

CLIMATE ALERT

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Negotiating Panel Completing Convention On Desertification

An initiative to draft a global convention to combat desertification, first pushed by some nations more than 15 years ago under a 1977 Plan of Action to Combat Desertification (PACD), may become a reality in June, the deadline for completion of a desertification treaty.

At the United Nations Conference on Environment and Development at Rio, it was decided to draft a global



M. Hulme/TIEMPO

convention to combat desertification, and as the 47th session of the UN General Assembly drew to a close in 1992, a resolution was adopted setting up an Intergovernmental Negotiating Committee to draft a Convention on Desertification, referred to as INC-D. A secretariat was set up in Geneva and a multidisciplinary panel of experts was appointed to assist it. A series of INC-D meetings has been held with the final one scheduled for June.

It was agreed that Africa should receive priority treatment. Although all regions of the world suffer from
(Continued on page 4)

Climate Change Funding Holds Up Well in FY95 Budget Despite Spending Constraints

Reflecting not only the President's interest but the strong commitment of Vice President Al Gore, climate issues fare quite well in the FY95 Federal Budget. For instance requests for efficiency and renewable energy of \$1.4 billion represent an increase of 33 percent over last year's enacted appropriation.

(In this article, budget outlay — the measure of government spending — is labeled "O"; budget authority —

the authority provided by Federal law to incur financial obligations that will result in outlays — is labeled "BA."

The Government fiscal year begins

on October 1 and ends on September 30 and is designated by the calendar year in which it ends.)

This year's budget is the first real opportunity for the Clinton administration to demonstrate the importance it places on climate change issues. The FY94 budget was of necessity prepared too early in the Clinton administration to reset priorities in any major way.

The proposed Clinton FY95 budget is a very tight one, necessitated by deficit reduction efforts and strict limits on discretionary spending.

Total spending would increase only from an estimated \$1.48 trillion in FY94 to an estimated \$1.52 trillion in FY95.

The Clinton budget is only the first step in lengthy budget negotiations which take the proposals through many Congressional committees before they are eventually approved by the whole Congress. A preliminary survey of budget items of particular interest to *Climate Alert* readers reveals some interesting trends. Many final breakdowns for specific programs were not available at press time.

The Global Change Research Program is an important aspect of addressing climate change and meeting U.S. commitments under the Climate Change Treaty. Funding is up 24% to \$1.8 billion (O), spread among AID, NSF, NOAA, NASA and EPA. The NSF global change program would get a hefty 46% increase.

Climate Change Action Plan funding is also spread among a number of agencies: the Department of Energy (DOE) requests \$191 million (BA); at the Environmental Protection Agency (EPA) funds are quadrupled, from \$9 to \$36 million (O).

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GUEST COLUMN

Climate Change and World Food Supply

By Cynthia Rosenzweig and Ana Iglesias

Food production has been and continues to be inextricably linked to weather and climate. Most recently, the 1991-92 drought in southern Africa is generally regarded as the worst of the century. Lack of rain affected nearly 100 million people living in the ten Southern African Development Community (SADAC) countries and 11.6 million tons of food commodities were imported within a 13 month period. In the coming century, we will need increasing amounts of food to maintain the growing world population (projected to double its present level of 5 billion by about the year 2060). Global climate change with projections of warming and changed hydrological regimes presents an additional challenge to the future of the world food system.

Integrated Assessment

Recent research assessing potential climate change impacts on agriculture has focused on regional and national evaluations, without regard to crucial changes in international demand for agricultural products. To fill the need for such integrated assessments, a project funded by the U.S. Environmental Protection Agency Climate Change Division was designed to analyze the potential effects of climate change on world food supply. The project was carried out with the collaboration of an international team from 25 countries drawn from the disciplines of atmospheric science, agronomy, geography, and economics.

The specific objectives of the global project were to calculate quantitative estimates of climate change effects on the amount of food produced globally, world food

prices, and the number of people at risk of hunger (defined as the population with an income insufficient to either produce or procure their food requirements) in developing countries.

Two Step Process

The research involved two steps. First, crop yield responses to greenhouse gas-induced climate change scenarios were simulated with dynamic process crop growth models (developed by U.S. Agency for International Development's International Benchmark Sites for Agrotechnology Transfer network). These responses were modeled at over 112 sites; the study sites represent 70-75% of the current world production of wheat, maize, and soybean. Rice production was also included but was less well represented. Second, the economic consequences of these potential changes in crop yields were simulated in a world food trade model, the Basic Linked System (developed by the International Institute for Applied Systems Analysis in Laxenburg, Austria).

The greenhouse gas-induced climate was simulated with "climate change scenarios" developed from three global climate models (GCMs) for doubled atmospheric CO₂ levels. The temperature changes of these scenarios (4.0 - 5.2° C) are near the upper end of the range (1.5 to 4.5° C) projected for doubled CO₂ warming by the Intergovernmental Panel on Climate Change (IPCC).

What may happen to crop yields in a greenhouse-induced climate? Experimental work indicates that crop yields and water use benefit from higher CO₂ concentrations, although these so-called "direct" effects of CO₂ vary with crop. Thus this additional process was taken

into account in the crop response simulations, as well as responses to changes in temperature, precipitation, and solar radiation.

In the simulations with direct CO₂ effects, yields were positive at mid and high latitudes and negative at low latitudes for the two climate scenarios with about 4° C mean global warming. Yield changes ranged from +30 to -30%. The scenario with the largest temperature increases (about 5° C) caused average national crop yields to decline almost everywhere (up to -50% in Pakistan). It is important to note that increases in yields are dependent on the realization of direct physiological CO₂ effects on crop growth and water use.

Latitudinal Variations

Several factors contributed to the latitudinal differences in simulated yields. At some sites near the high latitude boundaries of current agricultural production, increased temperatures improved crop yields otherwise limited by cold temperatures and short growing seasons. In many mid and high

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latitude areas where current temperature regimes tend to be cooler, increased temperatures exerted a negative influence on yields through shortening of crop development stages, but did not significantly increase stress levels. In these regions beneficial CO₂ effects dominated.

The climate change induced warming at low latitudes brought not only accelerated growing periods for crops, but greater heat and water stress as well. This resulted in greater yield decreases than at higher latitudes despite beneficial CO₂ direct effects.

Adaptations and Yields

The testing of climate change impacts without farm-level adaptation is only a preliminary step in the analysis, because farmers and agricultural systems will surely react to changes in climate conditions. Minor farm-level adaptations (e.g., small shifts in planting dates and changes in crop variety) compensated for the yield effects of climate change scenarios incompletely, particularly in the developing countries. Major adaptations (e.g., installation of irrigation systems) compensated almost fully for the negative climate change impacts in two of the scenarios. With a high level of global warming, major adaptations did not overcome the negative climate change effects on crop yields in most countries, even when direct CO₂ effects were taken into account.

Major adaptation implies more substantial changes to current agricultural systems, possibly requiring resources beyond the farmer's means, investment in regional and national agricultural infrastructure, and policy changes (for example, implementing new

regional irrigation systems). Thus, this level of adaptation represents a fairly optimistic assessment of world agriculture's response to the changed climate conditions.

Potential Obstacles

While introducing adaptation into climate change impact research improves realism, many critical uncertainties remain. Policy, cost and water resource availability were assumed not to be barriers to adaptation. Beyond these technical concerns, there may be social or economic reasons why farmers are reluctant to implement adaptation measures. For example, increased fertilizer application and improved seed stocks may be capital-intensive and not suited to indigenous agricultural strategies. Furthermore, such measures may not necessarily result in sustainable production increases, (e.g., irrigation may eventually lead to soil salinization and lower crop yields).

What are the economic consequences of these crop yield results? In order to find out, the simulated crop yields were introduced in a model of the world food trade system, taking into account the beneficial direct effects of CO₂, farm-level adaptations, and future technological yield improvement.

Climate change was found to increase the disparities in cereal production between developed and developing countries. Whereas climate change enhanced production in the developed world, production in developing nations declined. Adaptation at the farm-level did little to reduce the disparities, with the developing world suffering the losses. Cereal prices and thus the population at risk of hunger increased despite adaptation. Even a high level of farm-level adaptation in the agricultural sector

did not entirely prevent such negative effects. Thus, while some countries in the temperate zones may reap some benefit from climate change, many countries in the tropical and subtropical zones appear more vulnerable to the potential impacts of global warming.

This global assessment of the potential impact of climate change on world food supply suggests that doubling of the atmospheric carbon dioxide concentration may lead to only small to moderate decreases in global food production. But developing countries are likely to bear the brunt of the consequences, and simulations of the effect of adaptive measures by farmers imply that these will do little to reduce the disparity between developed and developing countries.

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Sun Day

SUN DAY will be a national celebration of renewable energy (solar, wind, geothermal, biofuels, hydroelectric, solar-hydrogen) as well as energy conservation. It will cover energy-efficient lighting, heating and cooling, and technologies for building, industry, energy-generation, agriculture and transportation.

The celebration will take place on Sunday, April 24 and feature activities around the country. Participating groups will be sponsoring events before and after that date, where possible coordinating with local Earth Day events occurring at the same time. For more information call (301) 270-2258.

Desertification

(Continued from page 1)

desertification and drought, they have taken a particularly heavy human toll in impoverished areas of North Africa and the Sahel where they are blamed for forced migrations, widespread malnutrition, sickness and death.

According to former conventional wisdom, the term desertification meant spreading deserts and advancing dunes. Recent evidence, especially in the Sahara, disputes whether deserts are actually advancing, but there is no doubt that degradation of dryland areas, home to 900 million people, is occurring.

UNCED defined desertification as "land degradation in arid, semi-arid and dry sub-humid areas, resulting from various factors including climatic variations and human activities." Desertification was included in Agenda 21, a "bulky ragbag of issues" proposed for the world agenda for the next century. With the UN Climate Change Convention and the UN Biological Diversity Convention now in force, support for a convention on desertification is gathering steam.

Issues that have been raised during the INCD meetings include:

- Recognition of the widespread extent of the problem
- Need for local participation
- Full integration of women
- Economic incentives and technology transfer in combating desertification
- Importance of transboundary aspects, information collection and exchange and strengthening of research programs

The following questions were raised:

- 1) Should the convention encompass socio-economic causes of desertification, such as debt, trade and poverty?
- 2) Are new and additional re-

sources and mechanisms needed or would better management of existing funds make them sufficient?

- 3) What role should the Global Environment Facility play?

UNCED's Agenda 21 paints an ugly picture of the problem which involves residents of more than 100 countries. "Desertification affects about one sixth of the world's population, 70 percent of all drylands, amounting to 3.6 billion

TERMINOLOGY

(Adapted from TIEMPO #9, Aug. '93)

Desertification Land degradation in dryland regions. (Synonymous with dryland degradation.)

Drought A period of two or more years of below average rainfall.

Desiccation A drying out process lasting for decades.

Climate Change Short-term climate variation and long-term trends in climate caused by natural processes or human activity.

Global Warming Climate change resulting from greenhouse gas emissions.

hectares and one quarter of the total land area of the world." Population and economic pressures are depleting the soil, damaging vegetation and ecosystems and depressing crop yields. In the Middle East where the population is increasing at about 3 percent a year, drylands cover about 99 percent of the land surface. Some Latin American and Asian countries have argued that their dryland problems are as urgent as Africa's. Implicitly, say Mick Kelly and Mike Hulme, staff members of the Climatic Research Unit at the UK's University of East Anglia, the UNCED definition links the assessment of the extent of desertification with climate change, but the precise contribution is not an easy matter to determine. Negotia-

tions on a desertification convention are complicated by the uncertainties surrounding this issue, say the UK experts. Climate change does alter the frequency and severity of drought and can cause desiccation, depending on the resource management in the area. Management failure — overgrazing, planting a poor choice of crops, stripping the land of trees, plowing that allows wasting erosion — can aggravate deterioration of dryland. Whether the drought actually turns dryland to desert is in question.

A satellite index of vegetative cover for the Sahara has been derived by Dr. Compton J. Tucker of the Goddard Space Flight Center. He and Dr. Harold E. Dregne at the International Center for Arid and Semi-Arid Land Studies at Texas Tech University have studied year to year changes in the Sahara from 1980 to 1990 and found striking variations in the extent and quality of surface vegetation in this dryland area. Their data contradict the notion that the desert is steadily expanding and moving southward, indicating there is no evidence to suggest continual expansion. Although the Sahara grew about seven percent from 1980 to 1990, year to year variations were so great that no long-term trends could be determined.

Rainfall variations could be responsible for marked interannual changes, according to Kelly and Hulme. Removing the effect of rainfall reveals an increase of 41,000 square kilometers a year in Sahara desert area. This trend could reflect the impact of a succession of dry years, hampering plant recovery. It might also be due to deterioration in plant cover caused by human activity — mainly poor management and conservation practices by herdsman, farmers, woodcutters and others who live off the land. Determining the relative effects in order to identify an appropriate response, they call a "pressing challenge."

Desertification does contribute to global warming by altering the sources and sinks of greenhouse gases. Eroded dryland reduces the amount of carbon stored in ecosystems. As vegetation dies and soil is disturbed, carbon emissions will increase. Cattle which are poorly fed in degraded areas may produce greater methane. On the other hand, as dry soils are methane sinks, desertification might reduce concentrations of methane in the atmosphere. While the UK authors feel that it may not be possible to measure the net contribution of dryland degradation at present, they conclude that it is not a major source of greenhouse gases, especially compared to, for example, fossil fuels. But slowing or reversing desertification could play a major role in reducing the contribution to

improved understanding of the nature and causes of dryland degradation is urgently needed

global warming of the countries concerned, offsetting emission growth in other sectors.

However, in the case of the African Sahel, the semidesert on the southern fringe of the Sahara, a clearer link exists between desertification and climate change. In the last 25 years there has been a "substantial and sustained change in rainfall," the greatest for any region in the world since instrumental records began. This could be caused by two processes:

1) internal feedback mechanisms within Africa associated with changes in land cover such as desertification

2) changes in surface temperature patterns in global ocean circulation

In the first case, changes in vegeta-

tion or in soil quality affect the amount of soil moisture and ultimately of rainfall. As land cover deteriorates, rainfall declines, plants suffer greater stress, soil becomes drier and rainfall declines further. But Kelly and Hulme state that observed changes in desiccation in the Sahel have been local and often short-term, and evidence of marked changes in surface albedo (reflecting power) is weak.

UK Met Office simulations, in the second case, point to a conclusion that sea surface temperatures are a more important influence on land surface moisture feedback. Higher temperatures south of the equator and lower temperatures north of the equator are associated with lower rainfall over much of North Africa. Evidence for the cause of the temperature contrast, whether natural or human, "must be considered circumstantial." It could be caused by a freshening of surface waters in the northern North Atlantic, reducing northern heat transport. Or, the authors suggest, it might be linked to global warming either from the very different effects of sulphur emissions in the Northern and Southern hemispheres "and/or the variable ocean response."

The relative importance of various causes of desertification processes: management failure, desiccation, feedback, oceans, greenhouse gases, anthropogenic changes, may vary in the future. Climate modeling suggests rainfall over the Sahel may continue to decrease as global warming develops. Recent simulations show rainfall decreasing over the Mediterranean, northern Africa and a large part of the Sahel. If this is what is actually happening, "the role of greenhouse gases in reducing rainfall in the Sahel could become a major factor in the future," Kelly and Hulme state. If international response to desertification is to be effective, improved understanding of the nature and causes of dryland degradation is urgently needed.

FY 95 Budget

(Continued from page 1)

Energy

Outlays for energy R&D in the total budget rise from \$2.5 to \$2.7 billion (O). Funding for energy conservation in the energy function of the total budget is increased from approximately \$590 to \$740 million (O).

A shift in DOE research priorities continues away from nuclear power and fossil energy toward renewable energy and efficiency.

Energy Efficiency The administration's request — nearly \$1 billion — is an increase of 42 percent over last year's appropriated level.

Renewable energy technologies would receive a 14 percent increase over the FY94 appropriation. (According to the Environmental and Energy Study Institute, renewable energy sources currently provide about eight percent of energy use.) The total renewable energy funding — which includes solar buildings, solar thermal, other solar, biofuels, wind, ocean energy, geothermal, as well as photovoltaics — was \$341 million for FY94. For FY95 the administration proposes \$393 million (BA).

According to *Earth Budget*, published by Friends of the Earth, 1993, other countries have been making larger commitments than the U.S. to research funding for renewable technologies. Japan has been spending 39 percent more and Germany 94 percent more on photovoltaic technology research than the U.S. at a time when the U.S. global market share of photovoltaic monitors was declining.

The **Environmental Protection Agency's successful Green Programs** promote such actions as increased lighting efficiency by encouraging U.S. companies to make cost-effective improvements in lighting design. Last year EPA convinced 400 companies to sign up. EPA is developing

similar energy-saving programs for refrigeration, computer technologies and heating systems. Spending for the Green Programs is tripled from \$8 million in FY94 to \$24 million in FY95 (O).

The Clean Coal Technology program includes a continuation of funding for the fourth and fifth rounds of innovative projects to significantly reduce emissions. Projects are cost-shared, with industry providing at least half of the funding. For some years, environmentalists have urged that this program be reduced drastically.

Transportation questions directly affecting climate are mostly energy efficiency issues. Department of Transportation R&D goes up nearly \$100 million (O).

The administration proposes to raise outlays for alternative fuel vehicles from \$31 to \$49 million (O).

Regarding the automobile in general, as the Earth Budget remarks, it "has grabbed far more than its share of public investment dollars and has never contributed its fair share," stunting the growth of cleaner transportation modes. The imbalance results, among other things, in energy inefficiency, increased air pollution, higher health costs, and accelerated climate change.

Since 1981, "transit lost almost half of its funding according to testimony by the American Public Transit Association (APTA). Transit received 20 percent of all DOT spending in 1981, but by 1991 this had dropped to less than 11 percent. Meanwhile, funding for highways increased. In 1981, highways were appropriated two federal dollars for each federal transit dollar. In 1991, highways received four and one-half dollars for every transit dollar."

"Mass transit modes...are all more energy efficient and less polluting alternatives to the standard, single-occupant commuter automobile." The basic federal transit program consists of two main grant programs for local governments and mass transit authorities which would cover both capital investment and partially cover operating costs. These added up to approximately \$4.6 billion in FY94 and are increased to \$5.0 billion for FY95 (BA).

International Environment, Development and Population Programs

The *Overview of International FY95 Budget Requests for Environment, Development and Population Programs*, issued by Friends of the Earth on February 23 states, "Two of the categories under International Affairs, 'Promoting Sustainable Development' and 'Providing Humanitarian Assistance,' would receive ... about 0.4% of the proposed Federal Budget... This can be compared to the UN target of 0.7%, which was endorsed at the Earth Summit."

The FY95 international budget is presented in a new way, making it difficult to compare FY95 requests

with the previous year's appropriations. "Where comparisons can be made, environmental and sustainable initiatives do well.. As yet there is no breakout for international organizations and programs ... so it is not possible to tell how much UNICEF, UNDP, UNEP, etc. will receive.... The overall level for international organizations and programs is \$358 million, or 1% below the FY94 level."

In general, the administration is relying heavily on the multilateral development banks and the IMF to address poverty, reduce population growth and protect the environment in developing countries. However, environmental organizations have been struggling for more than a decade to make the World Bank, IMF and the regional development banks more accountable to environmental concerns.

Through its support of projects in developing countries, AID is involved in improving efficiency and promoting energy conservation. Appropriations legislation for 1993 included language directing AID to allocate at least \$15 million to "replicable renewable energy" projects and another \$10 million

Highlights from International Programs
(Budget Authority)

- Stabilization of World Population Growth up 14% to \$525 mill.
- UN Population Fund (UNFPA) up 50% to \$60 mill.
- Of the \$350 million "to protect the Global Environment by addressing the root causes of environmental harm, promoting environmentally sound patterns of growth and supporting improved management of the environment and natural resources including long-term threats such as climate change and loss of biological diversity," little information is presently available about specifically how the funds will be spent.
- Disaster Assistance up 6% to \$170 mill.
- The Migration and Refugee Affairs area down 5% to \$683 mill.

Sources: *Budget of the U.S. Government for Fiscal Year 1995*
Friends of the Earth, "Overview of the International FY95 Budget Requests," Feb. 23, 1994,
and "Clinton's First Earth Budget," Revised Analysis, Feb. 24, 1994

was earmarked for several renewables- promotion organizations. (There are no comparable figures in FY95 data.)

Space Research

The present global monitoring system, NOAA's J. D. Mahlman has said, is "not nearly up to answering the questions that will be asked by the scientific community and the policymakers."

Mission to Planet Earth includes a series of environmental remote sensing missions, for which funding would climb 25% to \$1.238 billion (BA), in contrast to the overall NASA budget which would decline for the first time in more than two decades.

Montreal Protocol Ozone Fund is up 92%. New funding would expand the effort to reduce greenhouse gases; the fund would nearly double, from \$25 million in FY94 to \$48 million (BA) in FY95.

National Oceanic and Atmospheric Administration

Decadal-to-centennial changes in the environment. This budget category, part of the Global Change Research Program, is designed "to provide science-based advice to governmental and industrial decisionmakers on actions affecting decadal-to-centennial changes in the regional and global environment." The program is being cut about \$14 million. The activities include, "research on long-term global change including the role of carbon dioxide and other greenhouse gasses on climate, the detection of climate change, the development of global models for understanding and prediction of changes, and the understanding of stratospheric ozone depletion." The inclusion of the Regional Climate Centers among programs proposed for elimination concerns many NOAA supporters.

Army Corps of Engineers

The Corps has been out of favor with environmentalists because of its dam building, river straightening and large-scale construction projects which many found to be

environmentally insensitive. But new environmental initiatives and responsibilities have improved its record recently as it has been given responsibility for projects to conserve soil and to mitigate or remediate wetlands. Particular emphasis has been placed on coordinating restoration plans for the coastal wetlands in Louisiana which have been disappearing rapidly.

The Corps also played a large role in frantic efforts to protect and rebuild levees in the Great Mississippi Flood last summer. Its funding for flood control projects has been reduced about \$10 million in FY95 below the previous year. Questions have arisen about the appropriateness of trying to save lands which some feel might better be ceded back to nature as floodplain. Funds requested for emergency flood control, hurricane and shore protection activities, drought and repair of non-Federal levees have been cut, but additional funds may be requested in the event of another major flood or coastal emergency.

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Benedick Heads New Environmental Panel

After five years of effort, a national non-profit organization of 5,000 members has secured substantial bipartisan support in the U.S. Congress to promote basic understanding and research on specific policy issues like global warming and biological diversity. In early March, the group, named the Committee for the National Institute for the Environment, chose for its president Ambassador Richard E. Benedick, chief negotiator for the 1987 Montreal Protocol, the international agreement to protect the ozone layer. Ambassador Benedick, who recently retired from the State Department, was recipient of an award at the Climate Institute's Second Annual Awards Dinner in December 1988, "for his very significant role in drawing the diplomatic community into a realiza-



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Although more than 20 Federal agencies engage in environmental research costing about \$5 billion a year, much of it is aimed at short-term regulatory issues and is not subject to the peer review process. There is no coordinated national plan for environmental research; the proposed new institute would address these shortcomings.

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The Institute has been the recipient of a number of grants in the last several months:

- **The W. Alton Jones Foundation** of Charlottesville, VA has given the Institute \$50,000 each year for two years to assist in implementation of the Framework Convention on Climate Change in Asia.
- **The American Gas Foundation** awarded a \$10,000 grant to the

Institute to finance the development of a handbook related to its North American Cities Program.

- Several organizations have come together to fund the Environmental Refugee Program. The **UK Overseas Development Administration** is providing 25,000 pounds sterling (now roughly \$37,500) each year for the next three years. The **Moriah Fund** has approved funds of \$50,000, the **United Nations Population Fund (UNFPA)** is contributing \$80,000 and the **Swedish International Development Authority** approximately \$25,000 to the project. These monies are in addition to a **Rockefeller Foundation** grant which helped to launch the program.
- **The William Bingham Foundation** has approved a matching grant of up to \$10,000 for support of the Institute's Leadership Council initiative in 1994.



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Address correction requested

Inside

Climate Change and World Food Supply

by Cynthia Rosenzweig
and Ana Iglesias

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The Climate Institute is a private nonprofit organization formed to advance public understanding of climate change including the greenhouse effect and of strategies to avert stratospheric ozone depletion.

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