

Assessing the impacts of climate: The issue of winners and losers in a global climate change context

Michael H. Glantz

Environmental and Societal Impacts Group
National Center for Atmospheric Research*
PO Box 3000
Boulder, Colorado USA 80307-3000

1. INTRODUCTION

Most reviews of the greenhouse issue begin with the works in the mid-1890s of Swedish scientist Arrhenius. The physical processes have been well known for more than a century. Interest in the possible impacts on climate of CO₂ emissions as a result of human activities has waxed and waned since that time, with temporary peaks of interest appearing in the mid-1930s (Callendar, 1938), the mid-1950s (Revelle and Suess, 1957), and again in the mid-1970s (e.g. Kellogg, 1977). Today we are inundated by assessments of the prospects of a global warming and its possible impacts on society and the environment produced by national, international, and nongovernmental organizations. Discussions of such a prospect have steadily increased during the past twenty years, reaching very high political levels in the late 1980s and early 1990s.

The century-long interest in the science and impacts of the human-induced enhancement of the greenhouse effect has been interrupted partly by other more pressing and urgent historical events such as two world wars, a worldwide depression, decolonization, the Cold War and then its demise, and a temporary global cooling; and partly by the fact that the impacts of a CO₂-induced global warming were originally believed to be beneficial to society. For example, Callendar (1938) suggested that a greenhouse warming would help to thwart the emergence of an apparently imminent Ice Age. Scientific and anecdotal evidence was cited to suggest that the earth was coming to the end of an interglacial period, and that soon processes leading to an Ice Age would begin again.

From about 1940 to the late 1960s, the global atmosphere underwent a yet-to-be-understood cooling. Scientists provided scientific as well as anecdotal evidence (convincing both to the lay public and segments of the scientific community) to support the view that the earth was possibly on the threshold of an Ice Age: the growing season in England had been shortened by two weeks, fish species formerly caught off the northern coast of Iceland began

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appearing only off its southern coast, sea ice in the North Atlantic had increased in its southward extent in the early 1970s and was appearing in shipping lanes that were normally ice-free; and hay production in Iceland declined by 25% as a result of less hospitable weather. In the United States, the fact that the armadillo, which had migrated as far north as Kansas in warmer decades, was starting to retreat toward the south was also used as evidence to support the Ice Age hypothesis. Geologic records were invoked as well, to show that an Ice Age was near.

During this brief period of concern with global cooling, one issue widely considered was how it might affect the relative economic and political positions of different countries. Even the US Central Intelligence Agency undertook a set of studies to show how the cooling might affect the agricultural production and energy demand in the USSR (CIA, 1974, 1976). *The Ecologist* examined the potential impacts of a few degrees of cooling on agriculture in the Canadian prairies (Goldsmith, 1977).

Some books and articles on the topic went so far as to identify specific countries that would become climate-related world powers in the event of a cooling. For example, Ponte (1976) suggested that "adapting to a cooler climate in the northern latitudes, and to a drier climate nearer the equator, will require vast resources and almost unlimited energy. ... A few countries, such as equatorial Brazil, Zaire, and Indonesia, could emerge as climate-created superpowers." He also suggested that "We can say with high probability today that the global monsoon rainfall will be below average for the remainder of the century."

Another book on the possibility of a global cooling (Impact Team, 1977) suggested that with a cooling "there would be broad belts of excess and deficit rainfall in the middle latitudes; more frequent failure of the monsoons that dominate the Indian subcontinent, south China, and western Africa; shorter growing seasons for Canada, northern Russia, and north China. Europe could expect to be cooler and wetter. Of the main grain-growing regions, only the United States and Argentina would escape adverse effects." There was no reluctance whatsoever to discuss who might win and who might lose, or to identify specific countries or specific economic sectors within a country as winners and as losers in the event of a global cooling.

There is a striking difference between the scientific and political responses in the 1970s to a potential cooling and those of today to a warming. Today there is a strong reluctance, if not opposition, within scientific as well as policymaking circles to recognize (or address or discuss) the existence and identity of specific winners and losers, especially winners. When he was a US Senator, US Vice President Albert Gore (1992), for example, argued that there would be no winners in the event of a global warming, a view that is apparently also held by the US Environmental Protection Agency (EPA). Soviet scientist Mikhail Budyko (1988), in contrast, asserted that everyone would benefit from a global warming based on scenarios, plausible from his perspective. Perhaps the comments that US Senator Tsongas (1982) made about diametrically opposing views on the energy crisis of the 1970s and 1980s apply to the views of Gore and Budyko on winners and losers:

Both of these approaches are equally absurd, equally rhetorical, and equally successful. When talking to the convinced, they are very powerful. And that is basically how most people address the issue: we are awash in rhetoric, not to mention hypocrisy, when what we need is a careful sorting and weighing of the facts and values involved in making — or not making — a decision.

Many people seem to believe that discussing winners and losers (or, as some prefer to call them, advantaged and disadvantaged) will be divisive and could ultimately undermine

efforts to put together a global coalition truly intent on combating anthropogenically induced global warming. Reaction to a 1989 speech by Barber Conable, then-President of the World Bank, illustrates that discussion of winners and losers has, at least up to the recent past, been politically taboo. Environmental groups, which have been marching lock-step on this particular issue, opposed his public comments. In addition, some US congressmen even went so far as to suggest the need for a closer scrutiny of the World Bank's activities and budget. For example, the *Washington Post* (12 September 1989) reported, "In a letter to Conable, Wisconsin Senator Robert Kasten, Jr. wrote, 'the Bank's failure to be on the front lines of efforts to fight global warming threatens the Bank's long-term financial support from Congress.'"

A similar argument was raised with respect to preventive versus adaptive response strategies. When the US EPA released two reports in 1983 suggesting that global warming was inevitable (Seidel and Keyes, 1983) and, as a result, people should plan for a rising sea level (Hoffman et al., 1983), the Friends of the Earth publication *Not Man Apart* denounced the Agency for "throwing in the towel," while at the same time, President Reagan's science adviser denounced the EPA reports as "alarmist." There was a feeling that "premature" discussions about adaptive strategies with respect to global warming would break down the development of a united effort to support the pursuit and enactment of preventive strategies. Proponents of preventive strategies wanted attention to focus mainly on prevention as the best way to cope with global warming.

There is, however, one projected impact of global warming for which one is allowed to identify specific winners and losers — sea level rise. This is probably because it is the one impact of a global warming for which there may be no obvious winners at the national level. No one has been reluctant to identify specific losers associated with sea level rise (papers have identified winners at the subnational level, such as coastal engineering firms and people who would have beachfront property as a result of a neighbor's misfortune). In this regard, one could argue that the sea level rise problem is similar to the stratospheric ozone depletion problem — no readily apparent national winners can be identified. Such would probably not be the case for changes in rainfall distribution, water resources availability, agricultural production, fisheries productivity, and energy production and consumption.

The purpose of this presentation is to foster discussion of issues associated with the process of identifying winners and losers. What factors, for example, must be taken into account in labeling a region, an activity, an economic sector, or a country a winner or a loser? How do perceptions compare with reality? Can wins and losses be objectively and reliably identified? What are the costs and benefits of not addressing this issue as opposed to addressing it openly?

My intention is not to label specific countries as winners or losers. To do that, one could simply use any of the GCM-generated scenarios, the scenarios generated by paleoecological reconstructions, or assessments of recent environmental changes and label specific countries and regions within countries accordingly. My purpose is to draw attention to the importance of addressing the winner-loser issue.

As a note of caution, any attempt to identify potential winners and losers could only be viewed as a preliminary first step, because of the possibility of climate change surprises. For example, when I sought to include an assessment of the impacts of freezes on citrus production in the state of Florida as part of a larger set of analogues to possible global warming regional impacts, EPA advised me to drop that case study, asserting (not suggesting) that with a global warming "there would be no more freezes in Florida"! We did the study

anyway (Miller, 1988). As it happened, the 1980s, cited by scientists as the warmest decade in North America on record, witnessed the largest number of freezes in central Florida in its 130 years of record. Thus, regional counter-intuitive climate surprises must be expected. Nevertheless, identification of winners and losers is happening behind the scenes and should be brought out into the open.

I realize that there is a risk associated with identifying winners and losers. If winners and losers are identified with some degree of reliability, the potential for unified action against the global warming may be reduced. Winners will not necessarily want to relinquish any portion of their benefits to losers in order to mitigate the impacts of their losses. On the other hand, there is also a risk in not making such a distinction between winners and losers. While scientists and policymakers formally discuss only losses associated with a global warming, others may perceive that there will be positive benefits as well. The result is that the proponents for action on global warming could be likened to the fable about the emperor's new clothes, professing there are no winners, while everyone agrees with them in public but privately believes the opposite. This could sharply reduce the credibility of the proponents for taking action, lessening the chances for *any* response, preventive, mitigative, or adaptive.

2. SCENARIOS OF WINNERS AND LOSERS

In the following section, the notion of winners and losers is discussed in terms of climatic conditions. These conditions include today's global climate regime, an altered climate regime, and varying rates of change.

Winners and Losers with Today's Global Climate Regime

It seems obvious that, say, fifty years hence there will be some societies that benefit from whatever climate exists at the time. After all, with today's climate, we can identify climate-related winners and losers. As an example, the following map (Figure 1) shows drought-prone regions in sub-Saharan Africa, some of which could be considered climate-related losers. Such maps, depicting drought-prone and flood-prone areas, exist for other regions around the globe. Gains and losses at all levels of social organization, from local to international, may result directly from climate changes or from human responses to those changes. While there are several spokespersons for the extreme views (i.e., that all will win or all will lose), in all cases of changes (both relative and absolute), some will benefit, while others will be adversely affected. In addition, some nations, sectors, and groups may be in a better position to respond or adapt to climate change, turning this to their future advantage.

The currently identifiable relative advantages and disadvantages of different nations, sectors, and groups result from a combination of climatic factors (such as climate variability and the frequency and intensity of extreme meteorological events) and a wide range of unique (by country, region, sector, or group) economic, social, and political factors that must be taken into serious consideration in any analysis (for more discussion of this issue, see ESIG, 1990). The differences, attributable to climate factors (e.g., recurrent droughts or floods), are likely to persist, although the relative positions of those affected might change. Furthermore, if such differences become extreme, they can lead to population movements by the disadvantaged (i.e., generating environmental refugees) and to conflicts either within national borders or across them).



New York Times, 8/20/85

Figure 1

One could easily argue that there has been little sustained (or effective) effort to date by climate-related winners to assist those who might be considered climate-related losers. Examples that reinforce low expectations about adequate humanitarian assistance from the industrialized countries are not difficult to find. We have seen, for example, that in the past several decades, foreign assistance has been frequently tied to political considerations (e.g., aid to Cambodia and South Vietnam in the 1960s and 1970s, or to Ethiopia in the 1980s). In the early 1970s when there were widespread droughts throughout the world (except in the United States), then-US Secretary of Agriculture Earl Butz spoke about how food exports from the United States would be a new tool in the nation's foreign policy negotiating kit. Despite public statements to the contrary, few leaders in countries chronically affected by the adverse impacts of today's climate believe that they can rely on long-term, politically neutral assistance from those favored by today's global climate.

The Colorado River Compact of 1922 provides an example of a recent "climate change" in which winners and losers have been identified. The Colorado River Basin in the southwestern United States was divided into two parts, the Upper and Lower Basins. The flow in the system was estimated at about 15 million acre-feet (maf), based on the record for the previous 20-year period, 1900-20. The representatives of the various states in the basin agreed to divide in absolute terms 15 maf average annual flow equally between the two

basins: 7.5 maf for each basin (75 maf over a ten-year period). However, because the Upper Basin states thought that there would be more water in the system than 15 maf, they agreed to provide the lower basin states with 7.5 maf, thinking that they would benefit from any surplus that might exist (see Brown, 1988).

Shortly after the agreement was signed, however, the Colorado River entered a period of low streamflow, setting record lows in the 1930s (referred to as the US Dust Bowl decade). Today, the average annual streamflow (Figure 2) is estimated at about 13.5 maf. The loss of streamflow has to be absorbed by the Upper Basin. Thus, in this situation, one can

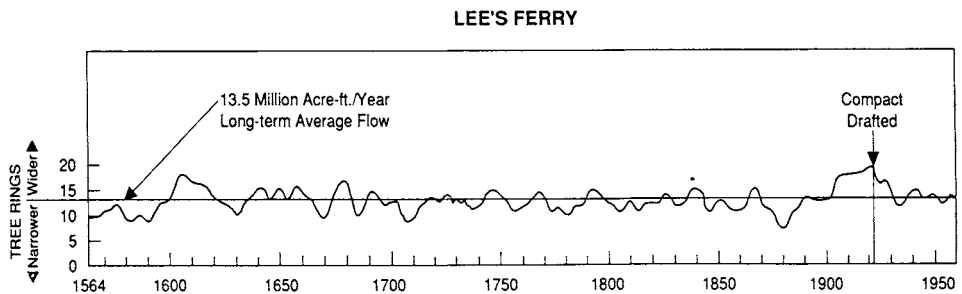


Figure 2 (from Stockton and Jacoby, 1976)

identify winners and losers as a result from what might be considered a climate change that has, to date, lasted about six decades.

Carrying this analysis a step further, one might ask what those who benefited from the Compact have done to compensate those who have not? What lessons for climate change responses by society might be drawn from this situation? Should future water compacts be based on proportional divisions of a variable resource, instead of absolute amounts? What does this case study suggest about when to reach agreement on a variable resource — before or after winners and losers are identified?

Finally, an important question that merits attention, but has yet to be addressed among discussions about possible strategic responses to global warming, is the following: who loses and who wins if no action is taken and the global climate regime remains as it is today? If it could be ascertained that no global warming were to occur, what actions would today's climate-related winners take to alleviate the climate-related problems of today's climate-related losers?

Winners and Losers with an Altered Global Climate Regime

While we do not yet know the global, let alone regional, specifics of the havoc (or windfall) that a climate change will bring, we can assume that there will be winners and losers with a global climate warming.

Some researchers and policymakers who are primarily concerned about regional impacts believe that, compared to the present climate of their region, it is possible that their climate could improve rather than worsen with a global warming. Saudi Arabia is one such example; Ethiopia might be another. Given their current climate, they might consider the risk of change worthwhile. Bandyopadhyaya (1983), an Indian social scientist, as well as Budyko

(1988) of the Russian Federation have made this argument at length in favor of a climate warming.

Often, when people talk about the possibility of increased rainfall in a given region, a counter-argument is raised that ambient temperatures (and, therefore, evaporation rates) will also increase. This would tend to negate any benefits that might come from additional rainfall. Yet, history shows that societies have devised ways to capture rainfall and reduce evaporation, thereby improving the percentage of rainfall that they can effectively use (Glantz, 1991).

Can we find examples of environmental conditions that different societies might have to cope with in the advent of a global warming? Are there existing climate change analogues for most places in the world? For example, in the United States, it has been suggested that the state of Iowa would become hotter and drier. Might Nebraska or Kansas provide a glimpse at Iowa's possible future environmental setting and, therefore, a glimpse of Iowa's future?

Attempts to identify climate analogues are not new. The following maps of the former USSR (CIA, 1974) and of China (Nuttonson, 1947), Figure 3 and 4, respectively, depict agroclimate analogues from North America. Similar analogue maps could be created pertaining to climate warming, once we have an improved picture of the regional impacts of a global warming.

Analogies

"Forecasting by analogy" provides social scientists with another approach to identifying possible societal scenarios associated with climate-related environmental change. The objective of this approach is not to forecast future states of either the atmosphere or society. Its purpose is to identify present-day societal strengths and weaknesses in human responses to environmental changes in order to forecast society's ability to cope with stresses that might accompany an unknown climate future. It can provide researchers with a low-tech approach to scenario development that encourages researchers to rely on existing, thus reliable, information about the regional impacts of extreme meteorological events. It can also provide a first approximation of societal preparedness for coping with an as-yet-uncertain climate future.

Each methodological approach to develop a global warming scenario generates highly speculative glimpses of the future. To date, no one has successfully identified a method to forecast with any degree of reliability future states of the atmosphere. It would, therefore, be misleading to rely on any one of these scenarios as a basis for making specific policy recommendations in a specific region or locale. Such scenarios should not be taken as predictions or forecasts. They can, however, be used to create awareness among policy-makers of the need to assess the regional consequences of climate change (e.g., Glantz, 1988).

Winners and Losers and Rates of Change

Many environmental changes with which decisionmakers are concerned today derive from human activities: climate change, tropical deforestation, desertification, mangrove destruction, and varying lake and inland sea levels. Climatologists, environmentalists, and policymakers have sought to obtain numbers that characterize the rates of these changes at global, national, and regional levels. These rates of current environmental change are determined directly or indirectly from space and ground observations, combined with

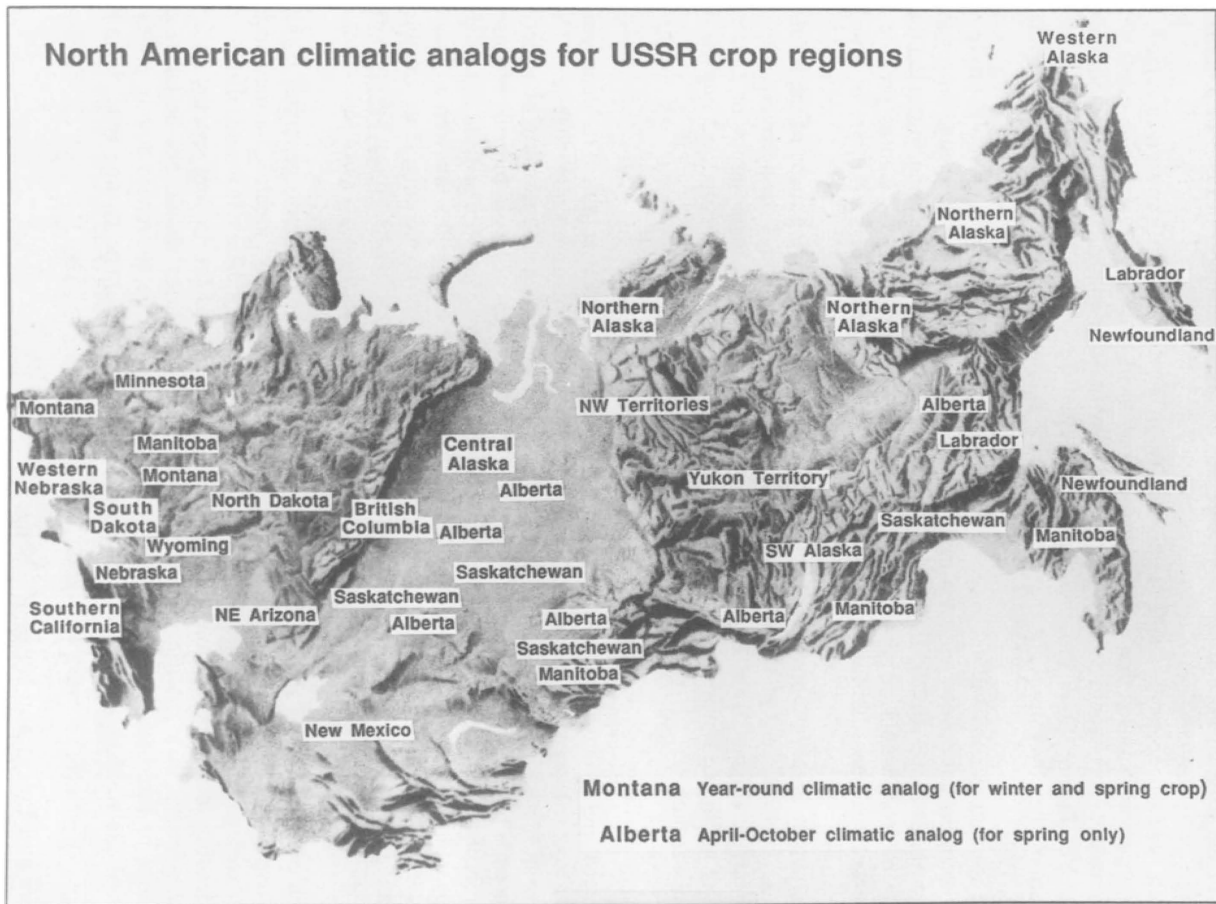
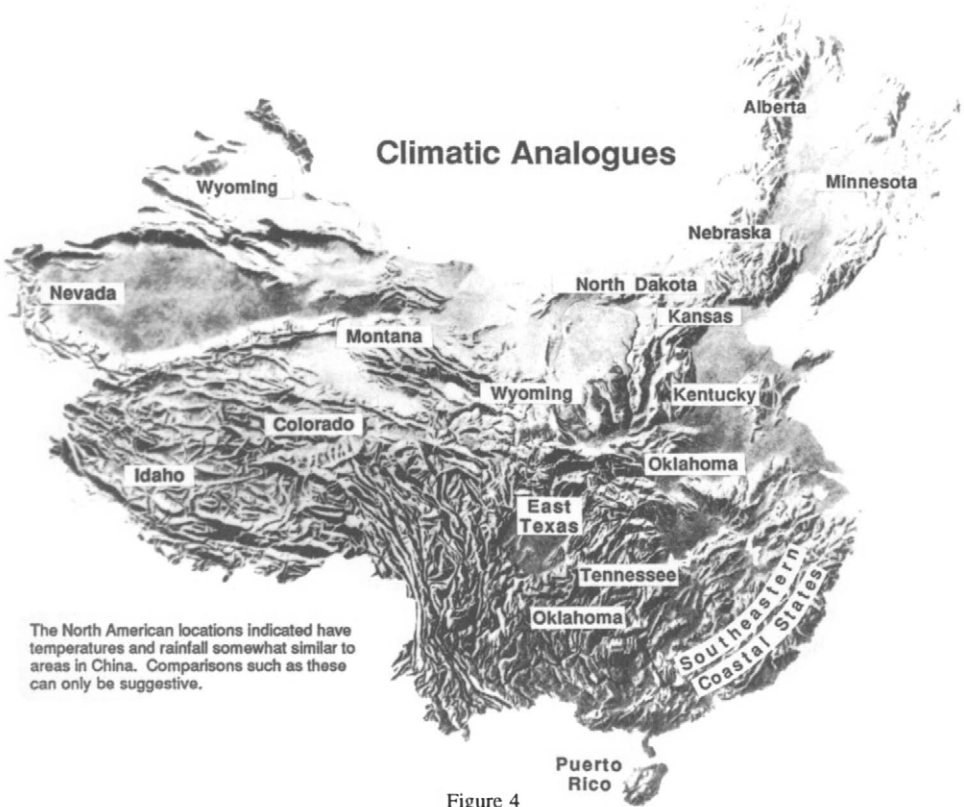


Figure 3



statistical measurements. Projections of future rates are obtained from modeling activities, extrapolations of present-day trends, and subjective "guesstimates." These rates are extremely important to the development of scenarios about environmental conditions (including climate) in future decades. They also have an important impact on the particular policies pursued to mitigate or adapt to those rates and processes of environmental change, as well as on attempts to fine-tune the methods of detection. Perceptions about rates of change of global warming can affect one's views of the costs or benefits of such a climate change.

Rates of environmental changes are often as important as the magnitude of those changes over the long term. When rates take on a crisis element (e.g., high stakes involved, perceived threat, short time to act, thereby challenging a society's ability to adjust), decisionmakers appear to take a more serious view of environmental changes that might affect them. High rates are more likely to cause alarm, while slow rates foster a "business as usual" attitude. One would even argue that it is often perceptions about the rates of change that prompt human action and not necessarily the order of magnitude of that change, even if that magnitude of change is unprecedented and beyond recent human experience.

Environmental change appears to be used frequently as a bargaining chip in domestic as well as international negotiations. More specifically, in this context rates of change will affect response by decisionmakers. Negotiating tactics and strategies will clearly be affected by the rates of environmental changes that are proposed or used in intra-national and international negotiations. Varying rates are used by different protagonists in debates about

policy responses that might be required to deal with such changes. Thus, the importance of taking the subjective elements out of rates and processes can lead to more informed, more integrated, and more objective decisionmaking and perhaps to a more realistic view of what regional and local gains or losses might accompany global warming.

It is also important to note that for any group, relative advantages and disadvantages are likely to change over time and that what might appear to be an advantage from climate change in the near term may, in the long run, turn into a disadvantage and vice versa.

3. RELATED QUESTIONS

Before any attempt to identify specific winners and losers from a global warming, there are several "prior" questions that must be addressed. In this section, some of these questions are posed and only briefly discussed to stimulate more critical examination. The following is meant to be suggestive of the kinds of concerns that must be raised when assessing the societal impacts of a global warming.

What Do We Mean By a Win or a Loss?

It is not sufficient, meaningful, or realistic to equate more rainfall than normal with a win, and less rainfall than normal with a loss. In reality, the actual amount of rainfall in a given location does not by itself tell much about agricultural production. There are numerous articles about definitions of drought (e.g., Wilhite and Glantz, 1985). Researchers have identified differences between meteorological, agricultural, and hydrologic droughts. For example, if the expected annual amount falls (no meteorological drought) but is distributed throughout the growing season at the wrong time with respect to crop growth and development, a sharp decline in agricultural production (an agricultural drought) could occur.

Likewise, defining a win or a loss according to changes in evaporation rates also may not be very useful. If evaporation rates increase, and all else remains the same, then there will be a depletion of water resources. However, as noted earlier, people in many arid and semiarid areas have devised ways to minimize the impacts of high evaporation rates by the way they collect, store, and use their available, often scanty, water resources. Thus, the dependence on a single physical parameter to identify the costs or benefits to a society of a climate change has severe limitations.

How Does One Measure a Win or a Loss?

One might suspect that Canada will be a winner because, as temperatures increase and the growing season lengthens, agricultural productivity will improve. But what will be the impacts on Canadian fisheries, the timing of seasonal snowmelt, or the Canadian ski industry?

Another local-scale example of the difficulty associated with measuring wins and losses is provided by historical attempts to augment precipitation in a semiarid part of central Colorado (USA). Cloud seeders were hired to suppress hail, augment rainfall during the growing season, and reduce rainfall during harvest, in order to improve the productivity of hops for beer production. Another group of farmers growing other crops (e.g., lettuce) and ranchers with different moisture requirements in the same valley opposed these cloud-seeding activities. The conflict between the two factions became violent, and the operation was eventually halted. Thus, even within small areas there can be different responses to changes in rainfall, making an objective determination of a win or a loss exceedingly difficult.

Finally, if one group loses, but loses less than others, should they be considered as an absolute loser or relative winner?

Can Wins and Losses Be Aggregated?

While wins and losses can be "added" together to produce a net figure, one must question the value of that figure. The wins (or losses) are not shared commodities. Those who lose may not benefit in any way from those who win. For example, when the Peruvian fishery collapsed, those fishermen who had focused their activities (fishing gear, fishmeal processing factors, etc.) on exploiting anchoveta were not prepared to take advantage of exploiting the sharp increase in shrimp populations that appeared along the Peruvian and Ecuadorian coasts. A country can expect to have both winners and losers within its borders in the event of a climate change. While the winners may be in a position to take care of themselves, someone will have to help the losers. Wins and losses cannot be meaningfully aggregated. A win is a win, and a loss is a loss.

What Is the Relationship between Perceptions of Wins and Losses and Actual Wins and Losses?

Given the uncertainties surrounding the regional impacts of a global warming, actual winners and losers within and between countries cannot be identified with any degree of confidence. Perhaps we will learn that in reality everyone will lose (or win) with a global warming of the atmosphere. However, as long as some regions or countries *perceive* themselves to be winners (or losers), they will act according to this perception. Thus, the issue of winners and losers must be addressed openly, objectively, and scientifically, if we wish to minimize the chance that actions taken in response to a global warming will be based on misperceptions (Jamieson, 1994).

How Should One Deal with the Issue of Intergenerational Equity?

Identifying winners and losers spatially, as well as temporally, must become a concern of those dealing with the global warming issue. Arguments about intergenerational equity have been invoked to generate support for taking action now against global warming. We are asked to take actions today to protect future generations from the environmental insults wrought by the present generation. But how can we generate support for inter-generational equity when we cannot even achieve *intra-generational* equity among the various groups and generations now living?

It appears that we have come to believe that any change in the status quo is, by definition, a bad change. But the real answer to this question will depend on who is asked to respond. A Saudi Arabian might believe that any change in the current climate regime will most likely be better for future generations of Saudi Arabians than the existing one. The opposite belief might be held by a farmer in the US Great Plains. The truth of the matter is that most people fear change (e.g., Hoffer, 1952).

4. CONCLUSION

Every discipline has dealt with the concept of winners and losers in one way or another — biology, political science, history, sociology, economics, geography, law, ecology, conflict resolution, risk assessment, game theory, and so on. Climate-related impact assessment as

a result of global warming is only the latest topic that requires consideration of winners and losers.

There have been conflicting views on whether to identify specific countries as winners or losers in the event of a global warming of the atmosphere. There has also been a reluctance to discuss the possibility that there may be any winners at all. It is time to get beyond that reluctance and to ask questions that need to be addressed so that the notion of winners and losers can be assessed on a more objective and realistic level.

There is a calculated risk in such a discussion. Once specific winners have been reliably identified, there may be a reluctance on their part to lend support for global action to combat a greenhouse warming. We must take this risk. Many issues must be resolved before we will be in a position to identify with any degree of confidence who those specific winners might be. In the meantime, other issues, such as equity, definition, measurement, and perception versus reality, must be addressed if we ever hope to identify with some degree of confidence how specific countries, economic sectors, and regions within countries can develop response strategies to climate change in the 21st century. With such information in hand, governments and nongovernmental organizations would be in a position to devise tactics and strategies for coping with global-warming-induced national and regional changes.

The Regionalization of Environmental Problems

Given the resurgence of worldwide concern about "global" environmental issues and their regional causes or consequences, regional organizations could provide an effective arena for discussing, resolving, or averting regional conflicts related to environmental change. Perhaps the 1990s provide a "window of opportunity" for a review of regional organizations and their potential contribution toward resource-related cooperation and conflict resolution at the regional level. Whereas regional international organizations (functional as well as geographic) have often been relegated to marginal roles in the international political arena with regard to resources issues, this could change in the future. Such a change can be expected because, as climate regimes shift in response to global warming, so too will the location of some highly valued natural resources, sometimes across national boundaries, such as water resources and fish populations. As resources and people dependent on them "migrate" on land and in the marine environment, the risks of regional conflicts, as well as the opportunities for regional cooperation, are likely to increase. The time may be right to talk about the "regionalization of environmental problems."

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