S. George H. Philander

on El Niño & the uncertain science of global warming

Most people first heard of El Niño in 1997 when newspapers and television gave extensive coverage to various disasters associated with that phenomenon: devastating floods in California, severe droughts in Indonesia, and strange weather everywhere. Everybody became familiar with El Niño, but few realized that the phenomenon has been with us for millennia and that, at first, it was welcomed as a blessing. Originally the name was given to a modest, warm current that appears along the shores of Ecuador and northern Peru around Christmastime when the accompanying rains transform the barren coastal desert of that region into a garden. (The term is Spanish for 'the boy' and refers to Child Jesus.)

Over the past few decades, even though the phenomenon has remained essentially constant, our perceptions of it have undergone a remarkable transformation. We now regard El Niño as a global hazard that we anticipate with trepidation. It is as if we, temperamental and capricious, have been having a stormy affair with aloof, indifferent El Niño.

Our affair is approaching a critical juncture. By rapidly increasing the atmospheric concentration of greenhouse gases, we are changing the climate of this planet, and hence El Niño. What have we learnt from our affair that can help us avoid a calamity?

An important lesson learnt thus far amounts to a paradox: as we grow in wealth and in population, so does our vulnerability to natural hazards. Insurance companies find that claims related to damages inflicted by severe storms, hurricanes, floods, earthquakes, etc. are rising steeply even though there is no evidence of an increase in the number and intensity of those hazards. The rains associated with El Niño still turn the desert of Ecuador into a garden, but today few people have time to behold that miracle; they are preoccupied with the roads, bridges, and houses that are washed away by the rains.

In our efforts to cope with natural hazards, we routinely ask scientists to predict those phenomena. Meteorologists have responded by transforming daily weather prediction from an augury into a reliable source of important information – a splendid achievement that nearly everyone takes for granted. Scientists are also making progress with the pre-

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Note by S. George H. Philander

diction of longer-term climate fluctuations that are strongly influenced by oceanic conditions. For a long time, the lack of measurements was a serious handicap. Until recently, oceanographers gathered much of their data from solitary vessels that they navigated by means of stars and sextants. (Asking for a "tall ship, and a star to steer her by" was not simply a romantic wish but a practical necessity.) The measurements thus obtained tell us much about the 'steady' aspects of the oceanic circulation, but not about its variability.

To explore the 'weather' of the ocean requires simultaneous measurements over large areas for extended periods. Such measurements first became available through an international field program in 1957, as, fortuitously, El Niño occurred. It then became clear that the interannual warming of the waters off Ecuador and Peru – the signature of El Niño – extends far westward across the entire ocean basin and affects atmospheric conditions globally. Resources for exploring such climate fluctuations, especially their oceanic aspects, increased significantly in the decades after the launching of Sputnik (also in 1957).

This led to rapid scientific advances that brought oceanographers to the realization that the warming of the eastern equatorial Pacific during El Niño is a consequence of changes in the winds over the ocean. To meteorologists, however, that warming causes the changes in the winds. This circular argument implies that El Niño is neither a strictly atmospheric nor a strictly oceanic phenomenon, but is attributable to interactions between the ocean and atmosphere that give rise to spontaneous oscillations between complementary warm (El Niño) and cold (La Niña) conditions. To ask why El Niño and La Niña occur is equivalent to asking why a pendulum swings back and forth.

Scientific progress was so rapid that, although the exceptionally intense El Niño of 1982 caught everyone by complete surprise, by 1997 oceanographers could anticipate the arrival of the phenomenon several months in advance. This was an impressive achievement, but it had an unfortunate blemish that illustrates how difficult it is to bridge the worlds of science and human affairs.

During the summer of 1997, scientists alerted Californians that a very intense El Niño would probably deliver exceptionally heavy rains to their state during the upcoming winter. Scientists also advised the people of Zimbabwe that rainfall there would probably be below normal. Californians did indeed experience floods, and were prepared, but Zimbabweans had normal rainfall and were unprepared. Because of the expectation that crops would be poor, and thus unprofitable, banks in Zimbabwe declined loans to farmers. The consequences were dire: crop production fell 20 percent below normal in the impoverished country.

The tragedy in Zimbabwe raises many questions. Did the policymakers of that country fail to appreciate the significance of probabilistic forecasts? Or did they cynically welcome the forecast of a mysterious phenomenon that threatens from the remote Pacific as an effective means for diverting attention from serious local political problems? Did the scientists, in their eagerness to demonstrate that their results can be useful, emphasize the large uncertainties insufficiently?

History tells us that accurate scientific information concerning environmental hazards is of enormous value, and also that much can be accomplished even when that information has large uncertainties. Consider, for example, the occasional failure of the Indian monsoons that results in poor harvests. The conse-

quences used to include horrendous famines and the deaths of millions. At first it was assumed that a solution to this problem required accurate forecasts of the monsoons; but for several decades now, there have been no disasters comparable to the famines of the nineteenth and early twentieth centuries, even though the monsoons still fail occasionally, and even though the predictions of such failures still have huge uncertainties. India learnt to cope with poor monsoons after it became a democracy and started developing and implementing effective policies that do not require precise scientific information. (Famines are attributable not to a lack of food, but to problems with the distribution of food.) Hurricanes are further examples of hazards whose impact can be minimized, even in the absence of accurate predictions, by implementing appropriate policies – by discouraging the construction of buildings too close to hurricane-prone shorelines.

From our affair with El Niño it is evident that we tend to see ourselves as the innocent victims of natural hazards, and are reluctant to acknowledge that the way we live and conduct our affairs contributes to our vulnerability. In the case of future global warming, our role in creating potential problems is more explicit. But this issue is very complex because the current rapid increase in the atmospheric concentration of greenhouse gases is an unfortunate byproduct of industrial and agricultural activities that bring us considerable benefits – increasing standards of living for the rich and poor alike. In weighing the costs and benefits, we should keep in mind that the technological advances that have brought the benefits have also brought grave responsibilities. We have become the custodians of Earth because our recently acquired technological prowess is such that we now are geologic agents capable of interfering with the processes that make this a habitable planet. We are capable of inducing global climate changes so that the decisions we make today will affect not only our offspring for many generations to come, but also all of the other forms of life on this planet.

The future of our planet is too serious a matter to be left strictly to scientists and economists. Everyone has to participate in the discussion of environmental policies, which means that everyone should have at least a rudimentary understanding of how our planet maintains the conditions that allow us to prosper. This is a daunting challenge, given the immense complexity of our planet. It is therefore heartening that we have had enormous success in coping with a system even more complex than our planet, namely the human body. We have increased life expectancy by several decades by strongly supporting activities that contribute to the prevention of diseases. Each of us needs to become as informed about Earth, and the effects of our daily activities on the environment, as we are about our own bodies. To live in harmony with nature, a passionate expression of concern about the environment is no substitute for a rudimentary understanding of the way Earth functions and of our impact on the environment.

In the debate about global warming, many people appear to be unaware that, because the growth in the atmospheric concentration of greenhouse gases over the past century has been exponential, merely reducing the rate at which we burn fossil fuels can amount to a significant mitigation of the potential problems we face. Greater efficiency will make the limited supply of fuels last longer, will make us less dependent on imports from other countries, will reduce the rate at which we emit green-

house gases into the atmosphere, and hence will delay the onset of the kind of global climate changes that are liable to turn El Niño into a serious hazard.

Our affair with El Niño is approaching a critical juncture. Constant El Niño could soon become fickle. Will he grow more intense? Will his brief visits become prolonged? As yet we have no definite answers. But we have learnt that much can be done to avoid calamities by implementing appropriate policies, even when the available scientific information has large uncertainties. Above all, we need to guard against the temptation to defer difficult political decisions because of a perceived need for more accurate information. Much more can be learnt from our affair with El Niño. We need to do so in a hurry, before we succeed in changing him.

Linda Hutcheon

on the art of adaptation

Despite the argument implicit in Spike Jonze's latest film, *Adaptation,* every age can justly claim to be an age of adaptation. The desire to transfer a story from one medium or one genre to another is neither new nor rare in Western culture. It is in fact so common that we might suspect that it is somehow the inclination of the human imagination – and, despite the dismissive tone of some critics, not necessarily a secondary or derivative act. After all, most of Shakespeare's plays were adapted from other literary or historical works, and that does not seem to have damaged the Bard's reputation

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