

CLIMATE ALERT

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Bonn Negotiations Yield Minimal Progress

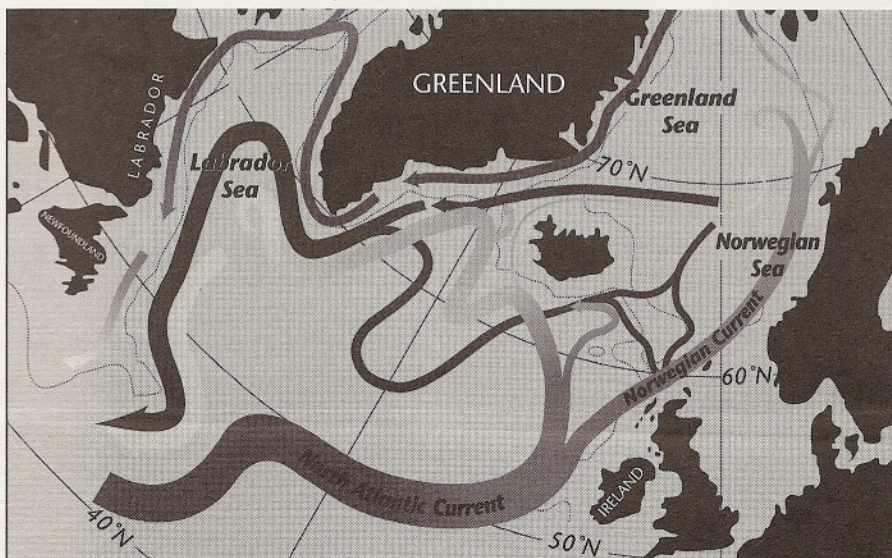
Representatives of 150 governments meeting in Bonn from February 25 to March 7 began drafting a text for a future international agreement on global warming and agreed to a "broad outline for further talks." They did not agree, however, on any specific targets or timetables for industrial nations to reduce greenhouse gases.

This round of talks is part of the process begun at the Earth Summit in Rio five years ago with the approval of a framework convention on climate change. Action since then has been disappointing with very few countries showing a decline in greenhouse gas emissions and with continued use of energy in an unsustainable fashion.

The negotiating text produced in Bonn combined a range of proposals but few particulars on what gases should be reduced, by how much and according to what timetable. A final paper is to be circulated by June 1 and talks will reconvene in late July and again in late October, in preparation for a third conference of the parties to the framework convention in Kyoto from December 1 to 10. The chairman of the group, Raul Estrada-Oyuela of Argentina, has stated he is confident that a pact with targets and timetables will be reached by the time of the Kyoto meeting. He has said that any targets adopted by the delegates

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Scientists Suggest an Enhanced Role for Ocean Oscillations in Understanding Extreme Weather



Michael McCartney, WHOI, Chart

Pathways Associated with Transformation of Warm Subtropical Waters into Colder Polar Waters in the Northern North Atlantic

After realizing the crucial influence of the El Niño/Southern Oscillation on the world's weather, scientists are now discovering other oceanic influences may play a vital role in extreme weather events. The connection of these events to climate change is an object of uncertainty and intense research.

Extreme weather events seem to be on the rise— record tempera-

tures, sudden snow melt, very heavy rainfall, floods, unexpected blizzards, drought. The possibility of an increase in storminess is also a subject of speculation.

Since we last reported on extreme events in 1994, the Pacific Northwest and California have been hit by severe flooding for the third consecutive year, there have been a "500-year flood" in the Northern Plains, an unusually arid winter and early spring in the UK and France, heavy rains and drenching floods in Bolivia. Summer floods in 1995 in North Korea were the worst natural disaster of the nation's history, leaving half a million homeless, washing away

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Green Purchasing: for government, business, universities

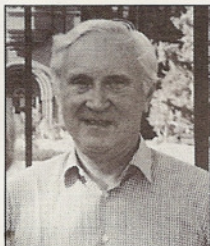
The following is an excerpt from a speech given by Sir Crispin Tickell, Chairman of the British Panel on Sustainable Development, to the Southern Universities Purchasing Consortium at the University of Kent at Canterbury, April 17.

The British Government Panel on Sustainable Development in its third annual report published in January called on the Government to use its powers to give greater weight to environmental factors in purchasing decisions, thereby raising environmental standards, reducing pollution and waste, and fulfilling its commitment to sustainable development. The report pointed out that leading companies had already understood the importance of supply chain management but that so far the Government had scarcely put into practice its own policies on the subject.

The Panel recommended that the Government should actively promote sustainable development through its procurement policies and practices, requiring other public bodies to do so, and should also monitor the results and publish relevant information annually. Finally it suggested that the Government should join with other countries in the European Union and the Organization for Economic Cooperation and Development to promote initiatives on green procurement.

In some respects business and industry are in advance of the Government. Last year the Advisory Committee on Business and the Environment issued for consultation a draft report on integrating the environment into business decisions. The draft guidelines for actions advised that

... beyond observance of laws and regulations, consideration should be given to many factors, such as the risk of adverse effects on humans and



Sir Crispin Tickell

on the environment across the whole life-cycle of the product, service or process including supplied goods and services, work done in-house and through to the ultimate after use disposal of any waste.

Such major companies as B&Q, Body Shop and British Telecom have already brought environmental policy into the center of their supply chain management.

Obvious benefits accrue to companies which adopt such environmental management:

- regulatory compliance
- means of assuring competitive advantages to interested parties (e.g. clients) and stakeholders (e.g. financial institutions)
- improved public and staff relations
- cost savings, such as waste minimization and energy efficiency
- such intangibles as improved team work and better morale

Whatever large companies are doing, most small and medium-size enterprises have so far failed to follow suit. In Britain such enterprises make up some 95 percent of all businesses, in 1994 contributing 38 percent to Gross Domestic Product. Yet in a recent survey 88 percent of those questioned saw no benefit in adopting environmental management systems. There are four main barriers:

1. inexperience in strategic planning
2. insufficient financial incentives (the cost is seen as prohibitive, although this is not necessarily so)
3. lack of resources (manpower and technical knowledge) and advice
4. the poor image of existing standards

According to a Department of the Environment survey two-thirds of companies surveyed were doing little or nothing to save energy and few

were prepared to make significant investments in energy conservation.

Put negatively, businesses which do not respond to environmental issues will encounter increasing difficulties, finding it more difficult to:

- sell their products
- dispose of waste
- obtain insurance
- attract finance
- recruit and retain able staff
- keep within the law.

They will also find an increasing number of supply contracts have environmental management clauses, or more onerously, an environmental management system. It is not difficult to see why.

Some companies may dictate the terms of a contract and allow competitive forces to decide which supplier is successful. Others may take a more cooperative approach in which suppliers work in long-term relationships with vendors with mutual commitments to improvement in environmental performance. This second approach allows each partner to share in the benefits.

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Before concluding I ought to say a word about the role of universities. So far most universities have yet to come to terms with environmental issues, from teaching to procurement. The essential points were well expressed by an October 1990 statement of twenty two presidents, rectors and vice-chancellors from round the world gathered at the European Center of Tufts University. It was entitled University Presidents for a Sustainable Future: the Talloires Declaration.

tion.

The Declaration has been endorsed by more than two hundred heads of universities from over 40 countries. It concluded with 10 points of action, covering three main areas: disciplines; cooperation with other institutions, business, industry and the public generally on environmental matters; and internal environment management.

With a spending power of some one billion pounds each year, the adoption of a green purchasing

policy by the Southern Universities Purchasing Consortium could make a real difference, bringing environmental concerns into the university framework, but also bringing real financial benefits.

Our most fundamental problem is to think differently from the way we thought before, and to do so together. Nothing is more difficult, but we are perhaps beginning almost imperceptibly to do so.

Extreme Events

(Continued from page 1)

schools, crops and livelihoods in three-fourths of the country. The floods reappeared in 1996 and have been followed by famine of still-to-be-confirmed dimensions. Are these excessive occurrences within the realm of natural variation? possible indications of global warming? swings in phenomena which could become more exaggerated later?

The North Atlantic Oscillation, linked to the currents in the chart

Clinton Speculates on Global Warming Connection

"We do not know for sure that the warming of the earth is responsible for what seems to be a substantial increase in highly disruptive events; but many people believe it is," said President Clinton, speaking before his departure to survey the damages inflicted by the North Dakota floods. "We have to find the best scientific evidence... and we have to keep searching for the answers to this. I think every American has noticed a substantial increase in the last few years of the kind of thing we're going to see in North Dakota today. And if there is a larger cause ... we ought to go after that solution as well."

on page one, is one of the factors yielding new clues to the cold winter and drought in Europe and chilly spring in northeastern US. Dr. Michael McCartney, senior scientist at the Woods Hole Oceanographic Institution in Massachusetts, and his colleagues have focused on variability in the North Atlantic and its impacts for several years. The NAO, a shift that occurs periodically in winds and atmospheric pressure, is partially related to the more intense storms over the past ten years, says Tom Karl of the National Climatic Data Center.

The previous phase of the NAO has made Europe and North America warm and Greenland cold for the last three decades, and now the pattern is reversed. "The Oscillation's new pattern is likely to persist for a few years, with continued cool weather" in Europe and North America, says Goddard Institute of Space Studies Director James Hansen.

We asked Dr. Hansen whether greenhouse-induced warming is likely to change the NAO and if so how. He replied that this is a tough question; nobody knows the answer. He speculated that "the 30-year trend toward Greenland cool, North American and Eurasia warm may be driven by global warming, especially tropical warming — if this is correct, then the reversal of North Atlantic

Recent Extreme Events Around the World

A freeze in Holland allowed skating on the canals for the first time in years. Heavy rains brought the worst flooding in 30 years to Brazil, and heavy rains in Peru triggered deadly mudslides. Brutally cold weather hit southern Russia and Scandinavia and many sections of continental Europe with temperatures averaging 6° C below normal. Excessive precipitation fell in southern Spain, Gibraltar and Morocco. Tropical cyclones drenched Northern Australia, with some sections recording 200-400 mm of rain, and six week precipitation surpluses rose to the 660 mm range.

patterns of the past two years may be temporary — and as an El Niño is now starting, we may revert to the Greenland cold pattern."

The interaction of the ocean and atmosphere has become an essential element in models, and the coupled changes of these two variables improves predictability. The ocean has a much greater capacity to store heat and carbon dioxide than the atmosphere. It also has the ability to move these components around horizontally over large distances as the atmosphere does.

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Extreme Events

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Photo from OCEANUS, WHOI

Michael McCartney, Woods Hole Oceanographic Institution

As the ocean and atmosphere exchange momentum, heat and water vapor, they form ocean currents. The ocean, sea surface temperatures, salinity and sea ice vary, circulation patterns shift; in the atmosphere heat and water are dispersed. The intense rain and drought, heat and cold, and storms are the product of these "coupled" changes.

In normal atmospheric circulation over the North Atlantic there is a high pressure cell near the Azores and a low pressure cell near Iceland and Greenland. The NAO is a seesawing of barometric pressures between these two. Sea surface temperatures of a basin of water off Newfoundland vary from cold to warm in periods about a decade long; near surface winds vary over the same time scale.

When there is a **high NAO** (intense westerlies) cold continental air from North America is warmed by heat from the ocean water on the way to Europe. This has been the phase for the past decade. When there is a **low NAO** as in the last two years, the Icelandic low pressure cell moves far to the south off Newfoundland, a

high pressure center moves over northern Greenland, cold dry polar air blows across northern Europe which experiences much cooler summers and more severe winters, and the northeast US has more nor'easters. Spring on the East Coast is windy, chilly, stormier as it has been this year.

Looking back historically over 50 years, McCartney also reports that the amplitude of the NAO appears to be greater now, the variations from average have become larger. It is possible, he speculates, that greenhouse gases may be modulating the Oscillation.

A comparison of the NAO with a similar oscillation, the Pacific-North American, indicates that, over decades, there may be coordinated variations throughout the northern hemisphere or even the whole globe.

What drives the NAO, causing it to flip? Unusual appearances of fresh water driven by ocean circulation could be an important key to the puzzle of the poorly understood phenomenon. One of the possible causes of the Oscillation over a decade is the transformation of water from warm to cold by the currents shown on the chart on page one. Winter winds cool the surface waters, they sink and mix

more deeply into the cooler waters below. In summer, the sun heats the surface, forming a cap of warm water. Surface cooling during the following winter removes the cap and the mix is cooled again, growing thicker. It cools and thickens over several years while moving around the subpolar gyre, a massive system of current flowing counterclockwise in the North Atlantic between Labrador and the UK.

The trip around the gyre takes about a decade, with the water entering east of Newfoundland at a temperature of about 12 - 14° C and emerging from the pipeline in the Labrador basin ten years later at about 4° C.

The heat released from ocean to atmosphere by water flowing along this pipeline acts as a regional radiator for northern Europe where the westerlies carry the warm air. The effect of changes in surface salinity, the impact of an unusually large discharge of ice from the Arctic Ocean in 1967, and fluctuations in sea surface temperatures are properties of the ocean which need to be more clearly understood. How are they linked? asks McCartney. Which are determining elements? Is the ocean a passive participant, responding to changes

Recent Extreme Weather Events in the US

The month of December 1996 and the first week of January 1997 brought tremendous amounts of rain and snow to parts of Washington, Oregon, Idaho, California, Nevada and Montana. Combined with unusually warm temperatures, there was enormous melting of snow, producing some record floods. The Truckee River in the Sierra Nevada Mountains reached its highest level on record. Lake Tahoe was higher than it has been since 1917. The Sacramento River flooding was at a 50-year level, according to a preliminary Army Corps of Engineers estimate. Mudslides were a severe problem. As of January 20, the death total was 36. It was the third consecutive year for severe flooding on the west coast, attributable to El Niño in 1995, but not in 1996.

At the end of the month, the Northeast was hit by a major nor'easter, producing snowfalls of one to three feet. Boston had its heaviest April snowfall on record and third heaviest for any month. And a little more than two weeks later, the Red River in the Northern Plains broke its 100-year flood crest record of 39.1 feet at Fargo and went on to a 500-year record with a crest of 54 feet.

forced by the atmosphere? Or do feedbacks from ocean to atmosphere force the evolution of the atmospheric system's climatic state?

The link between sea surface temperature anomalies and their possible forcing of climate change signals has been elusive and "is one of the primary unresolved issues in climate change research." Continual measurements are necessary to further progress in unraveling the signals and the physics underlying them, to monitor evolution of the system and sharpen our understanding. Salinity is an important element, but monitoring of salinity is difficult in the vastness of the ocean, and it cannot be done by satellite.

Besides the ENSO, the NAO, the Pacific North American, there is another, much shorter oscillation, the Madden-Julian, believed to be a

moist air reaching from the western tropical Pacific to the west coast of North America.

Like the NAO, no present theory fully explains the basic characteristics of the MJO phenomenon which one scientist calls "one of the most important unexplained components of current climate."

There are other relationships between warming and extreme events which need investigation, although as Tom Karl of the National Climatic Data Center warns, it is very difficult to assign any causes. In addition, he says, the deficiencies of models are "most apparent" in trying to reproduce extreme events. But, "it now seems probable that regional changes in severe weather and climate extremes will accompany warming."

Intense Rain

Precipitation has been increasing

—it has grown as much as 50 percent in high latitudes — and there is six percent more precipitation than a half century earlier. As the climate warms, the atmosphere is expected to change; it will hold more water vapor with temperatures rising. In a warmer world there is likely to be more precipitation in each rainfall even if the episodes of rain or snow do not

change much.

In the US, about 10 percent of total annual precipitation falls during very heavy downpours, defined as at least 50 mm (two inches) in a single day. At the beginning of the century, this share was 8 percent, and so the amount has grown 20 percent.

Drought

Paradoxically, soil in North America, southern Europe and other places is expected to become drier as higher temperatures parch

the soil by raising evaporation rates and transpiration by plants. Several models project an increase in drought severity. In the US,

It is estimated that flooding has taken the lives of nearly 120,000 people during the last 25 years, according to the British Institute of Hydrology, and has caused distress and disruption to over 750 million people. Such numbers are a strong incentive for any preventive actions we can take.

there was a six-year drought in California in the early 90s, and drought lingered in the Southwest. A May 1996 headline reads, "Worst Drought Since 30's Grips Plains," and the accompanying article describes, how "from Kansas south to Texas one of the worst droughts on record has pushed thousands of farmers on the Great Plains to the edge of financial ruin." In Nevada in February 1996, another article reports, "The last eight years have marked the longest drought on record." New York and New Jersey had severe water shortages in 1995 "after a mild, largely snowless winter and a hot, dry summer."

Around the world, there was a severe drought in 1996 in Bolivia that threatened the existence of the Chipaya tribe. Brazil's cocoa crop dropped by half during the five years preceding 1995, and "plantation owners have been walking away from their farms, hammered by drought among other reasons."

"Five years of unrelenting drought in southern and central Spain, the worst of the century, have sapped water from the streams and rivers and drawn the life from the region's rich groves and orange and olive trees." An IPCC study concluded last June that Mediterranean wetlands are under intense pressure from drought. Spain has lost two-thirds of its inland wetlands since 1965. A

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Photo lent by NOAA Library

factor in the heavy rains and flooding that began in the Pacific Northwest in late December. The Madden-Julian, first confirmed in 1971, is a 40-50 day fluctuation in the tropical atmosphere and ocean. In a strong MJO, an increased upward current of warm air shifts from the Indian Ocean to the western Pacific, strengthening the jet stream over the mid-latitudes of the North Pacific. Satellite imagery confirmed in late December an abnormally strong flow of warm

Extreme Events

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dispatch from Bangladesh in May 1995 reports that, "More than 25 million Bangladeshis, almost a quarter of the country's population, are on the verge of becoming 'refugees' in their own land as the once-mighty Ganges River dries up, turning vast green rice paddies into sandy beaches."

"The arid start to the spring [in the UK], coming on the back of an outstanding long term rainfall deficiency, has produced widespread and severe drought conditions," a *Drought Watch* communique by the British Institute of Hydrology reports in April 1997. "River flows and groundwater levels are exceptionally depressed and the very parched soils are producing difficulties for the farming community."

However, in examining drought records back to 1900, we find no confirmation of an increase in drought frequency and intensity. It is possible, Karl speculates, that at least in the early stages of global warming, other factors have overwhelmed the drying effects of warmer weather. It may be that increases in cloud cover in the US and Russia have led to a decline in evaporation. In fact in western Russia, soil moisture has actually increased.

Warmer Temperatures

Although central and eastern US were relatively cool in 1996, the year still ranks as the fifth warmest worldwide, according to GISS researchers, and this is surprising they point out because it occurred despite the cooling effects of aerosols from the Pinatubo volcanic eruption and the record depletion of ozone.

We know that the Earth's surface has, on average, been warmer for the last 20 years than the preceding 20, although not uniformly so. Is this a forewarning of a crisis which may continue through the next century? asks McCartney. Or is it a phase of a

natural oscillation lying on top of a less severe warming? Or is it the warming phase of a still longer oscillation?

"There is a preponderance of scientific judgment, as carefully compiled and described by the IPCC," says McCartney, that the answer is somewhere between the first two possibilities, between a forewarning of continuing crisis and a natural variation on top of a less severe warming, and that it is caused by human impact on the climate system.

For statistical reasons," says Tom Karl, "even small increases in mean temperature or variability can make a big difference in the frequency or severity of extremes... Temperature extremes can be very sensitive to unusual circulation/air masses. Sometimes trends in extremes do not coincide with trends in the mean." With a 6° F increase in mean July temperature, the probability of the heat index reaching 120° F increases from 1 in 20 to 1 in 4 during July.

More Storminess

Because cyclones form only if sea surface temperatures are at least 26° C, early work on global warming suggested the number of cyclones would be likely to increase as the ocean heated up. But recent research, says Tom Karl, suggests this is simplistic. Other factors may play a role in storm development: atmospheric buoyancy, instabilities in wind flow, differences in wind speed at various heights. It is impossible to establish a record of the history of tropical cyclones in the 20th century because of changes in observing systems (satellites were



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introduced in the late 60s) and population changes in tropical areas.

In the North Atlantic, good records (by aircraft) since the 40s, show a decline in intensity and in the total number of hurricanes. From 1991 to '94, it was extremely quiet in terms of the number of storms and strong hurricanes. Even the unusually intense '95 season did not reverse the downward trend, Karl has written. But the number of storms in the northwest Pacific, on the other hand, seem to have risen. "Overall it seems unlikely that tropical cyclones will increase significantly on a global scale," Karl concludes. However, a recent report by Drs. Mark Sanders and Andrew Harris of University College London using statistical studies of Atlantic basin hurricanes show that surface warming was the main influence on the 1995 hurricane season (more important than El Nino or rainfall in the Sahel), suggesting sea warming should be a factor in prediction calculations.

The outlook for the future depends on the trends in greenhouse gas emissions and aerosols. Or North Atlantic currents could suddenly shift causing fairly rapid change in Europe and eastern North America. The climate system is complex, and "the chance always remains that surprises will come about." (In a later issue we will have a report on potential climate surprises.)

Bonn

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would have to be binding. Only Australia has opposed binding targets.

Despite differences among members, the European Union managed to break a deadlock and agree on a goal: to cut emissions on a "basket" of greenhouse gases — CO₂, methane and nitrous oxide — by 15 percent below 1990 levels by 2010. (Originally the goal had been a reduction of 20 percent by the year 2005, a figure which seems improbably unattainable at this point.) Commitments by EU members varied from a 30 percent reduction by Luxembourg to a 40 percent increase by Portugal.

The proposal presented by the US at Bonn emphasized a high degree of flexibility:

- each country would meet treaty requirements in its own way
- each could meet the cap by reducing other greenhouse emissions, such as methane, nitrous oxides and halocarbons
- the targets could be for groups of years rather than a single year (Thus spikes in emissions caused by weather or business cycles would not present difficulties.)
- while there would be a cap on emissions in each time period, countries would be allowed to "borrow" from the next period, but

would have to pay back in "interest," reducing emissions in the next period by an even greater amount

- an international system for banking and trading emission allowances could be set up
- requirements for developing countries would be stronger than any other proposals so far. They would have to take "no regrets" actions to reduce greenhouse gas emissions and accept increasing responsibility for controlling emissions as they become industrialized.

The White House has set up a Climate Change Task Force to coordinate and win support for its position. It will try to obtain information for economic modeling which will be the foundation of its protocol.

The US proposal has run into a barrage of criticism for: being too weak and evading its responsibilities, succumbing to pressure from the energy industry, being too complicated, not setting concrete targets and timetables, and being too slow (poor nations may face devastating natural disasters caused by global warming if industrial nations don't act faster to reduce emissions). Global warming skeptics fault it for not examining existing climate commitments before pushing for stronger measures. Labor leaders in the US are opposed to the agreement fearing

that industry acceptance of emission limits might lead to a shift in production to countries not operating under caps, diminishing US jobs. Countries such as China and Brazil, they say, should not be excused from setting limits.

The AFL-CIO Executive Committee called upon the US to renegotiate the Berlin Mandate to ensure that any agreements signed at Kyoto apply to developing countries as well as industrialized ones. Richard Gephardt, House Democratic Leader, and John Dingell, ranking Democrat of the House Energy and Commerce Committee, have expressed similar views. The 1995 Berlin Mandate exempted developing countries from additional commitments, and few seem likely to give up this immunity.

An emissions protocol with legally binding targets would be construed as a new treaty and would require ratification by two-thirds of the US Senate. Prospects of such action seem distinctly uphill at this point, even if modeled after the Clinton administration position.

The likelihood of a protocol without participation of the world's leading producer of greenhouse emissions has caused some to look for alternatives that might still ensure North-South cooperation in limiting emissions.

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27 Developing Nation Representatives Craft Climate Action Plans

Bogor, Indonesia served as the venue for an international workshop on preparation of climate change national action plans in January. More than 130 participants from over 27 nations shared experiences of developing and transition countries in preparation and development of their plans.

A major policy session featured presentations by ministers and representatives from Kazakhstan, Russia, Ukraine, Japan, Philippines, Bulgaria, Indonesia, UN Climate Change Secretariat, The World Bank and US AID.

The US Country Studies Program (USCSP) provided financial and technical assistance to participating countries for climate change studies and to plans for implementing mitigation and adaptation

measures. International experts guided countries in preparation of their climate change national action plans. The Workshop explored opportunities for future technical assistance and linkages with donor programs.

The Workshop was co-sponsored by the USCSP, the Japan Environment Agency, the Indonesian Ministry of Environment and the Climate Institute. Sandy Guill

and Jack Fitzgerald represented the USCSP, Shinichi Arai represented the Japan Environment Agency which provided funding for Asian participants. Minister Sarwono Kusumaatmadja, Dr. Aca Sugandhy, Dr. Sutamihardja, Mr. Gunardi and other Ministry officials were local coordinators while Dr. Ata Qureshi of the Climate Institute served as an overall workshop organizer.



Participants at International Workshop in Bogor, Indonesia, January 1997

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Report on Extreme Weather Events

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