The Use of Scenarios in Assessing Climate Change, Human Security, and Potential Outcomes

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"We . . . need better mechanisms and organizations then we have had for anticipating technical and political developments and planning to meet them. While there is always the possibility that lucky muddling through or unassisted statesmanship will get the world out of the mess it is in, I find this unlikely without some guidance from systematic, hard-headed professional work."

Herman Kahn, *Thinking About the Unthinkable* (1962)

Several years ago, as one of the authors was making a formal presentation to the country team of the American embassy in Madrid, the senior political counselor suddenly burst out, "Why should anyone *care* about strategy? It's hard enough dealing with *policy,* going from one crisis to the next!" To be fair to this foreign service officer, who had recently experienced any number of policy crises—from Haiti to the Balkans—there was a point to his objection. Why *should* anyone care about strategy?

Strategy, after all, is not politically expedient; it is a long-term focusing instrument that helps shape the future environment.[1] Policy crises, on the other hand, always deal with the more immediate execution of initiatives to address critical needs and requirements. But if an argument could be made in defense of strategy, it would be this: In the absence of strategy, there is no clear direction for the future, and any road will take you there, bumping over crisis and change, and suffering through one knee-jerk reaction after another.

Perhaps what best illustrates this reality is the scene between Alice and the Cheshire Cat in *Alice's Adventures in Wonderland*, when Alice asks, "Would you tell me, please, which way I ought to go from here?"

"That depends a good deal on where you want to get to," said the Cat.

"I don't much care where—" said Alice.

"Then it doesn't matter which way you go," said the Cat.

"—so long as I get *somewhere*," Alice added as an explanation.

"Oh, you're sure to do that," said the Cat, "if you only walk long enough."

At its best, strategy will get you somewhere near where you intended to go. Strategy provides a systematic approach to dealing with change, with both what should and should not be expected to remain the same. Strategy, in short, is the application of available means to secure desired ends. As regards policy decisions, nonetheless, the outburst of the foreign service officer seems all too often the likely response to both crises and longer-term developing security conditions than simply immediate intervention choices. The issue of climate change and its impact on human security, in particular, requires, we argue, a more focused, more nuanced, more strategic approach.

We therefore argue that scenarios act as useful strategic tools in allowing policy and decision makers to assess potential outcomes long before (sometimes lethal) impacts occur. Well known scenario cases that have considered climate change and its security impact (such as the Peter Schwartz and Doug Randall case written for the U.S. Department of Defense's Office of Net Assessment)[2] have most often focused on how to mitigate risk, particularly in the context of "national security." Notably, while such scenarios focus on the "threat" to security inherent in rapid environmental change, few scenarios—to date—have addressed the possibility of how best to mitigate risk, lessen vulnerability, and possibly even limit threats.

Before proceeding further, nonetheless, it might prove useful to provide "operating" definitions for two highly contentious concepts—human and environmental security—and how they differ from more the traditionally approached national security paradigm. Briefly,

—*Human security* is still an emerging concept. In the September 1999 issue of *Security Dialogue,* Astri Suhrke pointed to a fundamental bifurcation that human security as conceptual approach and policy principle continues to suffer from: Is it related more to long-term "human development," such as was suggested in the 1994 United Nations *Human Development Report*, or (as a security issue) does it constitute a principle of intervention during immediate crisis, such as Rwanda in 1994 or Kosovo in 1999 or even Iraq in 2003? The answer to either question is "Nes"—a little bit of "no" and a little "yes."

—*Environmental security* emphasizes the sustained viability of the ecosystem, while recognizing that the ecosystem itself is perhaps the ultimate weapon of mass destruction. In 1666 in Shensi province, for example, tectonic plates shifted and by the time they settled back into place, 800,000 Chinese were dead. Roughly 73,500 years ago, a volcanic eruption in what is today Sumatra was so violent that ash circled the earth for several years, photosynthesis essentially stopped, and DNA samples suggest that the precursors to what is the human race amounted to only several thousand survivors worldwide. Yet from an alternative point of view, mankind itself is the ultimate threat to the ecosystem. Thus, from a radically extreme perspective, elimination of humanity proves the ultimate guarantee of the ecosystem's survival.

—*National security* represents the traditional understanding of security, to include the protection of territory and citizens from external threats—from other states, and, more recently, "stateless" actors (which range from NGOs to terrorist networks).

Few scenarios, to date, have considered the usefulness of assessing these alternative aspects of security and how best to mitigate vulnerability and avoid conflictual outcomes that are considered in a framework *other than* a nation-state response to a potential/emerging/real "threat."

Scenarios and Their Uses

Literally, scenarios are "story lines" that allow people to understand the "flow" of events and from which we can examine and question the constants, trends, and shifts that are taking place. It seems useful to recall that the roots of both words "history" and "story" spring from the same Greek word *historia*. Some languages, such as French, retain a single word for what others, such as speakers of English, differentiate with two. But of course, in policy debate, a scenario is not just *any* story; it is one that has been created to help examine and question choices for the future. Following from Herman Kahn, who prolifically melded story telling and security studies, a scenario is more precisely a "hypothetical sequence of events constructed for the purpose of focusing attention on causal processes and decision points."[3]

At their worst, scenarios help provide predetermined solutions to pre-conceived outcomes. Many who are engaged in intelligence work, gaming analysis, or "futurist" projections can easily fall victim to narrowly defined limits and acceptable outcomes. At their best, however, scenarios help distinguish between *threats, vulnerabilities,* and *risk*; scenarios may well be the best possible mechanisms to address the complex relationship among seemingly unrelated factors. The challenge for strategic planners is to help decision makers understand what the future security environment might look like, to affect their perceptions, in essence, to

help them "reperceive." Pierre Wack, who gained some fame as a strategic planner during the oil crises of the 1970s with his ability to get the senior executives in Shell Oil to understand what might happen in the energy business, wrote in the *Harvard Business Review* some years later:

> Scenarios deal with two worlds: the world of facts and the world of perceptions. They explore the facts but they aim at perceptions inside the heads of decision makers. Their purpose is to gather and transform information of strategic significance into fresh perceptions. This transformation process is not trivial—more often than not it does not happen. When it works, it is a creative experience that generates a heartfelt "Aha!" from you . . . [decision makers] and leads to strategic insights beyond the mind's previous reach.[4]

In short, to think and act effectively in an uncertain world, people need to learn to *reperceive*—to question their assumptions and their understanding about the way the world works. By questioning those assumptions and rethinking the correct way to operate under uncertainty, we often see the world more clearly than we otherwise would. Wack summarized his goals as a strategic planner and developer of scenarios by stating:

> I have found that getting to that [decision makers'] "Aha!" is the real challenge of scenario analysis. It does not simply leap at you when you've been presented all the possible alternatives . . . . It happens when your message reaches the microcosms of decision makers, *obliges them to question their assumptions about how their . . . world works, and leads them to change and reorganize their inner models of reality.*[5]

Former secretary of state Colin Powell, when he was Chairman of the Joint Chiefs during the first Bush and the Clinton administrations, often valued such analyses as setting the context for a "strategic conversation" so that real, and often difficult, decisions could be made about the future. Scenarios help decision makers select alternative courses of action.

Threats, Vulnerabilities, and Risk

Although security—as basic concept—is frequently considered in the study and analysis of policy decisions, its essential meaning ought to be more widely *disagreed* than agreed on. Commonly considered a basic concept is in policy and academic debates, security is in stark reality a quantity that is not basic at *any* register. Yet couching emerging "non-traditional" concepts such as environmental security and human security solely on their relationship to potential or real threats, most often within a topology of power, immediately captures such concepts hostage to "traditional" state-centered, national security paradigms. Moreover, not all security issues involve "threats"; rather, the notion of vulnerabilities is as serious to some peoples—and some regions—as the more familiar concept of threat. The issue truly is not one of "hard" traditional security (often based on state-to-state power relationships) or "soft" non-traditional security (that can involve multiple transnational aspects)—but a focus on *both*. Too exclusive a focus on one form of security may cause a boomerang impact by failing to recognize, or deal with, with a contending form of security. Recognizing, and *acting*, on the best approaches to issues of security will prove the greatest challenge.[6]

Thus, an important acknowledgment should emerge here: those who form policy and make critical decisions on behalf of states and of peoples must, ever increasingly, focus on aspects of traditional "national security," in which military forces will likely continue to play a preëminent role, as well as human security, in which "nontraditional" security issues pre-

dominate—in which other approaches will take center stage. If such premise proves true, and in a future where both "hard" and "soft" security will matter, those involved in policy decisions (and those affected by such decisions) will increasingly need to focus on aspects of *both* threats and vulnerabilities. There is a crucial need, then, to recognize the difference between these two categories.

A threat is an external cause of harm that is *identifiable, often immediate, and requires an understandable response*. Military force, for example, has traditionally been sized against threats: to defend a state against external aggression, to protect vital national interests, and enhance state security. Force options, traditionally, have included a range of response—from deterrence to intervention to pre-emptive strike. (The size of the U.S. and USSR nuclear arsenals during the Cold War made perhaps more sense than today because the perceived threat of global holocaust in the context of a bipolar, ideological struggle was far greater then.) A threat, in short, is either *clearly visible or commonly acknowledged.*

A vulnerability is an internal condition often only perceived through *an indicator, often not clearly identifiable, often linked to a complex interdependence among related issues, and does not always suggest a correct or even adequate response.* While disease, hunger, unemployment, crime, social conflict, criminality, narco-trafficking, political repression, and environmental hazards are at least somewhat related issues and do impact security of states and individuals, the best response to these related issues, in terms of security, is not at all clear. While Canada, for example, has emphasized the relevance of human and environmental security to "high politics," and attempted to restructure its armed forces to meet these challenges, the relevance of military state-centered forces to address or "solve" non-state-centered issues is questionable.

Moreover, a vulnerability (unlike a threat) is *not clearly perceived, often not well understood, and almost always a source of contention among conflicting views.* Compounding the problem, the *time* element in the perception of vulnerability must be recognized. Some suggest that the core identity in a security response to issues involving human or environmental security is that of recognizing a condition of *extreme vulnerability*. Extreme vulnerability can arise from living under conditions of severe economic depravation, to victims of natural disasters, and to those who are caught in the midst of war and internal conflicts. Long-term human *development* attempts thus make little to no sense and offers no direct help. The situation here, to be blunt, is not one of sustainability but of rescue.

R. H. Tawney, describing rural China in 1931, described the extreme vulnerability among peasants through a powerful image: "There are districts in which the position of the rural population is that of a man standing permanently up to the neck in the water, so that even a ripple is sufficient to drown him" (Scott, 1997, 1). In such instances, the need for intervention is immediate. (Equally, this need to intervene during a crisis is a hallmark of the liberal ideal. Franklin Delano Roosevelt, considering political/military security during the Second World War, is reputed to have said: "When your neighbor's house is on fire . . . you lend him your hose.")

But there also cases of long-term vulnerability in which the best response is uncertain. We term these problematic conditionalities—which are most difficult for policy analysts and decision makers, often driven by crisis response rather than the needs of long-term strategic planning—*creeping vulnerabilities.*[7] Given the uncertainty, the complexity, and the sheer nonliner unpredictability of creeping vulnerabilities, the frequent—and classic—mistake of the decision maker is to respond with the "gut reäction": the intuitive response to situations of clear ambiguity is, classically, to *do nothing at all.* The more appropriate response is to take an adaptive posture; to avoid the instinct to act purely on gut instinct; and to recognize what

variables, indicators, and analogies from past examples might best inform the basis of action.[8]

Finally, there is the issue of *risk*. Although multiple definitions abound, we might offer a simple calculus for risk in its relationship to threats and vulnerabilities: *risk* involves the ability to expose oneself to damage during the process of change and the resilience to be able to sustain oneself during such change. Acknowledging risk, while simultaneously working to reduce its impact, may well seem irreconcilable; yet decision makers, as human actors, inevitability will seek these ends both in scenarios and in real action. Risk is therefore as much a driving force in the guarantees of basic security as the absence of fear or the desire to be free to make choices on behalf of the collective good.

Some examples might help illustrate our arguments regarding threats, vulnerabilities, and risk. Although now well known that the United States, among so-called developed nations, has spent billions of dollars on *studying* the issue of environmental change—particularly regarding the issues of global warming and greenhouse gases—there still remain linkage problems between cause and effect. Yet given that no definitive, final, and unswervingly accurate data exist to establish such cause and effect, there is certainly enough substantiary evidence to suggest that change is occurring and that potential outcomes, in some instances, could be disastrous. If the temperatures were to rise, by some estimates, as high as 3.8° Celsius over the course of twenty-first century, there could be a concomitant rise in sea levels of ninety-seven centimeters.[9] Such a rise in sea level, although not of immediate concern to most nations, would be the single greatest national security issue for a nation such as the Maldives; in essence, such a sea level rise would mean the end of the Maldives (because the entire landmass would be under water).

A second example is equally striking. Because of rising temperatures—although no one precisely knows how high, at what rate, and how much the levels will fluctuate—Canada faces a unique conundrum. Sometime over the next fifteen years, the Northwest Passage—which Canada claims as territorial waters—may become navigable. As such, a navigable Northwest passage (which would cut the journey from Europe to Asia by 4,500 nautical miles, in comparison with transiting the Panama Canal) could lead to a rise in illicit crime, human-trafficking, drug-smuggling, pollution of the fragile Arctic ecosystem, human disasters at sea, and violations of Canadian sovereign territory.[10]

Given the amount of study that has been devoted to such vulnerability-based security issues, there has been far less attention given to the potential strategic responses. The time, perhaps, for study has passed and the time for action, implementation, and preparatory response may well have arrived. Daniel Esty phrases this dynamic well in describing how the notion of sustainable development is rapidly becoming a "buzzword largely devoid of content" and that new methods and ideas for action need, quickly, to be set in place:

> [The] world needs concrete pollution control and natural-resource management initiatives—for starters, a better global environmental regime, improved data and performance measurement and dissemination of environmental best practices, and a beyond-Kyoto climate change strategy. . . . The time for grand vision and flowery rhetoric has passed. The challenges ahead require sharper focus, real commitment, and concrete actions. [11]

To be clear: avoiding disastrous long-term impacts of creeping vulnerabilities (which can evolve with marginal and cumulative increases over decades) requires strategic planning, strategic investment, and strategic attention. To date, states and international institutions seem woefully unprepared for such strategic necessities. Moreover, environmental and human security, since they are contentious issues, often fall victim to the *do nothing* response because of

their vulnerability-based conditions in which the clearly identifiable cause and the desired prevented effect are often ambiguous.

In essence, we have moved from the dynamic of the traditional *security dilemma* to encompass issues in the twenty-first century that will include as well a new *human dilemma* in specific geographic locations that require sustainable development and long-term investment strategies. Clearly, we argue, the impact of climate change is one that involves "creeping" vulnerability. Moreover, if left unchecked over time, climate change will directly threaten human security in specific locales.

A Scenario Involving Climate Change and Human Security

In February 2004, the Department of Defense released *An Abrupt Climate Change Scenario and Its Implications for United States National Security.*[12] Written by Peter Schwartz and Doug Randall of consulting firm Global Business Network, the study outlined a possible future with climatic conditions similar to those 8200 years ago and speculated on implications related to the subsequent availability of food, water, and energy. As a result of media coverage about the report, which notably included misconceptions about the study's intents, the document may have become too politically controversial for defense planners to engage at the time As Schwartz explained in a radio interview, the project's publicity, which notably included misconceptions about its intents, may have rendered the document too politically controversial for government defense planners to engage at the present time.[13] Perhaps reflecting this possibility, *The New York Times* reported that the scenario had neither been sent up the military chain of command nor circulated to high ranking officials in the Bush administration.[14]

Regardless of the document's status within the Pentagon, it is of interest to many who are actively involved in discussions about the future. Broadly, as with any scenario-based undertaking, there are questions about how the vision of the future has been crafted and, subsequently, how it may best be used to inform a decision-making process. More narrowly, this particular scenario is also significant for on-going debates about the role of environmental factors in matters of national security.

The Pentagon study itself the study was initiated by Andrew Marshall, Director of DoD's Office of Net Assessment (ONA). After reading the National Academy of Sciences report *Abrupt Climate Change: Inevitable Surprises*,[15] Marshall asked Peter Schwartz and colleagues at GBN to develop a scenario for the Pentagon's consideration. Schwartz is well known among the ranks of scenario consultants and has written or co-written several books including *Inevitable Surprises*, *The Long Boom*, and the often cited *The Art of the Long View*.[16] He (like Pierre Wack) was once a member of the highly regarded strategic planning group at Royal Dutch/Shell and he has done work for organizations as diverse as the Central Intelligence Agency and the media company Dreamworks SKG. The twenty-two page report to ONA was dated October 2003 and became widely available to the public through the Environmental Media Service (EMS) website the following February.[17]

Schwartz and Randall give caveats throughout the report which should be emphasized with any reading of it, especially given the misperceptions that were conveyed in some of the mainstream press offerings. First, their intention was to dramatize the impact of climate change and discuss its strategic implications, not to predict when or how such change would occur. Secondly, the climatic conditions of the scenario were developed in consultation with several climate change experts and were based on a past sequence of events for which there is paleontological evidence. Thirdly, while the historic record supports the position that the climatic conditions of the scenario are not implausible, the assumptions about precisely

which parts of the globe are likely to be colder, drier, and windier cannot be confirmed on the basis of current climate models. Further, the scientists who were consulted for this project caution that these conditions are not the most likely to occur, that the magnitude of the change may be 'considerably smaller,' and that the impacts of such change may be limited to a few regions. Perhaps above all, the authors note that this scenario represents a low probability, but high impact future. In brief, the scenario describes a future in which the gradual rising temperatures that have been experienced since in the middle of the twentieth century continue through 2010. Worldwide, temperatures increase by 0.5° Fahrenheit (F) in the first decade of the twenty-first century and by as much as 2° F in some places.

Within this provocative scenario, weather patterns also become more erratic, floods become more common in mountainous regions, and droughts occur in coastal and inland agricultural areas. Importantly, the increasing temperatures contribute to a positive feedback loop in the global climatic system, which accelerates the rate of warming. As a result, weather patterns become even more severe and less predictable with the passage of time. Before the decade ends, rising seas and more intense storm surges render some coastal cities such as The Hague unlivable. The Greenland ice sheet shrinks, as amount of snow that falls over it is less than the amount of glacial melt sent into the Atlantic. Overall, there is increased freshwater runoff in the high latitude areas. By 2010, the freshening of the Atlantic from this runoff so alters the density of the seawater that the oceans' thermohaline circulation slows and the Gulf Stream, which had brought warm water and air to Northern Europe, shifts southward. (The thermohaline circulation is caused by differences in the temperature and salinity of sea water.)

Between 2010 and 2020, climatic conditions worsen. Growing seasons are reduced by 10–25% and farmers must adapt to manage different pests that come with the new conditions. Fish migrate with shifting ocean temperatures and affect commercial fishing activities, which are tied to location-specific rights. In Europe, average temperatures drop by 6° F. Northwestern Europe becomes much colder, drier, and windier and comparable to present day Siberia. Southern Europe faces intermittent cooling and rapid temperature shifts. Throughout Europe, drought and soil loss contribute to food shortages. On the other side of the Atlantic, average temperatures in North America drop by up to 5° F and windier, drier conditions reduce food production. The southern states become much drier and coastal areas are threatened by rising ocean levels. In Asia, China faces widespread famine amid rising average temperatures and greater uncertainty about the timing and extent of the once predictable monsoon rains. Additionally, long, cold winters and hot summers stress energy and water supplies. Bangladesh suffers from persistent typhoons and rising sea levels which make much of the nation nearly uninhabitable. East Africa suffers, in small part, from higher temperatures and drought and, in large part, by food shortages.

The authors note that anticipating the effects of the thermohaline circulation slowing in the Southern Hemisphere is (even) more uncertain because of a lack of paleoclimatic data. Thus, they offer two alternatives. One possibility is that areas below the equator also become colder and drier as the thermodynamic systems move toward a global balance. The other possibility is that the Southern Hemisphere could become much warmer and wetter since the ocean currents would no longer transport heat toward the north.

In response to these environmental changes, countries will adopt either a defensive or offensive strategy. Nations with rich and diverse natural resources, such as the United States (US) and Australia, will become defensive by securing their borders and taking steps toward greater self-sufficiency. The US will turn back starving people from the Caribbean, Mexico, and South America. Its energy needs will be met, in part, with continued Middle East con-

tacts, and, in part, through more expensive alternative energy supplies including nuclear, renewables, and hydrogen. As part of its inward turn, the United States backs out of the 1944 treaty with Mexico which guarantees flow from the Colorado River to the Gulf of California.

Other countries whose needs exceed their available resources adopt offensive strategies. Access to water for drinking, irrigation, and transportation will be a particular source of conflict around the world. As such, rivers and lakes may be the sites of future skirmishes. The means of waging war may also become more deadly as nuclear proliferation accelerates following the depletion of hydrocarbon fuels and the rising importance of nuclear power. Internal stability could also be weakened by the lack of or access to resources. Nations which currently have difficulty maintaining order over diverse populations will be particularly vulnerable to such conditions.

Given these circumstances and postures, the scenario outlines political and military conflicts that could take place between 2010 and 2030. In Europe, Scandinavian populations push southward and the European Union (EU) pushes them back. As climatic conditions worsen, people from northern EU nations move to southern EU nations. Russia joins the EU relieving energy concerns, but conflicts among member nations over food and water supplies develop. By the end of the time period, the EU nears collapse while an increasing number of Europeans move to Mediterranean African countries. In Asia, mass migration leads to internal pressures and to skirmishes along the borders of Bangladesh, India, and China. Southeast Asia suffers from persistent conflict and Japan, in response to regional instability, develops force projection capability. Between 2015 and 2020, Japan and Russia form a strategic agreement to develop energy resources, while China sends troops to protect pipelines in Kazakhstan. By 2030, there are increased tensions between Japan and China, which is now suffering from internal disorder, over Russian energy supplies. For the United States, disagreements with Canada and Mexico over water escalate, as do conflicts with European nations over fishing rights. Refugee flows from Mexico, the Caribbean, and Europe are so significant that by 2020, border control is turned over to the U.S. Department of Defense. The US also forges an integrated security alliance with its northern and southern neighbors. The nation's oil supplies are threatened by conflicts in the Middle East and, eventually, U.S. and Chinese naval forces come into direct confrontation as the result of internal instability in Saudi Arabia.

Interpreting this Scenario and Its Potential Uses for Thinking about Security

Because the future has not yet happened, it offers us no facts. Instead, we have only assumptions about what could occur at some later date. And as such, scenarios should be understood as sets of assumptions. The kinds of assumptions that go into a given scenario are often varied and include details about who will exist in the future, where they will operate, what resources they will have, and how they will behave. As is the case when looking at historical data, scenario assumptions are also open to concerns about the precision of representation. Here, the "granularity" of the decisions will drive the kinds of assumptions that are needed. For example, a scenario on global food supply might represent arable land in hundred-million of hectares, but a scenario on Kenyan food supply might require a figure in thousands of hectares.

When creating scenarios relating to the interaction of societies and the environment, it can be also analytically useful to distinguish between *events* and *actions*. Events are those happenings that occur as a result of natural forces. In describing the logic of events, we look to causes that are rooted in an understanding of the physical and biological sciences. In a strict

sense, the logic of events is described by *explanations*. *Actions* are those happenings that occur as a result of an effort by a human agent or group of agents. In describing the logic of actions, we look to rationales that are rooted in history and the social sciences (and sometimes in common sense). Again in a strict sense, the logic of actions is described by *reasons*.

This distinction between events and actions is analytically useful—if not imperative—given the "political nature" of decisions relating to the environment when both natural processes and human actions are at play. The specific concern concerns related to climate are particularly problematic. As revealed by paleoclimatic evidence, the earth has gone through several warming and cooling cycles which have progressed independent of human activities. Several factors which may contribute to these cycles are *events*. These include variations of the earth's axis of rotation or its solar orbit and the partial blockage of sunlight by volcanic ash erupted into the atmosphere. However, some scientists point to evidence that over the last century global warming has been at least partially influenced by actions, by green house gas emissions associated with the use of fossil fuels and through land use changes related to deforestation, desertification, and the construction of urban environments.[18] There is stronger evidence that over the last fifty years, human activity has been the dominant influence on climate change.[19]

This lack of a consensus about the science of climate change has had implications on policy debate regarding how actions might be or should be tempered to address future societal needs. One study of expert judgments found almost no agreement about the effect of climate change on policy-relevant factors such as changes in precipitation over land and various forms of inter-annual variability.[20] Even if there were such agreement, it is not clear that findings would or could be readily applied by decision makers**.** Here is a possible example of the misalignment between precision of the scenario assumptions and the precision of decision-making data. Another study found that the language used by experts to describe and assess the uncertainties of climate change is different that that of lay readers. As a result, non-experts, which include most members of the public and many policy makers, may under-estimate the probability of high-magnitude possible outcomes.[21]

The empirical, methodological, and practical limits of climate change knowledge present difficulties for the scenarioist who is trying to evoke an image of a future which will be salient to decision makers. If a specific model of climate change is used—say, one which is based on some set of human activities as the driving force—then the scenario as a whole may be dismissed as irrelevant by those who disagree with that model. Offering multiple models of change that lead to the same future may simply confuse the reader or prompt a conclusion that competing models signify a lack of any clear understanding of the system. Again, the scenario, as a whole, might be relegated to the nearest recycling bin. However, regardless of the mechanisms that could lead to abrupt climate change, it is still the case that the consequences of such a change would be significant. As such, they (still) warrant consideration so that society might be better prepared to meet the challenges of that tomorrow.

Schwartz and Randall's scenario can be divided into two large parts. The first describes the physical changes of the earth, and the second subsequent actions by various actors (primarily nation states). Beginning to make sense of the physical changes, and as noted earlier, one of the caveats for the report is that Schwartz and Randall do not attempt to describe how climate change will occur; instead, they simply speculate that the globe continues to gradually warm until the abrupt transformation. By leaving the reader to speculate why the warming trend continues, the authors sidestep the potential problem that comes with problematic or ambiguous models of change (i.e. a result of some natural event such as a change in the earth's axis or a result of a century of industrial green house gas emissions). Those fa-

miliar with the sometimes caustic debate on climate change in the US might warily suspect that by not explicitly citing human action as a significant factor of climate change, the authors are playing their tune for global warming skeptics in the current administration. But separate from any partisan distrust and above political cynicism, leaving the details of the warming trend to the reader may serve a pragmatic purpose by helping to direct the reader's attention to the possible consequences of change and thereby get on with the challenging task of grasping how society may be affected.

There are, however, two potential concerns that come with such an unelaborated leap into the future. First, just as with the perception of an incorrect or ambiguous explanation for change, an incomplete explanation may undermine the scenario's acceptance and thereby its usefulness. However, this concern is arguably mitigated by the record of the historic conditions on which the scenario is patterned. The 1991 National Research Council study on abrupt climate change, which is said to have precipitated ONA's interest, noted: "Because so many Holocene climate records are available and the cause of the event [8200 years ago] is rather clear, it provides an opportunity for an especially well-documented test case of model sensitivity. The event is also important because it punctuated a time when temperatures were similar to or even slightly above recent levels, demonstrating that warmth is no guarantee of climate stability."[22] Hence, although not notably emphasized in the report, knowledge of the climatic conditions 8200 years ago is relatively good and is (at least partially) analogous to our own time. And while this knowledge is incomplete, it may provide the best starting point to begin to speculate on future conditions following abrupt climate change. That is, particular to climate change, this scenario-as-event can be reasonably well supported, even if a consensus explanation cannot be had.

The second concern may be more problematic. What if the changes occur as described and what if it is proven (or at least largely believed) that rapid climate change was the result of anthropogenic actions? Would the United States feel a sense of responsibility to aid and assist nations that were not responsible (or less responsible) for contributing to the new and difficult conditions of the world? If so, could it really isolate itself? Would other nation's hold the U.S. largely responsible and would such a perception negatively influence America's ability to lead global initiatives writ large? Library shelves are filled with books on international relations that document how "history matters" and failing to consider actions that might lead to climate change could be shortsighted. That noted, here it must be emphasized that no scenario is complete, and indeed some omissions (even if unintended by the scenario writer) may prompt decision makers to stretch their own imaginations by filling-in the missing information. As such, not considering possible influence of anthropogenic actions on climate change in his scenario does not, in and of itself, render the scenario ineffective. However, the point does warrant consideration.

The second part of Schwartz and Randall's scenario raises other concerns. In the new climatic conditions, there will be decreased agricultural production and this situation will cause stress to societies. The authors assert, "Ever time there is a choice between starving and raiding, humans raid."[23] However, this is not necessarily the case. Steven A. LeBlanc, an anthropologist, who is mentioned in the scenario, writes elsewhere of the need to differentiate between kinds of societies.

> High levels of conflict are observed among most chiefdoms, but warfare among states actually is less intense and less and less demographically relevant than for foragers and tribes. There are a number of explanations for this phenomenon, but one is simply that people living in states will starve before they fight because the government won't allow them to fight. Moreover, such great crises as famines and

> other disasters knock the state's population back down to a sustainable level, so the problem is periodically—though only temporarily—solved.[24]

The possibility that a state would willingly allow its own to suffer and die, while certainly unnerving, is notable because it removes any rationalization that warfare is environmentally determined, even if it is, as LeBlanc argues, ecologically motivated. That is, going to war is an "action," not an "event." Furthermore, this observation introduces the consideration that state-level decisions can be based on a variety of competing concerns. And because there are trade-offs, additional details are needed to assess the rationale for any actions that may be taken.

The difficulty in making sense of the actions in this second part of the scenario is perhaps most evident in what may be the most specific decision mentioned in the text: The United States' backing out of the 1944 treaty with Mexico that guarantees water flow from the Colorado River. Given the "defensive" strategic posture of the U.S., maintaining all available fresh water seems reasonable. However, one might question whether or not this decision makes sense given the ecological consequences to Gulf of Mexico. Would contributing to possible internal resource problems for Mexico (and thereby possible refugee problems for the United States) be in this nation's best interest? Further, the scenario notes the interconnectedness of the U.S. economy with that of Mexico. Would backing out of this treaty impact trade relations with Mexico, and if so would there be a loss of economic security to either or both countries? Given the rapid climate change conditions described, the decision to withhold the water might indeed be a viable option for the U.S. but more assumptions need to be explicitly stated to establish the calculus that would allow a decision maker to balance internal vulnerabilities with external threats.

Alternative Scenario Approaches: Mindsets and Human Impact

> *"Our scientific ability to predict environmental consequences from anthropogenic-induced change is somewhere behind our ability to predict the weather next week."*
>
> W. C. King
> *Understanding Environmental Security: A Military Perspective*[25]

Scenarios, although acknowledged as useful tools for considering alternatives, are perhaps not well understood in how alternative methodological approaches used in creating them can also prove significant. One possible reason for this mis-perception—or conflicting understanding—is that those who practice scenarios often don't agree on the factors most critical to presenting coherent, plausible narrative scenarios.

Pierre Wack and Peter Schwartz, both former colleagues at Royal Dutch Shell in the 1970s, illustrate some of the more well known alternate approaches to scenarios. Schwartz, the more prescriptive of the two, insists on identifying and dissecting three discriminating factors that the lie at heart of "understanding" the scenario process; he names these exploration factors *driving forces, predetermined elements,* and *critical uncertainties.* Wack, by contrast, advocates a looser structure to scenario construction and refuses to give overly precise definitions to discrete aspects, or elements, of the story line. This refusal to identify or separate specific aspects of the story suggests that it could be dangerous, even trivial, to reduce a coherent, plausible narrative to bare bones. Instead of looking only at the skeleton, we must also exam-

ine the flesh and blood of the story line in its integral wholeness. As such, the scenario reader (and scenario writer) open themselves the complex interdependence among elements of a story and de-emphasize focusing on specific definitions.

At their best, scenarios provide *alternative projections* and possibilities for the future. To quote Wack's again, "Scenarios serve two purposes. The first is protective—anticipating and understanding risk. The second is entrepreneurial—discovering strategic options of which one was previously unaware."[26] Creating and understanding scenarios aids better recognition of plausible—and sometimes implausible—outcomes. Ideally, they allow one to act on and better plan for potential outcomes in advance.

In the 1980s, for example, few in the business of assessing the long-term global security environment forecasted the demise of the Soviet Union. (Those who did were almost always ridiculed within their organizations.) Most conducting assessments and research saw the Cold War trends of the previous four decades as continuing indefinitely. Beginning with the fall of the Berlin Wall in 1989, and later with the Soviet Union's collapse, the U.S. defense establishment found itself in a significant force drawdown and witnessed the cancellation of countless billions of dollars of planned purchases.

Equally, though many strategic assessments at the beginning of the twenty-first century focused on American vulnerabilities and the potential danger of "asymmetric" warfare, these assessments seriously underestimated the damage that dedicated terrorists could inflict on the United States ("9/11"), and the world. Scenarios that were designed, in others, were self-fulfilling—or, more appropriately, self-justifying—particularly in terms of defense budget and resource allocations.

Often, and probably naturally, decision makers prefer the illusion of certainty to understanding risk and realities. But the scenario "builder" and analyst should, at best, strive to shatter the decision maker's confidence in his or her ability to look ahead with certainty at the future. Scenarios should allow a decision maker to say, "I am prepared for whatever happens," because we have thought through complex choices with a knowledgeable sense of risk and reward.[27]

All too often, scenarios involving defense or foreign policy decisions—just as larger framings of security issues themselves—center almost exclusively on threat-based analysis. In defense panning scenarios, analysis is driven by assessments of current or postulated threats or enemy capabilities and determines only the amount and types of force needed to defeat an adversary. (Thus, recent defense "transformation" attempts within the U.S. Pentagon to develop capabilities-based planning largely seek to avoid the pitfalls and limits of threat-derived scenarios.)[28]

Scenarios that address climate change and human security, nonetheless, must look well beyond current evaluations of threats. Accomplishing this is a difficult but essential challenge, if decision makers are to come to any informed, perceptive conclusions for the future. In short, as regards our specific interest in climate change and its impact on human security, a focus away from "direct" threats and more towards creeping, long-term vulnerabilities seems necessary.

As regards climate change, how much do we know is natural (even cyclic) occurrence and how much is directly related to anthropogenic causes such as pollution, depletion of resources, environmental footprints? The answer remains unclear, yet the critical recognition, over recent history, is that events are accelerating rapidly and generally the impact on human security outcomes could prove lethal if nothing is done. Thus, scenarios provide an opportunity to reckon with alternative conditions. Within the previously discussed Schwartz and Randall assessment, for example, three conditions that previously existed in history were of-

fered as possible outcomes for rapid climate change and its resulting impact on security conditions. These potential scenarios were:

- **Extreme**: Return to the Younger Dryas, ending 9600 B.C. The Younger Dryas was the most significant rapid climate change event that occurred during the last deglaciation of the North Atlantic region. Although difficult to picture perhaps today, during this period icebergs were present south of Portugal, Greenland was 15ºC colder than today, increased dust from Asian desert was present in the atmosphere, and there was increased glaciation in mountainous altitudes throughout the globe. Prevailing theory suggests that a major reduction, and perhaps even a shutdown, of thermohaline circulation occurred due to fresh water flowing into the North Atlantic from deglaciation in North America.[29]

- **Feasible**: A return to the "Little Ice Age" which was characterized by hard winters, violent storms, and drought, such as occurred between 1300 and 1850 throughout Europe and the North Atlantic. Colder weather severely impacted agriculture, health, economics, social strife, emigration, and even art and literature. Increased glaciation and storms devastated those that lived near glaciers and the sea. Furthermore, as Mandia notes, the growing season changed by 15 to 20 percent between the warmest and coldest times of the millennium—directly impacting food production, especially crops highly adapted to use the full-season warm climatic periods. Climate changes directly impacted human security outcomes.[30]

Figures 1 and 2 show the price of wheat and rye, respectively, in European countries during the Little Ice Age.

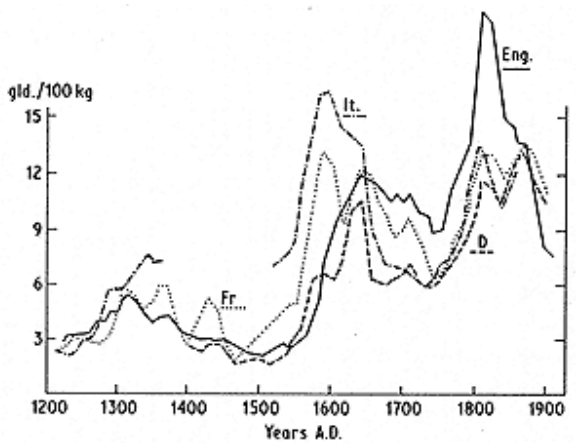


Figure 1: Prices of wheat in Dutch guilders per 100 kg. in various countries vs. time. (Source: Lamb, 1995)

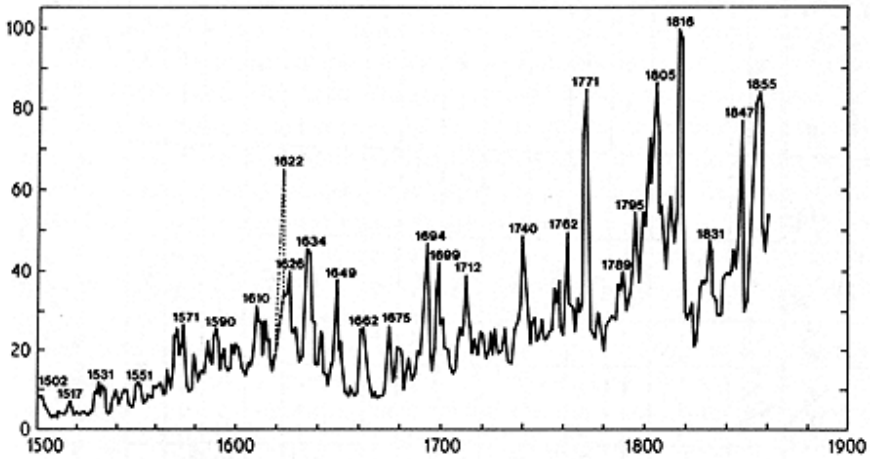


Figure 2: Price of rye in Germany vs. time expressed as an index.
(Source: Lamb, 1995)

Figure 3 offers a chronology of dearth and famine in Scotland during the Little Ice Age.

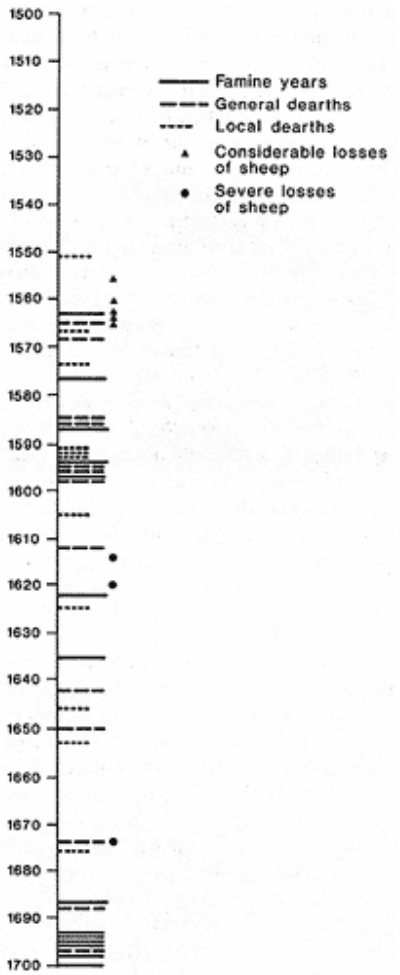


Figure 3: Dearth and famine in Scotland during the Little Ice Age.
(Source: Lamb, 1995)

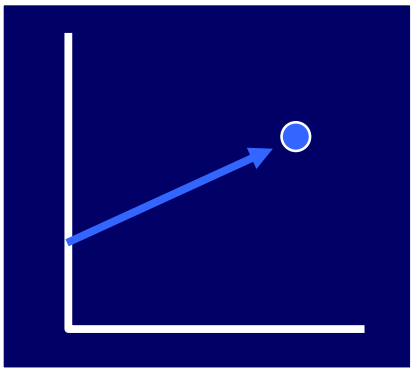
- **Reasonable:** Cold, dry, windy effects across much of Northern hemisphere—caused by "conveyor collapse" that occurred 8,200 years ago. Since a good bit of data exists regarding this event, much attention has equally focused on the possibility of the slowing of thermohaline circulation. Such circulation, nonetheless, is critical to environmental conditions; the United Kingdom, for example, though roughly similar latitude as Labrador, possesses a markedly different environment thanks to such circulation. The conveyor belt principle is relatively simple: As sea ice freezes, salt drains from the pores of the ice. Yet, owing to both evaporation and heat loss, water from the tropics becomes denser as it drifts towards the Artic and Greenland. Salty water, because it is more dense, sinks to the ocean floor. As a result, more warm water is drawn from the topics to the poles, moving heat and affecting human environmental conditions around the globe.[31]

While the scenarios in their own may indeed seem extreme as possible conditions leading to rapid climate change in our time, their value lies in the considerable debate their potential for human impact generated. Lamentably, much of that debate took place in the media; little practicable or practical policy action has taken place since the Pentagon released this scenario report.

Our purpose here, nonetheless, is far more than a consideration of how alternative scenarios are built. Rather, we are equally interested in the *mindsets*—the mental maps, as it were—of decision makers. While it may be a cliché it is also an evident certainty that how we view the world subtly but vitally determines how we act in it. All of must have "mental maps"; all of must recognize the constraints, however, that such mapping imposes on our own recognitions.

One of the more intriguing approaches to at least conceptually addressing strategic scenarios under uncertainty appeared in the *Harvard Business Review* in the late 1990s. Titled "Strategy Under Uncertainty," the essay addressed how executive decision makers might best address new forms of strategic change, while equally admitting that traditional strategic planning processes were unlikely to bear much fruit during times of significant shift.[32] Equally, the essay suggests, decision makers tend to view uncertainty with binary polarity: either predictions about the future are certain, or they are completely uncertain.[33] Risk-averse decision makers equally tend to do little in uncertain environments, choosing instead to defer to decision paralysis, to focus on re-engineering or program streamlining or cost-reduction efforts.[34]

While acknowledging that residual uncertainty will *always* exist, the three authors choose instead to consider four levels of uncertainty. In level 1, shown below, any form of residual uncertainty is not relevant to decisions necessary to be made. Just as, for example, in the Cold War, the "enemy" and military force composition was (supposedly) well known; the necessary adjustments and targeting mechanisms, along with the required military force structure, were *all* straight line projections. Graphically, this project would look:



A CLEAR ENOUGH FUTURE

- **A Single Forecast Precise Enough for Determining Strategy**

Essentially, a Level 1 "future" is a straight line projection. The future itself is clear enough; one need only apply the necessary resources to achieve a desired direction—or deflect an undesirable outcome. Level 1, in other words, is *not* uncertain at all.

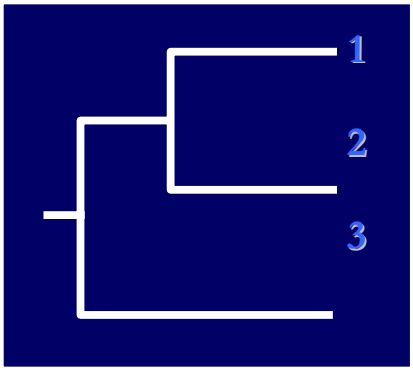
As regards climate change, and a single-mindedness regarding its "certainty," a prototypical example appeared in the Winter 2003 issue of the *Naval War College Review*:

> The fraction of carbon dioxide (CO_2) in the atmosphere has been slowly but steadily increasing since systematic observations began a century ago. Little concern was evident until the mid-1980s, when some researchers suggested that CO_2 would warm the atmosphere by absorbing infrared radiation emitted by the earth. Environmentalists soon joined on an international scale to clamor for stringent controls on the sources of CO_2. The result was the Kyoto Protocol . . .
>
> The protocol, which is both lengthy and complex, requires large reductions in CO_2 emissions. (The United States would have to reduce CO_2 emissions to a level 7 percent below that of 1990 by the years 2008 to 2012—this despite the steady growth of the U.S. population and the phase-out of nuclear power generation.) The "Third World," including the giants China and India, is exempt. Despite this exemption, Third World countries would, under the terms of the Protocol, accrue "credits" for emissions, which they could sell to the "First World." In other words, the protocol would become an instrument for transfer of wealth from nations such as the United States to Third World elites, a sort of international welfare scheme under a misleading name.
>
> Carbon dioxide molecules can warm the atmosphere through changes ("excitation") in their vibrational and rotational properties. (For CO_2, such excitation occurs in the infrared part of the electromagnetic spectrum, in which the earth is an efficient emitter. Heating of the atmosphere occurs by transfer of energy from CO_2 to air molecules via molecular collisions.) This compound is not the only atmospheric greenhouse gas, for several others, such as nitrous oxide (N_2O) and methane (CH_4), are also covered by the Kyoto Protocol. However, water vapor, which cycles through the atmosphere in about a week via evaporation from oceans, lakes, and rivers followed by condensation and precipitation, is far and away the most important greenhouse gas, because it is plentiful in the atmosphere and it strongly absorbs infrared radiation emitted by the earth. Absence from the atmosphere of water vapor would make the entire earth like the Sahara Desert—or, to state it more dramatically, like Mars. In contrast, CO_2, with a cycle duration of, according to recent analysis, thirty to fifty years, is much less plentiful and absorbs infrared radiation more weakly than does water vapor. The major removal mechanisms for CO_2 are absorption by vegetation and the oceans. . . .
>
> We know from geologic records, tree rings, and human records that the mean temperature of the atmosphere has varied markedly during the past million years. The most glaring aspect

> of the record is the series of glacial periods, at least partially associated with the earth's orbital characteristics, which last on average about ninety thousand years, with "interglacial" periods of about eleven thousand years. A more recent feature of the record is the "little Ice Age," which lasted from the end of the fourteenth century until about 1850, when began a gradual temperature rise that essentially ended in 1940. This period, which was characterized by low agricultural productivity and frequent famines, may have been due in part to reduced energy output by the sun; sunspot activity was abnormally low during much of the period of low temperature.
>
> The rise in mean atmospheric temperature during this century is often cited as evidence of the warming effect of CO_2. Those who cite this "evidence" fail, however, to mention that nearly all of the warming occurred before 1940, as the earth recovered from the "little Ice Age."
>
> What of the most recent record? Atmospheric temperature measurements are routinely made at airports, in urban areas, at sea . . . They are also made by balloon-borne radiosondes and (since 1978) by satellites. While the surface measurements do show a small temperature rise (about 0.6° F since 1980), they are contaminated by the so-called "urban heat island" effect. Urban areas and airports have been emitting greater and greater amounts of heat energy as a result of growing human activity that has nothing to do with the greenhouse effect. Corrections applied to the surface data are unreliable, because a large degree of estimation is involved.
>
> Balloon-borne radiosonde and satellite measurements of the temperature of the "free atmosphere" (i.e., at heights that would capture any heating caused by CO_2) are far more reliable. Although the records are characterized by a wild oscillation, one can compute a trend line using standard spreadsheet methods. The observed temperature change decreases slightly with time for the balloon data and is essentially zero for the satellite measurements. The National Academy of Sciences has recognized the conflict between satellite and surface temperature measurements as a major problem with no known explanation.
>
> U.S. energy consumption in 2000 was more than 10 percent larger than in 1990. Thus a 7 percent decrease from 1990 consumption would really mean either a 15 to 20 percent drop below 2000 levels or a very substantial increase in tax rates to purchase "credits" from Third World countries. Despite claims by treaty proponents to the contrary, such a reduction in use would have severe economic consequences, because of the strong dependence of our economy on energy. William Nordhaus of Yale University has calculated the cost to the world economy of "stabilizing" the climate to be $12.5 trillion (1989 dollars). Since the United States consumes about 25 percent of the world's fossil fuels, the cost to this nation would be in excess of three trillion dollars, an enormous stress to place on its economy. The national defense would also suffer, because of the enormous fuel requirements for training the armed forces, not to mention those for combat, as in Afghanistan. All this when there is *no credible evidence* for global warming due to carbon dioxide emissions.[35]

On the surface, at least, this does appear to be quite an impressive argument. The one (perhaps myopic) claim that we are on a straight-line projection, and should not divert resources for strategic benefits, because of faulty scientific measurement of carbon dioxide emissions fails to recognize a fairly significant alternative proof, nonetheless. Ice core from Antarctica effectively trace back more than four glacial cycles. Since gas samples themselves become trapped within the core as tiny bubbles, scientists have been able to demonstrate that carbon dioxide levels are far higher than at any time during the last four hundred and twenty thousand years. Equally, roughly half the temperature variance between cold and warm periods can be linked to changes in the concentration of greenhouse gases.[36] Arguably, the mindset of Level 1 regarding climate change and human security impact is anything *but* a certain, straight-line project.

In Level 2 uncertainly, decision makers enter a pathways of "branches and sequels," which the authors term "Alternative Futures." Although no clear outcome is certain, scenario analysis may help determine both outcome probabilities and outcome damage.



ALTERNATIVE FUTURES

- **A Few Discrete Outcomes that Define the Future**

Although not clearly addressed in the essay, Level 2 uncertainty may help decision makers acknowledge and better deal with risk—especially in light of our minimalist definition of risk as *the ability to expose oneself to damage during the process of change and the resilience to be able to sustain oneself during such change.* Although pathways and outcomes are more sophisticated than in Level 1, there are still some manageable "shaping" mechanisms that can be applied to deal with outcomes.

There are clear advantages, nonetheless, of simply connecting the logical standard, "If A leads to B, what mitigating responses—whether "C" or iterative response of "C, D, E . . ."—might best address Level 2 uncertainty. A powerful example of this response is found in the monograph, *The Death of Environmentalism: Global Warming Politics in a Post-Environmental World.* Although the tract itself is clearly meant as a polemic, the authors argue (with some justification) that environmentalists have *reverted* to Level 1 analysis by too narrowly focusing on constitutes "environmental policymaking":

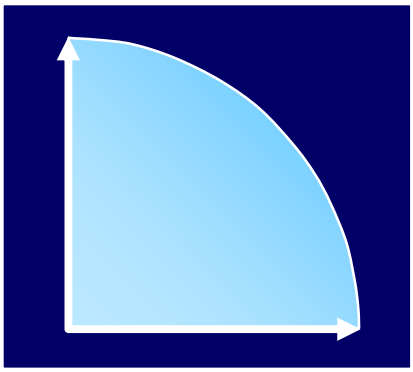
> . . . [I]n their public campaigns, not one of America's environmental leaders is articulating a vision of the future commensurate with the magnitude of the crisis. Instead they are promoting technical policy fixes like pollution controls and higher vehicle mileage standards — proposals that provide neither the popular inspiration nor the political alliances the community needs to deal with the problem.
>
> By failing to question their most basic assumptions about the problem and the solution, environmental leaders are like generals fighting the last war – in particular the war they fought and won for basic environmental protections more than 30 years ago. It was then that the community's political strategy became defined around using science to define the problem as "environmental" and crafting technical policy proposals as solutions.
>
> The greatest achievements to reduce global warming are today happening in Europe. Britain has agreed to cut carbon emissions by 60 percent over 50 years, Holland by 80 percent in 40 years, and Germany by 50 percent in 50 years. Russia [ratified] Kyoto. And even China – which is seen fearfully for the amount of dirty coal it intends to burn – recently established fuel economy standards for its cars and trucks that are much tougher than ours in the US.[37]

The authors, nonetheless, offer reasonable Level 2 outcome actions and policy responses, even as they suggest that such basic strategic planning has failed to take place:

> What do we worry about when we worry about global warming? Is it the refugee crisis that will be caused when Caribbean nations are flooded? If so, shouldn't our focus be on building bigger sea walls and disaster preparedness?
>
> Is it the food shortages that will result from reduced agricultural production? If so, shouldn't our focus be on increasing food production?
>
> Is it the potential collapse of the Gulf Stream, which could freeze upper North America and northern Europe and trigger, as a recent Pentagon scenario suggests, world war?
>
> Most environmental leaders would scoff at such framings of the problem and retort, "Disaster preparedness is not an environmental problem." It is a hallmark of environmental rationality to believe that we environmentalists search for "root causes" not "symptoms." What, then, is the cause of global warming?
>
> For most within the environmental community, the answer is easy: too much carbon in the atmosphere. Framed this way, the solution is logical: we need to pass legislation that reduces carbon emissions. But what are the obstacles to removing carbon from the atmosphere?
>
> Consider what would happen if we identified the obstacles as:
>
> - The radical right's control of all three branches of the US government.
> - Trade policies that undermine environmental protections.
> - Our failure to articulate an inspiring and positive vision.
> - Overpopulation.
> - The influence of money in American politics.
> - Our inability to craft legislative proposals that shape the debate around core American values.
> - Poverty.
> - Old assumptions about what the problem is and what it isn't.
>
> The point here is not just that global warming has many causes but also that the solutions we dream up depend on how we structure the problem.
>
> The environmental movement's failure to craft inspiring and powerful proposals to deal with global warming is directly related to the movement's reductive logic about the supposedly root causes (e.g., "too much carbon in the atmosphere") of any given environmental problem. The problem is that once you identify something as the root cause, you have little reason to look for even deeper causes or connections with other root causes.[38]

While their individual points may indeed be debatable, Shellenberger and Nordhaus do emphasize that dealing with the sequential and logical outcomes of events is essential in recognizing scenario potential and acting on valid, effective outcomes.

Level 3 uncertainty—and the shaping mechanisms necessary to respond to such uncertainty—require more nuance, more flexibility, and more adaptive postures. Rather than being able to "shape" the influencing agent (in our case, climate change) to lessen or mitigate outcomes (human security), decision makers care able, at best, to only identify a range of possible outcomes.[39]



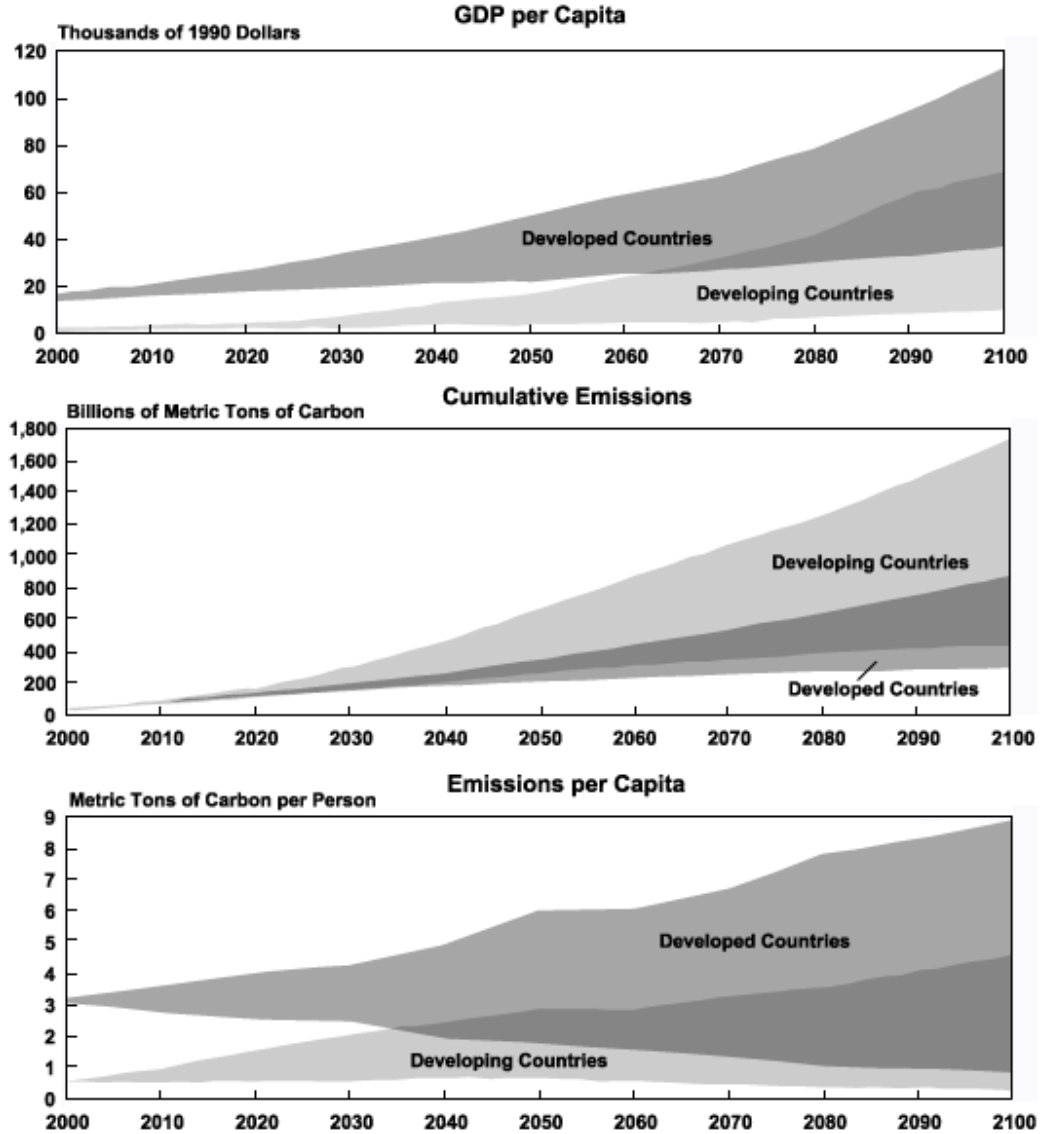
A RANGE OF FUTURES

- **A Range of Possible Outcomes, But No Natural Scenarios**

One example of an attempt to suggest the Level 3 "range" impact of climate change and its concomitant effect on a specific human security factor (economic impact) was published by the Congressional Budget Office in 2003. The report, titled *The Economics of Climate Change: A Primer*, effectively and repeatedly deals with how uncertainty involves a "range of futures" Two powerful examples of this range include:

Figure 4.

Range of Uncertainty in Economic and Carbon Dioxide Emissions Projections



Source: Congressional Budget Office based on Nebojša Nakićenović and Rob Swart, eds., *Emission Scenarios* (Cambridge, U.K.: Cambridge University Press, 2000).

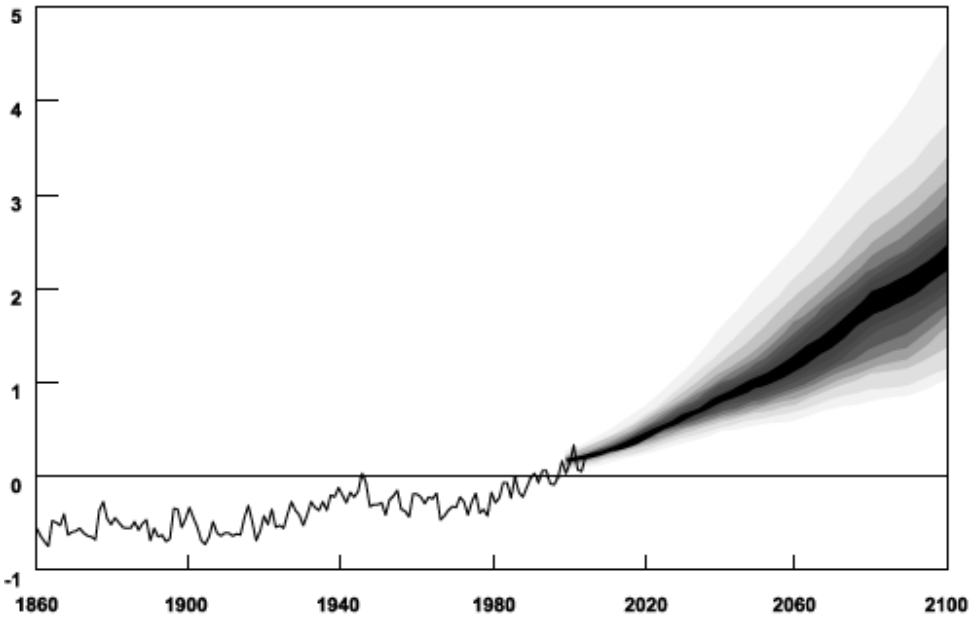
Note: All emissions are from fossil fuels.

as well as addressing the uncertainty of future predictions regarding climate change outcomes:

Figure 5.

Historical and Projected Climate Change

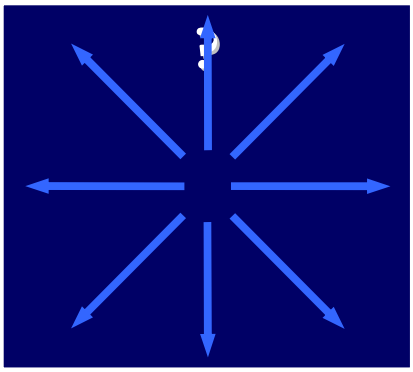
(Average Global Temperature (C) Relative to 1986-1995 Average)



Source: Congressional Budget Office. Historical data are from the Hadley Centre for Climate Prediction and Research, available at www.met-office.gov.uk/research/hadleycentre/CR_data/Annual/land+sst_web.txt and described primarily in C. K. Folland and others, "Global Temperature Change and Its Uncertainties Since 1861," *Geophysical Research Letters*, vol. 28 (July 1, 2001), pp. 2621-2624. The projection is based on data provided by Mort Webster, University of North Carolina at Chapel Hill, in a personal communication, December 11, 2002; the results are discussed in Mort Webster and others, *Uncertainty Analysis of Climate Change and Policy Response*, Report no. 95 (Cambridge, Mass.: Massachusetts Institute of Technology Joint Program on the Science and Policy of Global Change, December 2002).

Note: The projection, which is interpolated from decadal averages beginning in 1995, shows the possible distribution of changes in average global temperature as a result of human influence, relative to the 1986-1995 average and given current understanding of the climate. Under the Webster study's assumptions, the probability is 10 percent that the actual global temperature will fall in the darkest area and 90 percent that it will fall within the whole shaded area. However, actual temperatures could be affected by factors that were not addressed in the study (such as volcanic activity and the variability of solar radiation) and whose effects are not included in the figure.

The benefit of such Level 3 uncertainty and its usefulness in scenarios is that decision makers recognize the interconnectedness of often complex dynamics and the necessity to think in creative ways and to act through *inter*-dependent means. The necessity for international protocols, the role of international institutions, and even the influence of private citizens and multinational businesses take on new importance in addressing a common challenge.



TRUE AMBIGUITY

- **No Basis to Forecast the Future**

Level 4 uncertainty is the most challenging—and most serious basis for a scenario analysis to occur. Although Courtney, Kirkland and Vaguer insist that level 4 situations are quite rare—and occur often after major technological, macroeconomic, or legislative shock—there can be benefit for those who attempt to shape outcomes so that they can become more recognizable—and approachable—as problems at levels 3 or 2 of uncertainty. Arguably, the authors display perhaps too much optimism in suggesting that level 4 scenario situations are transitional.[40] Moreover—particularly apt in considering scenario relevance to climate change and human security—the authors fail to ever consider the consequence or response necessary in situations where level 4 uncertainty becomes *permanent.*

"Global warming is routinely described as a matter of scientific debate—a theory whose validity has yet to be demonstrated"—this characterization, or some form of it, constitutes much of the approach taken by the Bush administration (both father and son).[41] This strikes one as a particularly odd response to long-term, and encroaching, potential vulnerability. Rather, such a characterization is more illustrative of the *do nothing* response, which is the most dangerous response to level 4 uncertainty.

As regards climate change, level 4 uncertainty may be more prevalent as a feasible scenario condition than might seem immediately evident. Global warming, for example, is not simply a concept that emerged in the last few decades. To the contrary, as early as 1859 the physicist John Tyndall, experimenting with what was the first ratio spectrometer, intended to study to the heat-trapping properties of gases. Tyndall soon discovered that gases such as oxygen and nitrogen were "transparent" to visible and infrared radiation; by contrast, carbon dioxide, methane, and water vapor were not. From this discovery, Tyndall suggested that these "nontransparent" gases were largely responsible for the earth's climate—a phenomenon we today might know better as the natural "greenhouse effect." In 1894, the chemist Svante Arrhenius, convinced that humans were influencing the earth's energy balance, posited what the earth would be like if more greenhouses gases were present in the atmosphere—inducing what is termed the "enhanced" greenhouse effect. After a series of extensive calculations, Arrhenius posited that if greenhouse-gas levels increase (with all factors equal), the earth's temperature would rise. Scientists, nonetheless, continued to believe for several decades after these calculations that it was unclear how human-caused (anthropogenic) carbon dioxide increase would impact the environment—or even if humans were capable of affecting carbon dioxide levels.[42]

Arrhenius himself predicted that it would take three thousand years of coal burning to double the CO_2 levels in the atmosphere.[43] (Notably, more than 50 percent of electricity en-

ergy generated in the United States comes through coal production.[44]) We know that Arrhenius, despite the rigor of calculations that took fourteen hour days and nearly a year to complete, illustrated level 4 uncertainty by erring in his prediction of carbon dioxide doubling levels by *twenty-eight centuries*.

Ironically, we live in an age not far removed from a time when we lived in constant level 4 uncertainty. Although the phrase "The Cold War is over" is now no longer the constant refrain as it was in the early 1990s, few seem to remember that the uncertainty we lived with in those times, and the strategic policy actions taken, were made in response to an outcome which had never occurred (thermonuclear war). It might prove worthwhile to recall some of the thoughts and ideas from who attempted to address such "true ambiguity." One of the most powerful precepts to address such uncertainty as climate change is taken from Günther Anders's powerful essay, "These for the Atomic Age." One of the most powerful precepts he writes about in the "Atomic Age"—analogous to potential severe outcomes in the "Climate Age"—articulates *The Courage to Fear:*

> As a matter of fact, nothing is more deceitful than to say, "We live in the Age of Anxiety anyway." This slogan is not a statement but a tool to prevent us from becoming really afraid, of those who are afraid that once we may produce the fear commensurate to the magnitude of the real danger. On the contrary, we are living in the Age of the Inability to Fear. Our imperative: "Expand the capacity of your imagination," means in concreto: "Increase your capacity of fear." Therefore: don't fear fear, have the courage to be frightened, and to frighten others, too. Frighten thy neighbor as thyself. This fear, of course, must be of a special kind: 1) a fearless fear, since it excludes fearing those who might deride us as cowards, 2) a stirring fear, since it should drive us into the streets instead of under cover, 3) a loving fear, not fear *of* the danger ahead but *for* the generations to come.[45]

We therefore disagree with the claims by Courtney, Kirkland, and Viguerie that level 4 uncertainty is exclusively transitional. To the contrary, Anders' advice from an earlier age of terror seems particularly sage in considering how best to address, consider, and react to climate change and its impact on human security. In a real sense, we have become what Anders would call "Inverted Utopians"—smaller than our true selves; mentally limited; incapable of true action, response, production.[46]

While catastrophic climate change would affect the globe in a disastrous way, scenarios that consider the complex relationship—and uncertain outcomes—from direct impact on human security vulnerabilities might compel the serious development of a research agenda that moves beyond the nation-states as the best response mechanism to human security impact outcomes as a result of climate change and related vulnerability events. Specifically, if "human security" is the appropriate social (decision making?) unit of analysis, who or what co-operative regime is best suited to provide response? Moreover, what influence or range of responses might be available for such mechanisms to be effective? Finally, given the complex dynamics of this workshop's focus, we consider it likely suggests that one scenario will not work for all bases of action. Indeed, it well prove worthwhile to consider the options of "nested" scenarios—with multiple options for decision—as an effective policy mechanism for decision makers.

Policy Implications and Appropriate Responses

". . .as with all paradox,
the hardest part is not to answer
but to conceive the question."
--Jacob Bronowski[47]

With regard to the complex relationship between climate change and human security, scenarios could prove useful in determining policy and action response. By developing such scenarios, the interrelationship between that which is predetermined and that which is uncertain may be equally open to interpretation and changing factors. Pierre Wack offers several thoughts with respect to the use of scenarios as tools:

> I have found that scenarios can effectively organize a variety of seemingly unrelated economic, technological, competitive, political, and societal information and translate it into a framework for judgment—in a way that no model could do. . . . Decision scenarios describe different worlds, not just different outcomes in the same world. . . . You can test the value of scenarios by asking two questions: (1) What do they leave out? In five to ten years . . . [decision makers] must not be able to say that the scenarios did not warn of important events that subsequently happened. (2) Do they lead to action? If scenarios do not push managers to do something other than that indicated by past experience, they are nothing more than interesting speculations.[48]

We are experiencing a world of dynamic change where even the most mind-numbing, dramatic events do not impress us for long. Yet any good strategist and planner must be able to help the nation's leaders see more clearly the different futures that may occur. To operate in an uncertain world, we need to *reperceive*—to question our assumptions about how the world works, so that we see the world more clearly. The purpose of this is to help make better decisions about the future.

With respect to specific improvement of scenario-based studies of climate change and human/national security, we might offer four recommendations:

(A) Consult with experts in security studies in addition to climate and environmental experts. As noted earlier, the relationships between the environmental and traditional national security concerns have been a source of debate. While a consensus of opinion has not been reached, much has been done to productively move the discussion forward. Since the 1990s, the topics of study have evolved from efforts to identify which aspects of the environment could usefully and practicably be applied to security questions[49] to more complex considerations of how environmental factors contribute to some conflicts, but not to others.[50] Indeed, given the increasing number of journal articles and professional conferences, environmental and human security can be recognized as an important subdiscipline of security studies, if not disciplines in their own right.

(B) Identify or develop frameworks for inferring reasons for action at the regional, nation state, and super-state scale of organizations. The structural mappings, such as by Homer-Dixon, are useful for understanding the relationships among elements that comprise a model of an environmental security. However, such mappings do not, by themselves, allow for an understanding of how specific sequences of events and actions may transpire over time to destabilize a security situation. There is, therefore, also the need to understand the dynamics of change. The approaches described by Clayton Roberts and Kenneth Burke have been mentioned as possible ways to infer the logic of choice and can be used for scenario development.[51] Other frameworks used in literary analysis, history, anthropology, and sociology exist and should be recognized, adapted, and applied to help structure representations of the future. Of particular need are frameworks which link the relationships between societies and their environments. It should be noted that since our relationship to our environment is a

complex fusion of biological needs, religious beliefs, social values, and economic goals, employing any framework to better understand how people act in regards to 'nature' may be controversial. Relative to our own point-of-view, we may judge the actions of others as misguided or morally wrong, but the reasons for such actions exist nonetheless. As John Watkins has conscientiously noted, "To regard the doings of another as essentially unexplainable is to regard him [or her] as not quite human."[52] While we may not—or should not—excuse anyone or any organization for any unfortunate consequences that follow from poor decisions, efforts to make sense of reasons for action help us to better grasp the workings of our social world.

(C) Use the identified framework(s) to describe case studies of past actions in times of environmental stress. While the future may not be like the past, historical precedent can serve as a guide to understand and anticipate some of tomorrow's actions. Short of a systematic library, there are a growing number of historical accounts which could contribute to a collective knowledge base. LeBlanc's work which is cited by Schwartz and Randall is, as noted, a useful start. Another example is Brian Fagan's *Floods, Famines, and Emperors* which explores how some cultures have adapted to climatic change and others have not.[53] On a similar theme is Mike Davis' *Late Victorian Holocaust* which is 'a political ecology of famine.'[54] It examines the interactions between climatic and economic processes, interactions which have resulted in the kinds of social upheavals that may be reminiscent of future security concerns.

(D) Borrow a page from military theory and distinguish between strategic, operational, and tactical thinking and develop scenarios specific to each kind of decision-making in addition to synthetic visions of the future. The decisions to adopt a defensive environmental posture, to break a long-standing treaty with Mexico, and to administer border control through the Department of Defense may be related within a broad arc of geopolitical understanding, but each represents a different level of engagement with the world. On the one hand, one strength of a scenario which spans multiple levels of decision making is that it can be invaluable for understanding the breadth of choices that might need to be made. But on the other hand, such a scenario may also suffer from a lack of depth and detail in regards to any single choice. This lack may impede discussions about the future by both those who will help to inform the decision and those who will be impacted by it. The three decisions mentioned here could—and perhaps should—all be of interest to the office of the President's National Security Advisor, to the State Department, and to DoD's Northern Command, but it is not necessarily clear that each organization would be equally interested in the implications of all three decisions. Further, each of these organizations operates in its own political context, has its own mission, and takes different kinds of actions. As such, it could readily be imagined that each organization would, if given the opportunity, request its own unique set of further elaborations about the scenario in order to better evaluate the situation, assess its options, and plan its actions. Developing environmental scenarios (or any kind of scenarios) that are focused to strategic, operational, or tactical decisions will help deepen the discussion of policy options at each level.

The security "threats" posed by abrupt climate change will potentially affect every nation and every person on the planet in negative ways. Those nations that are better prepared may, in the long term, be better off, but that is not to say there will be winners and losers. Today, new frameworks to assess the interconnectedness of national and global security are being developed and should be used to understand common concerns and common solutions. Third, the fact that climate change is being discussed at all under the rubric 'national security' indicates that the kinds of threats that are recognized have greatly increased since the end of the Cold War. Reflecting this new situation, the range of specialists who can provide useful, if not much needed, insight has necessarily expanded. Today, seminars on security studies require a larger table.

These contextual differences lead to new opportunities and requirements for scenario development. Because the discussion can be open, assumptions about the future can be more explicitly stated. Because the discussion should seek, explore, and chart new relationships between society and the environment, the assumptions about the future should be more explicitly stated. And because the discussion must include people from multiple disciplines and diverse backgrounds who must talk to each other, the assumptions about the future must be more explicitly stated.

Perhaps one way to think about this is to obvert George Santayana's famous saying about learning from history by changing our perception of things that are yet to come, by suggesting that "those who do not learn from the future are destined to make mistakes in it." To be able to understand that future, we have to have a "mental map" flexible enough to consider plausible alternatives and possibilities we might not otherwise consider.

In the end, we can be certain of one thing: the future is not likely to be boring.

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[1] Lewis Carroll, *Alice's Adventure in Wonderland,* chap. 6, "Pig and Pepper," Millennium Fulcrum, 3.0, at <www-2.cs.cmu.edu/People/rgs/alice-ftitle.html>

[2] Peter Schwartz and Doug Randall, *An Abrupt Climate Change Scenario and Its Implication for United States National Security* (Written for the Office of Net Assessment, within the Office of the Secretary of Defense: Washington, D.C., October 2003). <http://www.ems.org/climate/pentagon_climatechange.pdf>

[3] Herman Kahn and Anthony J. Weiner, *The Year 2000: A Framework for Speculation on the Next Thirty Year*s (New York: Macmillan, 1967), p. 6.

[4] Pierre Wack, "Scenarios: Shooting the Rapids: How Medium-Term Analysis Illuminated the Power of Scenarios for Shell Management," *Harvard Business Review* (November–December 1985), pg. 140. Other general works regarding scenarios and strategic implications include Robert Jervis, *System Effects: Complexity in Political and Social Life* (Princeton, N.J.: Princeton Univ. Press, 1997); Kees van der Heijde, *Scenarios: The Art of Strategic Conversation* (Chichester, U.K.: John Wiley & Sons, 1996); Seymour J. Deitchman, *On Being a Superpower: Scenarios for Security in the New Century* (Boulder, Colo.: Westview Press, 2000); and Gill Ringland, *Scenario Planning: Managing for the Future* (New York: John Wiley & Sons, 1998).

[5] Ibid. Portions of this section have been adapted from an earlier essay titled "The Art of Reperceiving: Scenarios and the Future," P. H. Liotta and Timothy E. Somes, *Naval War College Review,* Autumn 2003. <http://www.nwc.navy.mil/press/Review/2003/Autumn/cy1-a03.htm>

[6] Passages within this section earlier appeared in earlier versions as "Boomerang Effect: The Convergence of National and Human Security," *Security Dialogue*, December 2002, Volume 33, Number 4, pp. 473–488, and "Through the Looking Glass: Creeping Vulnerabilities and the Re-ordering of Security," March 2005, Volume 36, Number 1, pp. 69-90.

[7] For an extended discussion, see: P. H. Liotta, *Security Dialogue,* 2005, pp. 51-56.

[8] Hugh Courtney, Jane Kirkland, and Patrick Viguerie, "Strategy Under Uncertainty," *Harvard Business Review* (November/December 1997): pp. 67-79.

[9] These examples are for the purpose of illustration and discussion. As such, they do not offer definitive, discrete data. Final, convincing, and irrefutable data for these issues do not exist—just as the American senator Jesse Helms asserted during his controversial career that final, definitive data that proved that smoking causes lung cancer does not exist. Equally, the estimate of 3.8° Celsius exceeds the estimates of recent UN and the American National Academy of Sciences data. These illustrations are meant to show the nature of security issues that rise out of vulnerabilities rather than out of direct threats. The issues themselves and the best responses to these issues lack the precision and clarity of threats.

[10] Brooke A. Smith-Windsor, "The Canadian Role in Human Security," in *Challenges of the Global Century: Report of the Project on Globalization and National Security,* Stephen J. Flanagan, Ellen L. Frost, and Richard L. Kugler, editors (Washington, DC: Institute for National Strategic Studies, National Defense University, 2001) pp.1077-1092. Two volumes. Available on CD-ROM. A. Mitchell, "The Northwest Passage Thawed." *The Globe and the Mail,* 5 February 2000.

[11] Daniel C. Esty, "A Term's Limits," *Foreign Policy* (September/October 2001) pp. 74-75.

[12] Previously referenced, fn. 2.

[13] S. Curwood, "Abrupt Climate Change, Living on Earth" (March 5, 2004), Available on-line through the Living on Earth website www.loe.org. (Active on-line June 3, 2004)
[14] A.C. Revkin, "The Sky is Falling! Say Hollywood and, Yes, the Pentagon," *New York Times* (February 29, 2004) Section 4, pg. 5.
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[17] <http://www.ems.org/climate/pentagon_climatechange.pdf>
[18] T.R. Karl, K.E. Trenberth, "Modern Global Climate Change," *Science* 302 (5651) (2003): pp. 1719–1723.
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[22] National Research Council, *Inevitable Surprises,* pg. 41.
[23] Schwartz and Randall, p. 16.
[24] Steven A. LeBlanc with Katherine E. Register, *Constant Battles: The Myth of the Peaceful, Nobel Savage* (New York: St. Martin's Press, 2003), p. 197.
[25]W. Chris King, Colonel, United States Army, Chair of the Department of Geography and Environmental Engineering, United States Military Academy. Dr. King wrote this unpublished study, as an advanced research product, while serving as a West Point Fellow at the U.S. Naval War College, during the academic year, 1999-2000.
[26] Wack, pg. 146.
[27] Peter Schwartz, "The Art of the Long View," in *Strategy and Force Planning* (Newport, R.I.: Naval War College Press, 1997, 2d ed.), chaps. 3 and 35, pp. 34-35. Reprinted by permission from *The Art of the Long View* by Peter Schwartz, 1991, 3–10 and 105–23. Copyright 1991 by Peter Schwartz, published by Doubleday.
[28] See John F. Troxell, *Force Planning in an Era of Uncertainty: Two MRCs as a Force Sizing Framework* (Carlisle Barracks, Penna.: Strategic Studies Institute, 15 September 1997) for a detailed discussion of both threat-based scenario development and capabilities-based planning. See also Henry Bartlett, G. Paul Holmes, and Timothy E. Somes, "The Art of Strategy and Force Planning," in Strategy and Force Planning Faculty, eds., *Strategy and Force Planning,* 3d. ed. (Newport, R.I.: Naval War College Press, 2000), chap. 2, pp. 26–30, for alternative approaches to force planning.
[29] http://www.agu.org/revgeophys/mayews01/node6.html < http://en.wikipedia.org/wiki/Younger_Dryas> (May 27, 2005)
[30] Drawn from information compiled by Scott A. Mandia, Suffolk County Community College, on "The Little Ice Age in Europe. Data referenced is drawn from: Lamb, H. H., *Climate, History and the Modern World.* London: Methuen, 1995. < http://www2.sunysuffolk.edu/mandias/lia/little_ice_age.html> (May 27, 2005)
[31] Elizabeth Kolbert, "Annals of Science: The Climate of Man—I," *New Yorker,* April 25, 2005, Vol. 81 Issue 10, pg. 69.
[32] Hugh Courtney, Jane Kirkland, and Patrick Viguerie, Strategy Under Uncertainty, *Harvard Business Review*, 68:3 (November-December 1997), pp. 79-91.
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[36] Kolbert, pg. 63.
[37] Michael Shellenberger and Ted Nordhaus, *The Death of Environmentalism: Global Warming Politics in a Post-Environmental World*, pp. 6-7. < http://www.thebreakthrough.org/images/Death_of_Environmentalism.pdf> (May 27, 2005)
[38] Ibid, pp. 14-15.
[39] Courtney, Kirkland, and Viguerie, pg. 77.

[40] Ibid., pp. 78, 79.
[41] Kolbert, pg. 71.
[42] Extracted and condensed from Kolbert, pp. 65-66.
[43] Ibid., pg. 66.
[44] Elizabeth Kolbert, "Annals of Science: The Climate of Man—III," *New Yorker,* May 9, 2005, Vol. 81 Issue 12, pg. 56.
[45] Günther Anders, "Theses for the Atomic Age," *Massachusetts Review,* 3:3 (Spring 1962): pg. 498.
[46] Ibid., pg. 496.
[47] Jacob Bronowski, *The Ascent of Man* (Boston: Little Brown and Company, 1973), pg. 247.
[48] Wack, pp. 146-150.
[49] T.F. Homer-Dixon, "On the Threshold: Environmental Changes as Causes of Acute Conflict," *International Security* 16 (2) (1991): pp. 76–116.
[50] G. Dabelko, "The Environmental Factor," *Wilson Quarterly* 23 (4) (1999): 14–19.
[51] A.W. Shearer, "Applying Burke's Dramatic Pentad to Scenarios," *Futures* 36 (8) (2004): pp. 823–835.
[52] J. Watkins, J. Watkins, "Imperfect rationality," in: R. Borger and F. Cioffi (Eds.), *Explanation in the Behavioral Sciences* (Cambridge, U.K.: Cambridge University Press, 1970), pp. 167–217; this note p. 216.
[53] Brian Fagan, *Floods, Famines, and Emperors: El Nin˜o and the Fate of Civilization* (New York: Basic Books, 1999).
[54] Mike Davis, *Late Victorian Holocausts: El Nin˜o Famines and the Making of the Third World*, Verso, New York, 2001.