



Reporting the human dimensions of climate change in the developing world



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## Evidence for climate change in advance of Rio+20

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On 20 June 2012, world leaders and scientific experts will meet in Rio de Janeiro, Brazil in an effort to reduce poverty, advance social equity, and ensure environmental protection. They face many complex, interrelated challenges, particularly concerning climate change and its potential impact on sustainable development.

In this, the inaugural issue of **UNEARTH News**, we felt it important to provide a bit of background on environmental issues facing attendees of Rio+20: the United Nations Conference on Sustainable Development as they grapple with the intricacies, and implications, of climate science and development. While scientific consensus exists on a number of issues, uncertainties remain in others. Perspectives regarding Rio+20 can therefore differ markedly. Heidi Cullen, for example, chief climatologist with [Climate Central](#), believes the most urgent question facing Rio+20 policymakers is addressing “this massive human and environmental risk at the international level in a way that provides opportunities for sustainable economic growth in developing countries.”

On the other hand, Richard Lindzen, Alfred P. Sloan Professor of Atmospheric Sciences at the Massachusetts Institute of Technology, says: “I would urge those attending Rio II to consider that while the dangers of increasing CO2 are likely to be greatly exaggerated, the dangers of proposed policies are clear. They will increase the price and reduce the availability of energy, and thus reduce the opportunities of much of the world for a better life.”

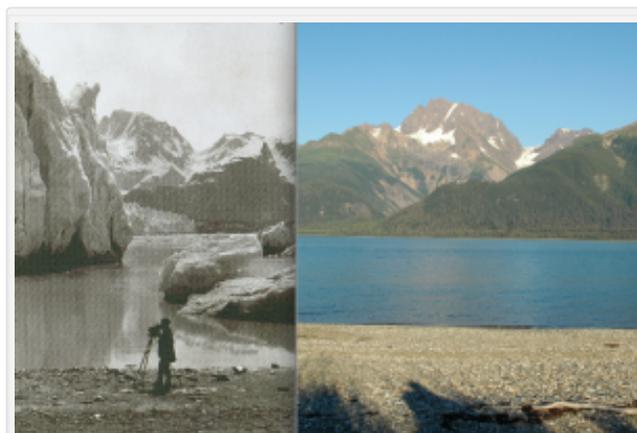
It’s been 20 years since Rio’s first Earth Summit. Thanks to increasingly sophisticated technology, we’ve learned a great deal about our environment. But important questions persist. What do we know about climate change, and what’s unresolved?

### What is the evidence for climate change?

Climate change is not new—the Earth has experienced seven cycles of glacial advance and retreat over 650,000 years, which experts attribute to changes in its orbit around the sun. But according to the National Aeronautics and Space Administration (NASA), an increasing body of evidence suggests current trends are exceptional.

Using satellites and other advanced techniques researchers worldwide are analyzing extensive data. The Intergovernmental Panel on Climate Change (IPCC), the top international body assessing global climate conditions, coordinates the work of thousands. Its conclusion? “Scientific evidence for warming of the climate system is unequivocal.” Despite this declaration, however, questions and controversies continue.

Experts agree for the most part on several concepts, according to NASA. Carbon dioxide and other gases trap heat in the atmosphere. When these



Photographed by G.D. Hazard in 1891 and by Bruce F. Molnia in 2005. Courtesy of the Glacier Photograph Collection. Boulder, Colorado, US and the National Snow and Ice Data Center/World Data Center for Glaciology.

“greenhouse” gases increase, the Earth reacts by warming. Its climate is sensitive not only to greenhouse gases, but also to variations in solar output and its own orbit. Significant climate change can happen fast—not in millions of years, or even thousands of years, but rather tens of years.

NASA points to several signals we are currently in the midst of rapid climate change:

- Sea levels are rising throughout the world; increases in the last ten years are nearly double those of the last 100. In addition, our surface ocean waters have seen a 30 percent increase in acidity since the Industrial Revolution.
- Global temperatures are also on the rise, particularly in the last 12 years; ocean waters have taken on much of this heat.
- Ice sheets in Greenland and Antarctic are decreasing in mass even as Arctic sea ice declines. Glaciers in Africa, Alaska, the Alps, the Andes, the Himalayas and the Rockies are all retreating.
- Extreme weather events are of global concern. In the United States alone, record high temperatures have been increasing, while record low temperatures have been decreasing. Intense rainfall events are also on the rise.

### **What remains uncertain?**

NASA says understanding triggers for rapid climate change presents the “single largest uncertainty in climate science.”

Many things affect climate. Some may actually initiate a shift in climate—what scientists call “forcings.” The sun’s light is one example of a forcing. Aerosols, dust, smoke, and soot—generated by both humans and nature—are also potential forcings.

While forcings have been the subject of concentrated investigation, additional research is required to fully understand their impacts. For example, scientists have been measuring variations in solar irradiance since the 1970s but still lack confidence in long-term implications.

Forcings can affect the already complex interactions between climate processes (such as cloud and water systems). These “feedbacks” may either increase or decrease warming and it’s therefore essential to unravel their mysteries.

Clouds are perhaps the most intriguing example of feedbacks. Despite their vital importance, it’s been difficult to assess their role. Some scientists feel clouds have the capacity to protect us from warming’s dangers; others believe their effect may be neutral or even accelerating. But cloud physics are not well represented by the models scientists use to measure and predict climate change. And so, evidence remains elusive.

Here are other issues scientists are exploring in relation to feedbacks, according to NASA:

- Where do human carbon dioxide emissions go? Nature removes about half from the atmosphere, but we need more information on how both oceans and land absorb carbon dioxide, and how warming affects these processes.
- Will increased warmth turn traditional weather patterns upside down? Scientists are trying to understand how ocean circulation keeps regional climates stable.
- Can we improve methods for predicting rain and snow? Precipitation is essential for survival. Unfortunately, models currently used to predict regional changes generate varied results. One might predict more local precipitation, while another might predict less.
- With ice sheets melting, how high will sea levels rise? Researchers need more information about ice itself before they can make precise predictions.

### **Is there consensus among scientists?**

With many outstanding questions, the climate community has much to explore, particularly with respect to the magnitude of warming’s effects. It’s hard to predict with absolute certainty where and when changes may strike, or [how severe their impact may be](#).

However, it seems there is little disagreement among climate scientists on whether warming is real. Most also believe, in accordance with evidence presented by the IPCC and others, that human activities are largely responsible.

In advance of Rio+20, the Global Environmental Change Programmes with the International Council for Science organized the world's largest gathering of experts (3000+) on global environmental and social issues. The result? A "State of the Planet Declaration" indicating urgent action is needed to prevent "economic, ecological and social crises" with the potential for a global "humanitarian emergency."

Others, such as the Heartland Institute, are skeptical. In February, 2012, Lindzen spoke in London's House of Commons Committee Rooms, stating: "There are numerous reasons why an intelligent observer should be suspicious of the presentation of alarm" including "identification of complex phenomena with multiple causes with global warming and even as 'proof' of global warming."

Cullen says, "Ongoing research has shown us that global warming is real, human-caused and a very serious threat. While there is uncertainty with respect to specific local climate impacts, we know enough about large-scale global and regional impacts to get started. We simply cannot afford to delay action."

As policymakers and scientists gather for Rio+20, they will have much data to assess and many decisions to make. Climate change is a serious challenge requiring comprehensive, global participation. The stakes are high.



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