove to be an important carbon-free fuel for transportation use. Hydrogen is an energy carrier and must be produced by a primary energy source through, for example, the electrolysis of water. Hydrogen has the advantage that its combustion products are primarily water vapor, but as yet it is expensive to produce and difficult to store. Prototype automobiles that run on hydrogen have been demonstrated, however, and a recent study proposes a strategy by which photovoltaic power facilities could produce hydrogen for use in automobiles in some areas of the United States within a couple of decades [(6) Robert Williams, World Resources Institute, 1989]. This option deserves further study.

Changing Industrial Practices to Reduce CFC Emissions

Although the industrial sector can be seen as encompassing many of the activities described under the energy sector, it has one important unique component: chlorofluorocarbons, which molecule-for-molecule are the most potent greenhouse gases known. Reducing production and controlling release of these substances in the immediate future is thus critical for reducing the risk of global warming.

International cooperation to limit CFCs emissions is already well underway in response to the role played by CFCs in depleting the stratospheric ozone layer. The Montreal Protocol to Control Substances that Deplete the Ozone Layer is intended to reduce the production and use of CFCs in the industrialized countries by fifty percent from 1986 levels before the year 2000. Developing countries are permitted to increase CFC use to 0.3 kg per person, but it is to be hoped that CFC substitutes can also be deployed there. Unless management practices, substitutes, and new technologies are universally implemented, the hoped for 50 percent cut in CFC production could easily become a 50 percent increase, even if all nations comply with the provisions of the Protocol. On the other hand, reductions to essentially zero by the year 2000 are being proposed to protect the ozone layer, which would prevent CFCs and related compounds from becoming an even larger component of the global warming problem. Unfortunately, these chemicals are among the longest lived of all the greenhouse gases, residing in the atmosphere for a century or more.

A number of options exist for rapidly reducing the most widely used CFCs to the level specified under the Montreal Protocol. The first strategy involves incentives (or penalties) to improve equipment maintenance and encourage the more efficient use of CFCs in applications such as residential refrigeration where their

special properties may make substitutes impractical in the short term. In the process of manufacturing foam products, substantial potential exists for recapture rather than release to the atmosphere of the blowing agents. Enclosing process lines, aging the product before shipment, and carefully controlling spray heads can substantially reduce emissions in manufacturing and may allow recapture of the dangerous gases. A number of recent advances have occurred in the use of CFC-based solvents in the electronics industry. Some corporations have been highly successful in minimizing solvent losses by enclosing their production lines and passing the captured gases through a bed of absorbent carbon. Similar opportunities exist throughout the electronics industry in solvent applications.

The second option involves policies that encourage recapture and recycling of these compounds rather than their release and periodic replacement. It would be simple and cheap to require installation of service valves in the cooling loops of most devices so that the refrigerant could be removed and captured either during routine servicing or at the point of disposal. In the case of automobile air conditioners, higher-quality hoses and fittings would reduce leakage significantly, and it is now possible to capture and recycle the air conditioning cooling fluid rather than replacing it whenever the unit is serviced. For those applications where the CFCs can be recaptured but for which recycling is not feasible or is prohibitively expensive, careful disposal techniques are essential.

Alternative technologies for refrigeration, and local and district heating and cooling can also play a major role in reducing CFC releases. One should not automatically assume, however, that substitutes for CFCs can safely be released into the atmosphere. The substitutes themselves may be greenhouse gases, or retain some ozone-depleting potential. In addition, these compounds may spur chemical reactions in the troposphere which may contribute to air pollution or to an increase in other greenhouse gases. All of these possible consequences should be carefully explored before large quantities of CFC substitutes are released into the atmosphere.

Slowing Deforestation

As shown above, the agriculture and forestry sectors contribute significantly to greenhouse gas emissions. The most important of these arises from land use changes, principally deforestation, which releases large quantities of CO₂ and methane to the atmosphere. Reducing and ultimately ending deforestation is therefore an immediate priority, and would dramatically reduce emissions of two principal greenhouse gases. Brazil, by suspending tax credits that encouraged deforestation as a means of establishing title to land in the Amazon region, has sharply reduced the rate of deforestation in the last two years, although the rate remains high [(7) INPE report]. Overall, however, deforestation rates in many key tropical forest countries have accelerated during the 1980's (see Chapter 6). Thus there exist

opportunities for significant near-term reductions in the risk of global warming.

Deforestation is not the only source of greenhouse gases from this sector. Some agricultural practices release CO₂ and N₂O through energy inputs, fertilizer inputs, and soil erosion. Several steps can be readily identified to moderate these releases, although technologies per se play a much smaller role than in the energy sector policy options. Enclosing manure piles or feedlots would allow the capture and use of methane as a commercial-quality fuel rather than being an additional atmospheric burden. New strains of rice may not require the flooding now required to control weed growth, thus significantly reducing methane production. Revising agricultural practices to reduce fertilizer requirements would reduce N₂O emissions, no-till agriculture can stabilize carbon in the soil rather than releasing it to the atmosphere through erosion, and improved productivity reduces pressures for deforestation which currently emanate from the need to rotate among poorly performing agricultural plots on an ongoing bases.

Each of these policy options has local benefits besides slowing global warming. There is some evidence, for example, that tropical forests in regions of poor soils have greater economic value for natural products harvested on a sustained basis than as farmland [(7) Nature, ref TK]. Indeed, significant resources are already dedicated to making progress in these areas, e.g. through the Tropical Forestry Action Plan, although such progress is woefully slow. The threat posed by global warming should encourage a rededication of effort and resources to these areas.

Mitigating the Effects of Greenhouse Gas Buildup

The agricultural and forestry sectors offer one of the few opportunities for actively mitigating and slowing global warming. This option consists of using biotic processes to remove carbon from the atmosphere and store it over the long-term in vegetation, in soils, or in long-term products such as building materials. Forests and soils play a key role in the global carbon cycle, serving as a large sink for carbon that would otherwise have to be distributed between the oceans and the atmosphere. Policy options such as reforestation and soil carbon enhancement can increase the net size of the biotic carbon sink, and help stabilize atmospheric carbon dioxide concentrations.

Just how much of an offset to carbon emissions through reforestation is not certain. The size of the biotic carbon sink varies widely by the type of forestry, the rotation times of the trees being planted, and the ultimate disposition of the wood being grown. The area of new forest required just to offset current CO₂ emissions for the next 40-50 years probably exceeds over 1 billion hectares. Clearly, net reforestation of this magnitude is unlikely to occur, and global warming itself may create havoc for some of the world's forests. Whether the potential for increased uptake

by green plants is large enough to offset significantly the rate of emissions growth from fossil fuel combustion, or to reverse the historical trend of increasing concentrations, remains to be determined. Some analyses are sceptical that significant additions to the world's forest stocks are possible and suggest that neither more intensive forest management nor reduced industrial harvests would have more than a very modest impact on the atmospheric carbon buildup [(8) Sedjo and Solomon, Greenhouse Warming: Abatement and Adaptation, RFF, Washington, DC, 1989.] Other analyses are more optimistic, pointing to the possibility of expansion of northern boreal forests as northern temperatures and rainfall increase and higher CO2 levels stimulate more rapid growth rates [(9) Revelle, ibid, p. 170]. It is most likely that such approaches can play a supporting role during a transition period in which fossil-fuel related greenhouse gas emissions are reduced. Bounding the actual potential of individual forestry projects will require the evaluation of a number of strategic factors including land availability and suitability, the growth rates likely to be achieved, and the many implementation uncertainties which can interfere with such projects. Clearly, more study of these policy options warrents a high priority. In addition to mitigation effects on global warming, reforestation would bring local benefits in many developing countries, including reducing erosion and increasing supplies of firewood.

The first project to actually offset the CO2 emissions of an electric powerstation is getting underway in 1989. The equivalent of the 15 million tons of carbon that will be emitted from a new fluidized bed coal plant built in the state of Connecticut in the United States will be sequestered over 40 years by large scale woodlot and agroforestry planting in Guatemala. Utility funding will make the project possible, and it will be implemented by the relief and development organization CARE with support from the Guatemalan Forestry Department.

Institutional Issues and Policy Instruments

Several conclusions can be drawn from the preceding analysis of the scientific and policy issues surrounding global warming:

- 1) The threat posed by global climate change to human and natural systems is unparalleled in recorded history and means that the community of nations making up the planet must come to grips with the likelihood of rapid and significant global warming.
- 2) Technological and policy decisions made by nations in the relatively near term will substantially affect the timing and severity of any global warming that occurs.
- 3) The technologies needed to substantially prevent, reduce, or mitigate further human impacts on the atmospheric concentrations of the gases contributing to global warming exist or are likely to exist soon, although they are not yet widely disseminated.

These conclusions in place, it becomes evident that the challenge facing nations is fundamentally of an institutional rather than technical character. Institutional issues that will have to be addressed range from the structure of east-west and north-south trade, patterns of developing country debt, and facilitating the transfer of new technologies, to restructuring the taxation and subsidy policies which in many countries steer energy investment, agricultural and forest policy, development, and consumption patterns. Ranging across these issues are many institutional impediments to addressing global warming.

While the mandates of many national and international institutions are tangentially related to the threat posed by global warming, few are charged with responding to the threat in any way. Energy departments and ministries around the world, for example, may have extensive responsibilities in the areas of energy exploration, development, and consumption, without being charged with evaluating and responding to broader threats such as that of climatic change. This lack of a mandate to deal comprehensively with energy or other issues often results in policy decisions which actively aggravate rather than offset these broader threats.

Tax incentives which underwrite with public money the exploration and development of fossil fuel resources, for example, subsidize the artificially low prices paid for fossil fuels in many countries. International trade policies often have the unintended impact of compounding rather than ameliorating the severity of human impacts on environmental systems. International institutions charged with promoting economic development in developing countries have historically ignored the environmental implications of their actions, indirectly promoting activities such as tropical deforestation which contribute to global warming.

This suggests that a significant restructuring of organizational mandates will be required at all levels of government. Responsibility for holistically evaluating and responding to the threat of climate change, or at least coordinating the evaluation and response process, must be assigned to specific institutions. These institutions in turn must seek to rationalize the policy process operating at other levels of government and in other agencies. This will require comprehensive education not only of governmental bureaucracies, but of individual citizens.

The realities of international cooperation and action suggest that the institutional infrastructures most prepared and most able to actually address and regulate the emission of greenhouse gases are agencies at the national level. Notwithstanding the international ramifications of global warming, and the fact that solving the problem over the long term cannot be achieved without organized international cooperation, national action remains the obvious point for immediate policy intervention. International coordination and cooperation will follow much more easily once national actions reflect the existence of a consensus on the need for action, and a political willingness to take such action.

National governments should therefore move to adopt policies of global warming prevention, mitigation, and adaptation on an ongoing basis, without waiting for formal international agreement which is likely to be years in the future.

International action in the short term should focus on the activities currently underway through the Intergovernmental Panel on Climate Change. Efforts to better understand both the effects of and possible responses to global warming are pivotal to developing the type of international consensus that will have to precede formal international cooperation. Within this category multilateral research efforts deserve a very high priority.

An additional vehicle for action with a clear international flavor is also immediately available, namely bilateral and multilateral development banks and other development assistance institutions. If the problem of global warming is to be addressed and the risks minimized, the World Bank and other multi-lateral bodies must systematically address the contributions that their lending and foreign assistance programs are making to these problems. The Bank must evaluate not just the environmental impacts of the individual project loans whose approval is sought by the member countries, but it must also evaluate the overall impact of the national energy strategies which it encourages developing countries to follow.

In the longer term, considerable attention should be devoted to the components of a "global bargain" that will allow an equitable sharing of responsibilities for addressing the problem.

Global warming is not the only policy problem facing human societies that is characterized by massive uncertainty and equally massive risk. In evaluating national defense needs, for example, nations are also confronted with the possibility of future destruction, with the timing and likelihood of such destruction remaining uncertain. Nevertheless, nations invest huge resources in national defense programs, even though many mechanisms exist to help prevent war, ranging from a fear of mutually assured destruction to memories of the horrors of past wars. Such mechanisms are not available to help avoid global warming. Climate change will result from societal actions taken incrementally, largely in ignorance, and with no past history to learn from.

It is for these same reasons that the world can ill afford to wait to begin responding to the threat of global warming until the precise character and timing of the threat is known.

There is no single solution to the complex challenge posed by global warming. Virtually all elements of human societies are involved in creating the problem to one degree or another, and all must play a role in ultimately bringing it under control.

TABLE 2.6
WARMING CONTRIBUTION
BY GREENHOUSE GAS AND HUMAN ACTIVITY
(Percent of Global Warming)

Sector	Gas	Carbon Dioxide	Methane	Ozone	Nitrous Oxide	Chlorofluorocarbons (and others)	Percent Warming by Sector
Energy Direct		35	3		4	---	49
Indirect			1	6			
Deforestation		10	4	---	---	---	14
Agriculture		3	8	---	2	---	13
Industry		2	---	2	---	20	24
Natural Feedbacks		↑	↑	↑	↑	---	?
Percent Warming by Gas		50	16	8	6	20	100

Source: Radiative forcing estimates
from Ramanathan, 1985a.
Op. Cit. Emissions estimates
collected from various sources.

THE WHITE HOUSE
WASHINGTON

December 1, 1989

Dear Paul:

Many thanks for your letter with its enclosed op-ed piece from the New Haven Register. I am trying to do what Michael Schrage has in mind with respect to sitting down with private sector folk and have already, I think, substantially increased the private sector input into upper level government decisions. All of this, unhappily, takes more time than I am sure most people could believe possible.

I very much appreciated your input concerning the IPCC meeting in Paris. Some of the problems you raise have been endemic in our entire global change activity, and, at least I hope, things will now improve. President Bush has asked me to chair a Working Group of the Domestic Policy Council charged with developing a single, coherent U.S. federal policy in this area and with making sure that our various agencies actually adhere to that policy. As you undoubtedly recognize, we have a few free spirits who would like to behave like sovereign powers.

I attended the Noordwijk conference with Bill Reilly, and probably my most useful input to that particular activity was arbitrarily cutting the U.S. delegation by a factor of two. I had indeed been completely opposed to our participating in any high-level fashion in the Noordwijk meeting, because a key part of the Dutch proposal was that of establishing an ongoing, annual series of ministerial meetings, which, as far as I was concerned, simply undercut the United Nations' initiative in which the U.S. was a founding and major participant. As it turns out, most of the seventy other countries present at Noordwijk had exactly the same view, and so the Dutch very quickly withdrew the suggestion.

As it turns out, I think that we had a decidedly positive impact on the declaration that was issued. A great many nations, without any idea of how they might do it or what it might cost, were prepared to sign up immediately for twenty percent CO₂ reductions. My own feeling is that we may be able to stabilize our greenhouse gas emissions by aggressive conservation and other measures, including substantial

reforestation, but I am also convinced that in order to obtain any substantial in CO₂ emissions, we will necessarily have to go to major fuel switching, specifically, to modular nuclear units, and there is no way that we can do that on a short time scale.

What I am trying to do is to develop some understanding of the impacts of climate change beyond the rather peripheral studies so far reported to obtain as professional as possible an economic estimate of the impact of those changes attributable to climate change, and I am also meeting with cross-sections from the scientific, environmental and economic communities, to try to get some feeling for whether a consensus view is possible or, if not, how wide the range of disagreement may be.

It is currently my intent to host a meeting of science ministers here in Washington some time early in the coming year to try to at least agree on where the gaps and uncertainties are in our understanding of the more general global change problem, with substantially less focus on global warming than has been the case thus far.

Many thanks for giving me this very useful input. I shall certainly keep in touch with you as we proceed. Pat joins me in sending you and Barbara our warmest best wishes.

Sincerely yours,



D. Allan Bromley
Assistant to the President
for
Science and Technology

Dr. Paul E. Waggoner
The Connecticut Agricultural Experiment Station
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"CORRESPONDENCE TRACKING"

TYPE: Information

DOCUMENT NUMBER: 8920436

FROM: PAUL E. WAGGONER
THE CONNECTICUT AGRICULTURAL

TO: BROMLEY

DATE OF
CORRESPONDENCE: 11/19/89

SUBJECT: ENCLOSING COMMENTS ON SCIENCE POLICY AND GLOBAL
CLIMATE CHANGE.

ASSIGNED TO:

ACTION REQUIRED: NONE

SENDER'S DUE DATE:

OSTP DUE DATE:

DATE COMPLETED: 11/20/89

COPIES TO: D. Allan Bromley
Nancy Maynard

REMARKS:

DATE RECEIVED: 11/20/89

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The Connecticut Agricultural Experiment Station

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Founded 1875

Putting science to work for society

September 19, 1989

Dr D Allan Bromley
Assistant to the President for
Science and Technology
The White House
Washington DC 20500

Dear Allan:

Two items: Science policy and Climate change.

■ Science policy. The OpEd piece in the New Haven Register (enclosed) is precisely the kind of criticism one needs. Yielding gracefully to it, one can go exactly where one wanted to go all the time.

■ Climate change. At the end of October, I participated as a representative of a non-governmental organization (AAAS) at the Intergovernmental Panel on Climate Change meeting, Palais des Nations. Several nations seem underwhelmed by the issue. The US had a large delegation. In addition to the EPA and the Department of Agriculture, the people shown by their enclosed cards were present.

As I understand, the US delegation does not have a single leader but rather three leaders, each for a subdivision of the subject. The leader of the US delegation for one subdivision is Allen Hecht, formerly of the National Climate Program Office of NOAA and now at EPA. He was not present, but when a tough question came up, the EPA representative present responded, postponing his answer until Hecht could be telephoned.

The Corps of Engineers has retained Peter Rogers, a big shot from Harvard. Rogers gave a paper atheistic about climate change. Further, he attacked my agnostic paper as being too pro-climate change!!!!

The representative of USGS complained publically about the indifference of the other nations who were to work with him in a subgroup.

The representative of USDA frequently spoke about complications of the issue.

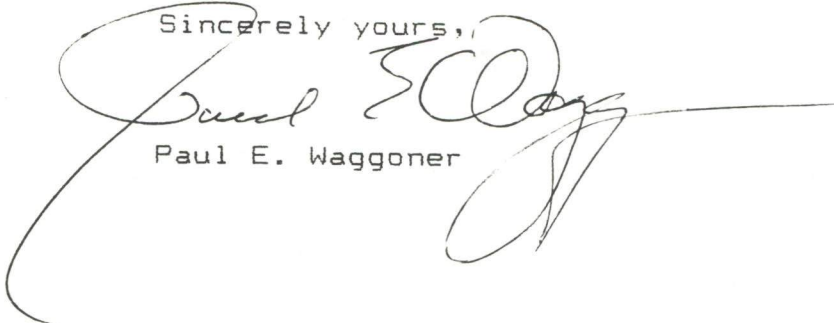
The representative of USDC only smouldered publically but was frank in private about impact of the issue on business, e.g. coal exports.

The representative of EPA only spoke when spoken to.

Privately I was given the word that in the US, Australia and New Zealand the environmental agencies were running off with the climate change issue, ignoring scientists in other agencies of their governments. I was told that in the US the EPA would get its way by leaks and by having the dollars to fund studies.

Finally, Canadian Pentland made concluding remarks from the chair. He made good sense. I enclose his card.

Sincerely yours,


Paul E. Waggoner



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Bush administration lacks science policy

By Michael Schrage

SOMEWHERE, stumbling aimlessly between Pennsylvania and Constitution avenues in Washington, is \$18 billion-plus in search of a policy. That's roughly what the federal government plans to spend on non-defense-related science and technology this fiscal year.

Only in our nation's capital, where a dash of politics sweetens unpalatable taxes into tasty revenue enhancers, can a phrase like "science policy" be an oxymoron. That's not healthy and it's not smart.

The irony is that, after an initial delay, the Bush administration seems to have made all the right moves in setting up a policy infrastructure.

The appointment of Yale physicist D. Allan Bromley as White House science adviser was well received — as was the upgrading of the post to Cabinet-level status.

Bush even reconstituted an Office of Science and Technology Policy to further assure that intelligent policy advice and technical expertise wouldn't be total strangers.

"I couldn't have hoped for much more," says William Golden, president of the New York Academy of Sciences and a longtime player in science policy circles.

Moreover, the speechwriter who penned candidate Bush's campaign commitments to emphasize science and innovation is now deputy to Office of Management and Budget Director Richard Darman, overseeing the science and technology budget.

At 32, Robert Grady is one of the younger turks shaping the dollar flow to NASA, the National Science Foundation and the nation's universities, as well as brokering some of the budget trade-offs between Congress and the White House.

"Investments in science and technology are a priority," says Grady, who is less than thrilled with the way Congress has trimmed Bush's initiatives. The administration's rationale is crisp and well-defined: A dollar spent on science and technology is an investment; a dollar spent on "entitlements" is a dollar destined for consumption.

Darman has publicly decried what he describes as America's "I want my Maypo . . . now!" culture and it's clear that boosting the science budget sends a clear signal that this administration wants to bias the budget towards investment and away from consumption. Investing in science and technology becomes a symbol.

Yet the trick is matching the symbolism with substance. Spending money is easy. Making intelligent investments for the long term is not. Despite having sharp people in the right places, the Bush administration has yet to articulate a real policy to deal with the difficult trade-offs involved in funding this area:

- Are the National Science Foundation and the National Institutes of Health structured the best way for funding research?

- Should the government fund more little science efforts vs. big science projects like the superconducting supercollider?

- What should be the balance between basic or applied research?

- Should the government spend more on science equipment or science education?

- How much science should be funded with an eye towards global competitiveness?

These are precisely the questions that aren't being answered. These are precisely the questions that are getting lost amid the budget battles.

They are also the questions that will determine what kind of return America's taxpayers get for their multi-billion-dollar investments.

Grady freely acknowledges, "There will be a very healthy debate — maybe even a tension — about investment in emerging technology vs. industrial policy."

When does one blur into the other? The answer is politically charged because Republican free traders-free market-loathe industrial policy with a passion.

They don't want Washington to be picking winners. Instead they want to rely on, as Ronald Reagan put it, "the magic of the marketplace" to determine what emerging technologies are best.

Nevertheless, Grady says that Darman is interested in "competitiveness inducing investments" in science and technology. "We're prepared to push that envelope a little further than our predecessors," he says.



Michael F. O'Brien/Register

White House science adviser, Yale physicist D. Allan Bromley, must explain what science policy ought to be in an era of deficits.

What about the high definition television technology consortium that Secretary of Commerce Robert Mosbacher pushed to get U.S. industry back into consumer electronics? Or other consortiums to encourage state-of-the-art science and technology? What is the policy guiding the budgeteers? "We'll decide that on a case-by-case basis," Grady says.

Which is precisely the point: Case-by-case means that there is no policy. What you find instead are themes impersonating initiatives.

The Bush administration has expressed intense interest in promoting space exploration. The administration is also intrigued by establishing a supercomputer network to link up universities and industry.

And for good old-fashioned scientific pork barreling, there's the superconducting supercollider — a high-energy physicists' dream that will be located in Texas, a state that has more electoral votes than quality physicists.

It's not that these efforts lack merit, it's that they lack focus, coherence and context. What's so troubling about the Bush administration's approach to science and technology policy is that there seems to be no center. The people Bush has are, I think and hear, top notch. Unfortunately, you can't tell this by what's happened so far.

National Science Foundation Director Erich Bloch, who has seen his agency's proposed budget double under the new administration, argues that the administration's emphasis on education is a cornerstone of its science policy and that its commitment to science is a necessary precursor to whatever new policies emerge.

Bromley, Darman, Grady and Bloch will perform a great public service if, instead of simply discussing initiatives, they sit down with leaders in industry and science to explain what they think science policy means — and should mean — in an era of deficits.

They should talk tough about which priorities of theirs are partisan and which priorities are motivated to keep this country the global leader in basic science.

What's more, they have to have the guts to be bipartisan. An administration that gets America's science and business establishments to explore ways to get more bang for the science buck — instead of just more bucks — will have made a contribution to this country that leaves science in better condition than they found it.

Michael Schrage writes for the Los Angeles Times.

Surprises awaited returning Hungarian student

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THE WHITE HOUSE**Office of the Press Secretary
(Brussels, Belgium)****For Immediate Release****December 4, 1989****FACT SHEET****The President's Initiatives During the Malta Meeting****December 2 - 3, 1989**

The President and Chairman Gorbachev exchanged views on a variety of issues during their meetings in Malta, including the remarkable events leading to peaceful and democratic change in Eastern and Central Europe.

The President noted his strong support for perestroika and suggested that the two leaders work to give major new impetus to the U.S.-Soviet relationship. The President conveyed his strong personal commitment to this goal.

In this spirit, the President put forward the following ideas:

Next Steps

1. Holding the Summit in the United States during the last two weeks in June.
2. Having the next meeting of Foreign Ministers next month in the Soviet Union to prepare for the Summit.

Economics and Commercial Relations

1. Targeting the 1990 Summit for completion of a trade agreement granting Most Favored Nation status to the Soviet Union, so that the President can grant a Jackson-Vanik waiver at that time. To reach that goal, the President proposed beginning negotiations on a trade agreement now and urged the Supreme Soviet to complete action on its emigration legislation early next year.
2. Supporting observer status for the Soviet Union in GATT after the Uruguay Round is completed next year. The President urged the Soviet Union to use the intervening time to move toward market prices at the wholesale level so its economy will become more compatible with the GATT system.
3. Expanding U.S.-Soviet technical economic cooperation. The President presented a paper proposing specific economic projects, covering topics such as finance, agriculture, statistics, small business development, budgetary and tax policy, a stock exchange, and anti-monopoly policy.
4. Exploring with Congress the lifting of statutory restrictions on export credits and guarantees after a Jackson-Vanik waiver.

5. Beginning discussions of a bilateral investment treaty that would provide protections for American business people who want to invest in the Soviet Union.
6. Improving ties between the Soviets and the OECD, and East-West economic cooperation through the economic basket of the CSCE process.

Human Rights

Resolving all divided family issues by the time of the 1990 Summit. In this regard, the President handed over a list of people wishing to emigrate.

- MORE -

- 2 -

onal Issues

Expressed disappointment with Soviet policy on Central America, noting it was out of step with the new Soviet direction domestically in Eastern Europe and in arms control. Nicaragua/Cuba remains the single most disruptive factor in the relationship.

is Control

Speeding achievement of a chemical weapons ban by offering to end U.S. production of binary weapons when the multilateral convention on chemical weapons enters into force, in return for Soviet acceptance of the terms of our UN proposal to ban chemical weapons.

Proposing to sign an agreement at the 1990 Summit to destroy U.S. and Soviet chemical weapons down to 20 percent of the current U.S. level.

Suggesting joint U.S.-Soviet support for a CFE Summit to sign a CFE treaty in 1990.

Accelerating the START process in order to resolve all substantive issues and to conclude a treaty, if possible, by the 1990 Summit. To this end, the President suggested that Secretary Baker and Foreign Minister Shevardnadze concentrate on resolving at their January meeting three of the outstanding START issues: ALCMs, non-deployed missiles, and telemetry encryption.

Completing work on the Threshold Test Ban Treaty (TTBT) and the Peaceful Nuclear Explosions Treaty (PNET) for signature at the 1990 Summit.

Proposing that the Soviet Union join efforts to constrain missile proliferation more effectively by observing the limits developed by the U.S. and its allies in the Missile Technology Control Regime.

ilitary Openness

Making public more information on military programs. The President suggested that the Soviet Union make public the details of its military budget, force posture, and weapons production figures, just as the United States now does.

ympics

Suggesting joint U.S.-Soviet support for Berlin as the site of the 2004 Olympic Games.

vironment

Hosting a conference next fall to negotiate a framework treaty on global climate change, after the working groups of

treaty on global climate change, and the UN-sponsored Intergovernmental Panel on Climate Change submit their final report.

2. Convening an international meeting at the White House next spring for top level scientific, environmental, and economic officials to discuss global climate change issues. The President expressed hope that the Soviets will join us by sending their top officials in the field.

Student Exchanges

Increasing significantly university exchanges so that an additional 1,000 American and 1,000 Soviet college students are studying in each other's country by the beginning of the 1991 school year.

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** TOTAL PAGE.03 **

"CORRESPONDENCE TRACKING"

TYPE: Information

DOCUMENT NUMBER: 9020425

FROM: PIER VELLINGA
MINISTERIAL CONFERENCE ON ATMOSPHERIC
POLLUTION & CLIMATIC CHANGE
TO: BROMLEY

DATE OF
CORRESPONDENCE: 12/12/89

SUBJECT: ENCLOSING THE DECLARATION ON CLIMATIC CHANGE FROM
THE CONFERENCE.

ASSIGNED TO:

ACTION REQUIRED: NONE

SENDER'S DUE DATE:

OSTP DUE DATE:

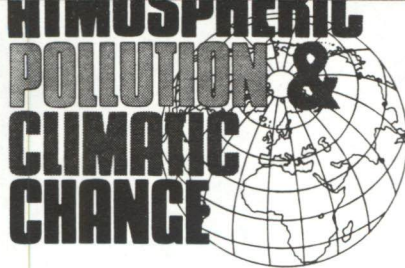
DATE COMPLETED: 02/02/90

COPIES TO: D. Allan Bromley
Nancy Maynard
James Wyngaarden

REMARKS:

DATE RECEIVED: 02/02/90

FILE: NEOB



by the Minister of Housing, Physical
Planning and Environment of The
Netherlands in cooperation with
UNEP and WMO.

P.O. Box 450
2260 MB Leidschendam
Tel. 31 70209367, ext. 2125
Telex nr. 32 362 VROM NL
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Your ref.:

Our ref.:

DGM/L/KL/JG

Date: 12 DEC 1989

13D9004

Subject: Ministerial Conference on Atmospheric Pollution and
Climatic Change

Dear conference delegate,

I would like to thank you for your enthusiastic participation in
the Ministerial Conference on Atmospheric Pollution and Climatic
Change.

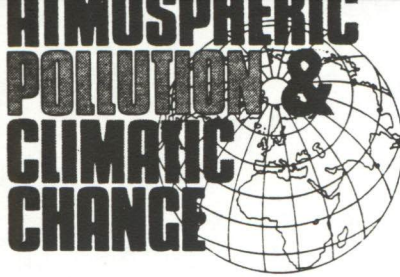
As you probably know, sixty seven countries and eleven
international organizations participated in this meeting. The
Conference adopted the Noordwijk Declaration on Climate Change
by consensus. This Declaration is historic because it has not
only qualitative objectives, but it addresses quantitative goals
with respect to carbon dioxide emissions and afforestation. The
issue of a climate fund is also covered. All countries have
agreed on the urgency for a World Climate Change Convention and
there is a consensus about a number of basic elements.

I am sending you a copy of the Declaration. I will send you a
complete report of the Conference by January 1990. This
Declaration shows that we have a lot of work to do. We have to
work towards implementing the actions expressed in the
Declaration, both within national boundaries and within the
framework of the Intergovernmental Panel on Climate Change. We,
also, have to work together towards the Second World Climate
Conference, 1990.

Looking forward to continuing and further strengthening our
cooperation on this most challenging issue,

Yours sincerely,


Dr. Pier Vellinga
Coordinator of National
Climate Change Programme



Annex

References to IPCC in the Noordwijk Declaration

The Noordwijk Declaration on Climate Change makes several references to the Intergovernmental Panel on Climate Change. In our view these references can be summarized as follows:

The Noordwijk Declaration on Climate Change:

"*Recommends* that this declaration and the supporting papers be conveyed to the IPCC at the conclusion of this Conference for further consideration and action." Paragraph (30).

This is based on the fact that:

"Global warming is being addressed by the Intergovernmental Panel on Climate Change (IPCC), which was established by UNEP and WMO, and recognized by UN General Assembly Resolution 43/53 on Protection of global climate for present and future generations of mankind." (Paragraph (4))

In the above mentioned Paragraph it is stated that, "... it is now time for governments of all countries to commit themselves to the IPCC, to strengthen and to extend the process of addressing climate change".

Thus,
Paragraph (8) declares that estimates with respect to the reduction of global anthropogenic greenhouse gas emissions by more than 50% "... should be the subject of further examination by the IPCC".

Furthermore, in Paragraph (10):

"The conference recommends that appropriate fora, including the IPCC, consider the necessity and efficiency of the introduction of CO₂ -equivalence" and " the development of common definitions and the harmonization of methods to calculate CO₂ emissions".

In Paragraph (15), the Conference:

"Agrees that it is timely to investigate quantitative emission targets to limit or reduce CO₂ emissions and encourages the IPCC, in their interim report due in 1990, to include an analysis of target options."

Specifically, the Conference declared in Paragraph (16) that with respect to CO2 emissions and greenhouse gas emissions not controlled by the Montreal Protocol:

"Industrialized nations agree that such stabilization should be achieved by them as soon as possible, at levels to be considered by the IPCC and the Second World Climate Conference of November 1990. In the view of many industrialized countries such stabilization of CO2 emissions should be achieved as a first step at the latest by the year 2000.

"Urges all industrialized countries to support the process of IPCC through the investigation of the feasibility of achieving targets to limit or reduce CO2 emissions including e.g. a 20 per cent reduction of CO2 emission levels by the year 2005 as recommended by the scientific World Conference on the Changing Atmosphere in Toronto 1988. "

The Document further:

"Calls on the IPCC to present the analysis and conclusions referred to above to the Second World Climate Conference in November 1990" in Paragraph (18). In terms of a net forest growth of 12 million hectares per year in the next century, the Conference under Paragraph 21: "Requests the IPCC to consider the feasibility of achieving this aim."

In Paragraph (24) the Conference:

"Recognizes the need to convene a Ministerial Conference to review the interim report of the IPCC. The Conference endorses the plan of the organization by WMO, UNEP, UNESCO and ICSU of such a meeting as part of the Second World Climate Conference in November 1990."

Under the provisions of Paragraph (27), the Conference:

"Recommends that, initially, international funding be directed towards [...]

(v) supporting developing countries to enable their participation in the IPCC process and the other international meetings on this subject; "

In addition, in Paragraph (28), the Conference:

"Also urges states to co-operate in, and provide increasing support for, international co-ordination of these activities building on international programmes such as the World Climate Programme and the International Geosphere-Biosphere Programme, and on the present roles of the UNEP, WMO, ICSU, IEA, UNESCO, IOC, and other competent international organizations and bodies."

Finally, under Paragraph (29) Sub Paragraph 1, the Climate Change Convention "Urges all countries to join and intensify the ongoing work within UNEP and WMO through the IPCC with respect to the compilation of elements for a framework convention on climate change so that negotiations upon it can start as soon as possible after the adoption of the interim report of the IPCC."