Sampling-based models, it is suggested, may not be the best choice to examine whether biodiversity enhances ecosystem stability. What the sedimentary deposits from icebergs in the South Atlantic Ocean may indicate about the stability of the Antarctic Ice Sheet is discussed. And although the mortality rates in Eastern European countries did not uniformly decline during the early 1990s, they reflected an unusual feature: "the health crisis in many Eastern European countries...did not affect those groups that are considered especially vulnerable, such as children and the elderly, but instead affected those of working age."

Assessing Biodiversity and Ecological Stability

Jocelyn Kaiser, in her New Focus article "Rift over biodiversity divides ecologists" (25 Aug., p. 1282), repeats the conventional wisdom that Robert May's theoretical work in the 1970s showed that diversity works against stability. The centerpiece of May's work involved Monte Carlo samples of models—the larger the system and the stronger the interactions among populations, the smaller the proportion of the sample that would be stable. Complex ecological systems are generally not, however, the outcome of some sampling process, but arise through development over time with the addition, growth, decline, and elimination of populations.

Several modeling studies in the 1970s and 1980s showed that, whereas stable systems may be extremely rare as a fraction of the systems being sampled, they can be readily constructed over time by the addition of populations from a pool of populations or by elimination of populations from systems not at a steady state (*1*). Both sides of the debate reviewed by Kaiser about whether biodiversity enhances ecosystem function depend, conceptually, on a sampling view of ecological complexity. The developmental view would be preferable for any serious consideration of the implications of human interventions within ecosystems.

Peter J. Taylor
Graduate College of Education, University of Massachusetts, Boston, MA 02125, USA. E-mail: peter.taylor@umb.edu

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Interpreting Iceberg Deposits in the Deep Sea

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In their report "Millennial-scale instability of the Antarctic Ice Sheet during the last glaciation" (9 June, p. 1815), S. L. Kanfoush *et al.* suggest that increases in ice-rafted detritus (IRD) observed in deep-sea sediment records from the South Atlantic Ocean identify times of instability of the Antarctic Ice Sheet. IRD is the material deposited from melting icebergs and is easily identified by its much coarser texture compared with other deep-sea sediments. We believe that the linkages between the physics of ice sheets and the formation of an IRD signal have not been clearly established, and that the de facto claim that IRD layers in the South Atlantic record instability of the Antarctic Ice Sheet is premature.

The idea that an increase in IRD reflects ice-sheet instability (that is, either mechanical or a highly nonlinear response to a given forcing) originated with studies of deep-sea records from the North Atlantic Ocean. The most celebrated of such interpretations involves Heinrich events, which are thought to represent armadas of icebergs released from an ice stream draining the Laurentide Ice Sheet through Hudson Strait (*1*). The IRD layers representing Heinrich events show high sediment fluxes distributed over a large area in a short interval of time (*2*). The interpretation that such layers require an ice-sheet instability (a surge), however, still poses problems (*3*).

A number of additional IRD layers are found in North Atlantic glacial sediments, but these differ from Heinrich layers in having low sediment fluxes and in being derived from multiple ice sheets. Although these layers have also been associated with ice-sheet instability, their physical properties and their association with cold events in the North Atlantic indicate a stable, climatic response of marine ice-sheet margins to a climate forcing (*4*). Even this interpretation, however, is based on several untested assumptions: (i) IRD is delivered to a site from icebergs versus sea ice; (ii) an increase in IRD represents greater iceberg flux versus a greater amount of debris incorporated at the base of the ice sheet that delivers the icebergs or a greater distance of iceberg transport; (iii) all icebergs carry the same IRD load, and thus there is some common function between IRD concentration and iceberg flux; and (iv) an increase in IRD and associated iceberg flux represents ice margin advance versus retreat.

The IRD records from the South Atlantic described by Kanfoush *et al.* appear to share more in common with the non-Heinrich IRD layers in the North Atlantic than with the Heinrich layers. We suggest that, at the least, IRD layers derived from the Antarctic Ice Sheet must show the characteristics of Heinrich layers to support the argument for ice-sheet instability, but much more work remains to be done in interpreting ice-sheet behavior and climate dynamics from IRD records.

Peter U. Clark
Department of Geosciences, Oregon State University, Corvallis, OR 97331, USA. E-mail: clarkp@geo.orst.edu

Nicklas G. Pisias
College of Oceanic and Atmospheric Sciences, Oregon State University, Corvallis, OR 97331, USA. E-mail: pisias@oce.orst.edu

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Response

Clark and Pisias raise several important points. They propose that "at the least, IRD layers derived from the Antarctic Ice Sheet must show the characteristics of Heinrich layers to support the argument for ice-sheet instability" and that those characteristics are "high sediment fluxes distributed over a large area in a short interval of time." We agree with these criteria as evidence of ice-sheet instability.

The areal extent of the South Atlantic

(SA) IRD layers is unknown. However, the layers we described in our report correlate across 12° of latitude (greater than 1300 kilometers). Although a correlative relation has not been established with the SA events, discrete glacial-aged IRD layers have also been reported in numerous other South Atlantic cores (*1*). The northernmost record of SA events (at 41°S) was situated north of the Polar Front even during the last glaciation (*2*). This supports the interpretation that SA events are not simply an artifact of increased iceberg survivability due to decreased glacial sea surface temperatures, and it implies that the associated influx of icebergs was of sufficient numbers or sizes or both to survive the comparatively warm water at 41°S. Consequently, we believe that IRD analysis of additional core locations around the South Atlantic will support our proposition that the SA events are areally extensive, although only further work can prove this unequivocally.

Clark and Pisias contend that "[t]he IRD records from the South Atlantic…appear to share more in common with the non-Heinrich IRD layers in the North Atlantic than with the Heinrich layers" and because the non-Heinrich detrital carbonate layers of the North Atlantic have been associated with cold events, they represent "a stable, climatic response of marine ice-sheet margins to a climate forcing." To establish the age control of the cores we described, we used linear interpolation between radiometrically determined ages and ages derived from correlation of the oxygen isotope record to SPECMAP [(*3*); see description in our report]. The limited occurrence of carbonate within South Atlantic sediments poses a significant obstacle to high-resolution radiocarbon dating of such sequences (*4*). Therefore, the chronology is not precise enough to discuss with confidence the duration of each of the individual SA events. However, with the exception of events SA1 and SA3, accumulation rates of total lithics during SA events rise to about 10 times that of ambient rates (greater than 60 times the ambient rates in the case of SA0). Thus, similar to the Heinrich events interpreted as evidence of surging of the Laurentide Ice Sheet, the SA events appear to be both areally extensive and rapidly deposited. Also, correlation of the South Atlantic marine core from site 1094 to the Vostok Ice Core did not reveal a similarly strong association between the SA events and regional cold events (*5*). Thus, they do not appear to represent a stable response of marine ice-sheet margins to a regional climate forcing.

Finally, we agree with Clark and Pisias that the linkages between the physics of ice sheets and the formation of an IRD signal have not been clearly established. Several statements made by Clark and Pisias suggest they equate ice-sheet instability with surging. Although many researchers would similarly restrict the definition of ice-sheet instability to mean a surge, we use the term in the manner defined by Clark and Pisias, to encompass "either mechanical or a highly nonlinear response to a given forcing." We differ from Clark and Pisias in that we hesitate to postulate what the precise nature is of the nonlinear response to forcing. A surge is one means by which Antarctic Ice Sheet instability could result in increased influx of debris-laden icebergs to the South Atlantic. However, so too could a rapid disintegration of ice-shelves as a result of sea-level rise (*6*). Whether and in what ways such vastly differing ice-sheet behaviors leave differing imprints on IRD records remains to be answered.

Sharon L. Kanfoush
Department of Geology, Utica College of Syracuse University, Utica, NY 13502, USA, and Department of Geological Sciences, University of Florida, Gainesville, FL 32611, USA. E-mail: skanfoush@utica.ucsu.edu

David A. Hodell
Department of Geological Sciences, University of Florida. E-mail: dhodell@geology.ufl.edu

Thomas P. Guilderson
Lawrence Livermore National Laboratory, Livermore, CA 94550, USA, and Department of Earth and Planetary Sciences, Harvard University, Cambridge, MA 02138, USA

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Life Expectancy in Eastern Europe

In his News Focus article "Stress: The invisible hand in Eastern Europe's death rates" (9 June, p. 1732), Richard Stone highlights the potentially important role that psychosocial stress plays in cardiovascular disease mortality and suggests that this factor, at least in part, explains the epidemic of heart disease in Eastern Europe and the former Soviet Union. Although this is an important issue to raise, Stone says that life expectancy "plummeted" in Eastern Europe in the early 1990s; however, for many countries in the region the opposite, in fact, occurred: life expectancy began to rise after 1989, following the decades of stagnation in life expectancy that began in the mid-1960s. This is particularly true in the countries that more successfully implemented market reforms. In Poland, for example, male life expectancy at birth rose from 66.2 years in 1990 to 68.1 years in 1996 (*1*), and in the Czech Republic, male life expectancy at birth rose from 67.5 to 70.4 years between 1990 and 1996 (*2*). A graph in Stone's article even shows the increase in life expectancy in Hungary in the early 1990s.

Also in contrast to Stone's article, cardiovascular disease mortality has fallen in many East European countries in the 1990s (*3*). Although it is true that many countries of the former Soviet Union suffered severe declines in life expectancy in the early 1990s—especially Russia, Ukraine, and the Baltic countries—the mortality experiences of the former socialist countries in that period were far from uniform.

Elizabeth L. Brainerd
Center for International Development, Harvard University, 79 John F. Kennedy Street, Cambridge, MA 02138, USA. E-mail: elizabeth_brainerd@harvard.edu

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Response

Brainerd is right to point out that mortality in the former socialist countries was not uniform between 1989 and the early 1990s. Stone's article covered several but not all of the issues discussed at the NATO Advanced Research Workshop ["Increase in Coronary Heart Disease in Central and Eastern Europe: Stress- and Gender-Related Factors," 20 to 24 May 2000, Budapest (*1*)].

The most striking feature of the health crisis in many Eastern European countries is that it did not affect those groups that are considered especially vulnerable, such as children and the elderly, but instead affected those of working age. For example, between 1989 and 1993, mortality, primarily due to cardiovascular conditions, among 30- to 49-year-old men (divided into four age groups) rose 70 to 80% in Russia, 25 to 52% in Ukraine, and 7 to 13% in Poland; among women, the increases were 52 to 57%, 20 to 28%, and 4 to 11%, respectively (*2*). Furthermore, estimates of excess mortality (that is, absolute number of people who have died exclusively due to rises in age- and sex-specific death rates and not because of aging or population growth) show very different health prospects for men and women, especially in Romania, Poland, and the Czech