Living with Global Warming

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Executive Summary

Should we try to prevent global warming? Or should we use our resources to adapt to the consequences of warming? An argument for the former is that climate change will exacerbate existing problems — specifically, malaria, hunger, water shortage, coastal flooding and threats to biodiversity. This is a particular concern for developing countries, many of which are beset by these problems but lack the economic and human resources needed to obtain and implement technologies that would finesse or cope with them. This paper analyzes costs and benefits of two different approaches. One approach — mitigation — would limit carbon dioxide (CO_2) in the atmosphere largely by reducing emissions due to human activities. The Kyoto Protocol is an example of this approach. The second approach — adaptation — would reduce society's vulnerability to, or help cope with, the consequences of global climate change due to higher CO_2 emissions.

The projections underlying this study are from researchers who are sympathetic to mitigation. However, their conclusions show that adaptation is preferable. Cost estimates are based on reports from various United Nations-affiliated organizations. The findings:

- By 2085, the contribution of (unmitigated) warming to the above listed problems is generally smaller than other factors unrelated to climate change.
- More important, these risks would be lowered much more effectively and economically by reducing current and future vulnerability to climate change rather than through its mitigation.
- Finally, adaptation would help developing countries cope with major problems now, and through 2085 and beyond, whereas generations would pass before anything less than draconian mitigation would have a discernible effect.

The Kyoto Protocol will cost participating countries about $165 billion annually. Kyoto, however, will not stabilize, much less reduce, atmospheric concentrations of CO_2. Stabilizing atmospheric levels of CO_2 at 550 parts per million (much higher than today's levels) would cost several trillion dollars. Halting climate change, if that were possible, would cost many more trillions of dollars. Focused adaptive measures to reduce or eliminate the risks posed by malaria, hunger, water shortage, coastal flooding and threats to biodiversity, by contrast, would cost less than $10 billion a year. Moreover, these measures can be implemented now:

Malaria. Today, some 4.4 billion people worldwide are at risk from malaria spread by disease-carrying mosquitoes. This will grow to 8.8 billion people in 2085, even in the absence of climate change, due to increased population in developing countries where the disease is epidemic. Global warming is projected to increase the population at risk by 3 percent (256 to 323 million additional people) in 2085. This is due to an increase in the range of mosquitoes, for example, to higher altitudes. However:

- Meeting the Kyoto Protocol's emission reduction targets would reduce the population at risk from malaria by only 0.2 percent

- Stabilizing CO_2 emissions at 550 ppm would reduce the population at risk from malaria by 0.4 percent
- By contrast, investing an additional $1.5 billion annually on malaria prevention and treatment today would cut the current annual world death toll of malaria in half — from one million to 500,000 a year.

Hunger. Today, at least 521 million people worldwide are at risk of hunger. The good news is that their numbers are expected to fall to 300 million in 2085, despite an increase in global population, due to continuing increases in agricultural productivity. However, global warming is projected to partly offset that decline, exposing an additional 69 million to 91 million people to food shortages by 2085. This would occur due to a slight fall in the rate of agricultural productivity growth, as changing weather patterns increase drought and spread deserts. Thus:

- Meeting the Kyoto Protocol's emission reduction targets would reduce the population at risk of hunger by approximately 1.5 to 2 percent in 2085.
- Stabilizing CO_2 emissions at 550 ppm would reduce the population at risk of hunger by approximately 9.7 percent in 2085.
- By contrast, investing an additional $5 billion to solve agricultural problems that developing countries face today would reduce the population at risk of hunger by 50 percent — beginning today, and in 2085, and in the intervening years.

Water Shortages. Today, 1.75 billion people face shortages of drinking water. This is expected to increase to 6.5 billion people by 2085, due to the increasing population of poorer countries. Global warming may increase the number at risk by nearly 13 percent (862 million) in 2085 — or it may have a positive effect, cutting the population at risk by more than a third (37 percent), or 2.4 billion people. The actual affect depends on changes in weather patterns that occur with global warming, which climate models are currently unable to project accurately on a regional basis. As a result:

- Meeting the Kyoto Protocol's emission reduction targets would, at best, reduce the population facing water shortages by 1 percent in 2085 — and could, in fact, exacerbate the problem.
- Stabilizing CO_2 emissions at 550 ppm would, at best, reduce the population facing water shortages in 2085 by 860 million, but could increase the population at risk by 2.4 billion.
- Institutional reforms such as allowing water pricing and transferable water rights would help stretch water supplies. The water available for nonagricultural uses could be doubled by reducing agricultural water use 18 percent.

Coastal Flooding. Today, 10 million people are at risk of coastal flooding, and this number is projected to increase by 3 million by 2085 as coastal populations increase. Global warming is expected to raise sea levels by about 0.5 meters by the end of this century — due to such factors as melting ice sheets, storm surges and thermal expansion — putting an additional 81 million people at risk. However:

- Meeting the Kyoto Protocol's emission reduction targets would reduce the total population at risk from coastal flooding in 2085 by 18 percent.
- Stabilizing CO_2 emissions at 550 ppm would reduce the total population at risk from coastal flooding by approximately 80 percent in 2085.
- By contrast, investing an additional $1 billion annually in preventive measures — like building sea walls and other hardened structures and an orderly relocation of coastal populations — would address this problem just as well, if not more effectively.

Risks to Biodiversity. Due to development and agriculture, the forested area of the world is expected to fall 25 percent to 30 percent by 2050 and the area of coastal wetlands are expected to decline 40 percent by 2085. The major risk to biodiversity is the loss of natural habitat to development. Increased levels of atmospheric CO_2 favor plant growth; however, the effects of global warming on sea levels and weather patterns could reduce wetland area.

- Between now and 2085, global warming could increase forested areas by 5 percent; but it could reduce the area of coastal wetlands another 13 percent.
- Mitigation could cost several trillion dollars, but would have little effect before 2085.
- At a cost of less than $10 billion annually, the adaptive measures mentioned previously (such as those to reduce hunger, water shortages and costal flooding) could slow, halt or even reverse habitat loss by increasing the efficiency of land and water use.

Developing countries are most vulnerable to warming because they lack adaptive capacity. That capacity can be increased by enhancing economic development, human capital and the propensity for technological innovation, which are precisely the goals of sustainable development. Moreover, enhancing adaptive capacity would also increase their ability to mitigate greenhouse gas emissions.

Such an integrated strategy — simultaneously pursuing sustainable development while advancing the capacity to adapt to and/or mitigate climate change — could be accomplished by meeting the United Nations' Millennium Development Goals. In any event, achieving those goals would cost no more than the Kyoto Protocol while delivering substantially greater benefits.

Accordingly, over the next few decades the focus of climate policy should be to: (a) broadly advance sustainable development, (b) reduce vulnerabilities to climate-sensitive problems that are urgent today and might be exacerbated by future climate change, and (c) implement "no-regret" policies, such as eliminating subsidies for energy consumption, land conversion and agricultural overproduction in developed countries, while (d) striving to expand the universe of such measures through research and development of cleaner and more affordable technologies. Such a policy would help solve urgent problems facing humanity today while preparing it to face future problems that might be caused or heightened by climate change.

Introduction[1]

The 1997 Kyoto Protocol is an agreement among a number of countries to reduce emissions of greenhouse gases — principally carbon dioxide (CO_2) — thought to be warming the earth's climate. The agreement pledges 38 developed nations to control their CO_2 emissions by varying amounts so that their cumulative emissions between the years 2008 and 2012 would be about 5 percent below 1990 levels. The Protocol entered into force in February 2005. The United States chose not to participate, in part because it exempts developing countries such as China and India, although they have the world's fastest growing economies with emission growth rates to match. As we will see in greater detail below, meeting the Protocol's targets for lowering emissions will have little effect on climate change or on reducing its impacts, despite inflicting substantial economic pain.[2]

"The Kyoto Protocol will barely affect, let alone halt, global warming."

According to the Intergovernmental Panel on Climate Change (IPCC), the estimated cost of the Kyoto Protocol to participating countries in 2010 would range from 0.1 percent to more than 2 percent of their cumulative gross domestic product (GDP).[3] In this analysis I will assume that its cost will be at the lower end of this range — 0.5 percent of their cumulative GDP, or about $165 billion in 2010 (in 2003 dollars).[4]

However, by themselves, the reductions under the Protocol will not stabilize, much less reduce, the current level of atmospheric CO_2. Kyoto implicitly hopes that subsequent agreements will include the larger developing countries, and that future reductions will be much more drastic. In fact, the IPCC suggests that under some scenarios cumulative CO_2 emissions during this century would have to be reduced by 60 percent merely to stabilize atmospheric CO_2 concentrations at twice today's level — that is, 750 parts per million (ppm).[5] Such deep reductions, however, would only reduce the rate of warming rather than prevent it.

"Mitigation through drastic emissions cuts would cost trillions of dollars."

Climate change is mainly projected to add to existing problems, rather than create new ones. Of particular significance are four categories of hazards to human health and safety which have frequently been cited as major reasons for controlling greenhouse gas emissions: malaria, hunger, water shortage and coastal flooding.[6] To this list, one must add potential threats to biodiversity such as loss of wildlife habitat. This paper examines whether these problems can be ameliorated more efficiently by: (a) mitigation of greenhouse gas emissions through either the Kyoto Protocol or efforts to stabilize the atmospheric concentration of CO_2; or (b) adaptation, through efforts to reduce the vulnerability of societies to climate-sensitive hazards — whether those hazards are caused by climate change or other factors. This analysis is limited to the short and medium term because long-term socioeconomic scenarios extending beyond 2085 are not credible.[7] Consequently, it will not consider potentially high-impact, low-probability events such as a radical change in oceanic currents (specifically, the thermohaline) or complete melting of the Greenland or West Antarctic Ice Sheets. These are unlikely to occur during this century.[8]

"Spending less than $10 billion a year to adapt to climate change is far more beneficial than spending $160 billion a year on the Kyoto Protocol."

Except where noted, this paper adopts the results of recent studies sponsored by the United Kingdom's Department of Environment, Food and Rural Affairs (DEFRA) or its predecessor agency, the U.K. Department of the Environment, Transport and the Regions (DETR).[9] It does so mainly because their results, available in the peer-reviewed literature, have been used to justify additional and more rapid control of greenhouse gases.[10] Notably, the authors of these studies are in good standing with the IPCC. They include Martin Parry, the current chairman of IPCC's Work Group 2, which is charged with producing the IPCC's upcoming assessment of the impacts of climate change, as well as several "lead authors" of various chapters of that assessment.

Nevertheless, there are significant shortcomings in these studies. In particular, their analyses of projected impacts do not adequately account for the improved range of social responses that would result from the higher level of economic development they assume in generating future emissions scenarios and climate change projections. Specifically, increased economic development should reduce society's vulnerability to climate change because greater wealth will allow it to develop and obtain the technologies necessary to reduce the adverse impacts of climate change, while also taking advantage of any opportunities that climate change might offer.[11] In other words, economic development increases "adaptive capacity." Nor do these studies account for the technological innovation that would necessarily occur over time and as societies grow richer. This, too, should reduce the future vulnerability of societies to the impacts of climate change.[12] Consequently, the DEFRA-sponsored studies are internally inconsistent with the emission growth scenarios on which they are based, and their impact estimates are probably biased upward.[13]

"Adaptation can solve the problems of malaria, hunger, water shortage, coastal flooding and habitat loss more effectively and certainly than emissions reductions."

This paper will examine the impact of climate change under five emission control scenarios. In order of increasing stringency, they are: unmitigated emissions, the Kyoto Protocol, stabilization of atmospheric CO_2 at 750 ppm in 2250, stabilization at 550 ppm in 2150, and, as a baseline, "no climate change." Under these scenarios the increase in the global mean temperature between 1990 and 2085 would be held to 3.2°C, 3.0°C, 1.8°C, 1.4°C and (of course) 0°C, respectively.[14]

In this analysis, the magnitudes of the problems of malaria, hunger, water shortage and coastal flooding are measured by the global population at risk or suffering from the specific hazard. The magnitude of the problem of biodiversity loss is measured by global losses in the extent of forests and coastal wetlands.

Global Population at Risk with and without Climate Change

Table I, based on the results of the DEFRA-sponsored studies noted above, indicates the total population at risk from malaria, hunger, water shortage and coastal flooding in 2085 assuming: (a) no climate change, and (b)

TABLE I

Magnitude of Problem

Climate-Sensitive Risk Factor	Population at Risk in 1990 (in millions)	Population at Risk in 2085 if No Climate Change after 1990 (in millions)	Net Increase in Population at Risk in 2085 Due to "Unmitigated Emissions" (in millions)	Contribution of Unmitigated Climate Change to Population at Risk in 2085
Malaria	4,413	8,820	256 to 323	2.8 to 3.5%
Hunger	521	300	69 to 91	18.7 to 23.3%
Cereal Production (*millions of metric tons)	1,800*	4,000*	-73*	-1.9%*
Water Shortage	1,750	6,464	-2,387 to 862	-58.5 to 11.8%
Coastal Flooding	10	13	81	86.2%

Sources: For water shortage, N.W. Arnell, "Climate change and water resources," *Global Environmental Change*, No. 9, 1999, pages S31-49; and, for all others, N.W. Arnell, et al., "The Consequences of CO_2 Stabilization for the Impacts of Climate Change," *Climatic Change*, Vol. 53, No. 4, June 2002.

unmitigated emissions. In addition to providing the global population at risk from hunger, this — and subsequent — tables also show estimates of the corresponding changes in global cereal production, a surrogate for global food production.

"Studies sympathetic to mitigation show that adaptation is preferable."

Table II provides estimates of the reduction in total global population at risk under each of the four mitigation scenarios — from the least stringent mitigation scenario — the Kyoto Protocol — on the left, to the most stringent, "no climate change" scenario, on the right.

Let us look at the hazards individually. In particular, I will compare the relative costs and benefits of amelioration through what I will call "focused adaptation" against those due to different mitigation scenarios.

Malaria. Table I shows that the current population at risk from malaria will grow from 4.4 billion today to 8.8 billion in 2085, even in the absence of climate change, due to increased population in developing countries where the disease is epidemic. This is about 80 percent of the projected world population in 2085**,** according to the scenario used in the DEFRA-sponsored studies. Climate change would add only marginally to the population at risk in 2085, due to an increase in the range of mosquitoes, for example, to higher altitudes. Table II shows that:

"Global warming will have a minor effect on malaria."

- The Kyoto Protocol would reduce the total number of people at risk in 2085 by 0.2 percent while costing, as noted previously, about $165 billion in 2010 alone.
- Reductions in the population at risk of malaria from stabilization at either 550 ppm or 750 ppm would be even smaller, amounting to 0.4 percent and 1.3 percent, respectively, while costing trillions of dollars.[15]
- Curiously enough, stabilizing CO_2 at 750 ppm would reduce the total global population at risk for malaria in 2085 more than stabilization at 550 ppm — by 1.3 percent versus 0.4 percent. The reason: climate change will alter temperature and precipitation patterns in ways that sometimes will favor mosquito propagation and malaria transmission, and at other times will not.
- Halting further climate change as of 1990 (if that were possible) would at best reduce the total problem of malaria in 2085 by 3.2 percent.

TABLE II

Percent Reduction in Total Population at Risk in 2085

Climate-Sensitive Risk Factor	Due to the Kyoto Protocol	Stabilization Path Toward 750 PPM	Stabilization Path Toward 550 PPM	No Climate Change
Malaria	0.2%	1.3%	0.4%	3.2%
Hunger	1.5%	16.6%	9.7%	21.1%
Cereal Production (*percent change in production)	-0.1%*	-1.5%*	-0.6%*	-1.9%*
Water Shortage	-4.1% to 0.8%			-58.6% to 11.8%
Coastal Flooding	18.1%	62.8%	80.1%	86.2%

Note: Negative sign for cereal production indicates that yields would increase under unmitigated climate change, while for water shortage it indicates a worsening situation.

Sources: N.W. Arnell, et al., "The Consequences of CO_2 Stabilization for the Impacts of Climate Change," *Climatic Change*, Vol. 53, No. 4, June 2002; and N.W. Arnell, "Climate change and water resources," *Global Environmental Change*, No. 9, 1999, pages S31-49. Reductions due to Kyoto Protocol are per Indur M. Goklany, "Relative Contributions of Global Warming to Various Climate Sensitive Risks, and Their Implications for Adaptation and Mitigation," *Energy & Environment*, Vol. 14, No. 6, November 1, 2003.

But, according to the World Health Organization (WHO),[16] malaria's current annual death toll of one million could be *halved* with annual expenditures of $1.5 billion or less (in 2003 dollars)[17] by attacking present-day vulnerabilities, through such measures as further development and better delivery of public health services for — and research targeted at — better treatment and prevention of malaria.

"Malaria's one million annual death toll could be cut in half for $1.5 billion annually."

Therefore, even if the WHO's cost estimate is overly optimistic by an order of magnitude, the benefits of reducing current populations' vulnerability to malaria now would be much greater and cost significantly less than actions proposed under the Kyoto Protocol.

Notably, developing and/or instituting adaptive measures — technologies, practices and institutions — to reduce vulnerability to malaria today will also help reduce malaria tomorrow, whether the risk of disease is due to warming or unrelated factors. These measures would reduce risks to 100 percent of the global population at risk today and in 2085, while mitigation would at most address the problem of only 3.2 percent of the at-risk population in 2085, and an even smaller proportion of the billions of people at risk annually between now and then**.**

Perhaps even more important, reducing malaria in developing countries today would enhance those countries' adaptive capacity. It would improve public health, and assure fuller development of their human capital and potential for economic development, which would enhance their resiliency and reduce their vulnerability to any adversity, whether caused by warming or another agent.[18]

Hunger and Food Production. Today, at least 521 million people worldwide are at risk of hunger. The good news is that their numbers are expected to fall to 300 million in 2085, despite an increase in global population, due to continuing increases in agricultural productivity. However, global warming is expected to partly offset that decline, exposing an additional 69 million to 91 million people to food shortages by 2085. This would occur due to a slight fall in the rate of global agricultural productivity growth, as changing weather patterns increase drought and reduce soil moisture in many developing areas. As with malaria, stabilizing CO_2 concentrations at 750 ppm would reduce the total global population at risk for hunger in 2085 by a greater amount than pursuing stabilization at 550 ppm. The reason is that fertilization from atmospheric carbon benefits crops, and the CO_2 concentration under the 750 ppm stabilization pathway is higher than under the 550 ppm pathway.

Table II also indicates that post-1990 warming would be responsible for 21 percent of the total global population at risk for hunger by 2085. This amount, seemingly large, is, in fact, the result of a small (1.9 percent) warming-related drop in future global food production between 1990 and 2085. In effect, unmitigated warming would reduce the annual growth in food pro-

ductivity from 0.84 percent per year to 0.82 percent per year.[19] But in the 1990s the world spent about $33 billion annually on agricultural research and development (R&D), including $12 billion in developing countries. Therefore increasing R&D investment, say, by $5 billion per year, should more than compensate for the 0.02 percent annual shortfall caused by unmitigated warming, particularly if the additional investment is focused on solving current agricultural problems in developing countries that might otherwise be exacerbated by warming.[20] Thus, as shown in Table II:

- Meeting the Kyoto Protocol's emission reduction targets would reduce the population at risk of hunger by approximately 1.5 to 2 percent in 2085.
- Stabilizing CO_2 emissions at 550 ppm would reduce the population at risk of hunger by approximately 9.7 percent in 2085.
- By contrast, investing an additional $5 billion to solve agricultural problems that developing countries face today would reduce the population at risk of hunger by 50 percent — beginning today, and in 2085, and in the intervening years.

"Investing $5 billion a year in agricultural research could cut world hunger in half, whereas spending 30 times as much on emissions reductions would, at best, reduce hunger less than 2 percent."

The agricultural problems of developing countries include growing crops in poor climatic or soil conditions. Should warming cause such conditions to spread, agriculture might have to expand further into areas with low soil moisture or too much water, or soils that are highly saline, alkaline or acidic. Thus actions to improve current agricultural production under marginal conditions would alleviate hunger in the future whether or not the climate changes. Similarly, since science cannot predict increases in CO_2 and temperatures in any particular area, crops should be developed to take advantage of such conditions as and when they develop. But even if we don't know what changes will occur precisely where, we can make substantial progress on these approaches in the short-to-medium term.[21] Such focused measures should be complemented by measures that would broadly increase agricultural productivity.[22]

By 2085, the measures outlined above would not only help reduce the 80 million increase in global population at risk for hunger due to unmitigated warming, but also the 300 million at risk due to factors unrelated to warming.[23] Equally important, they would do more than any mitigation efforts to reduce global population at risk for hunger in the interim, whether it is 521 million people in 1990 or 300 million in 2085 (Table I). Moreover, the additional R&D investment is relatively modest compared to the costs associated with the Kyoto Protocol.

This approach would also boost the adaptive capacity of developing countries by improving public health, enhancing human capital and economic growth, and in turn reducing their vulnerability to any adversity, whether caused by warming or another agent.[24] Furthermore, this approach would produce other benefits, including:

- Reduced demand for additional agricultural land by increasing food production per unit of cultivated land. This would limit conversion of habitat to agriculture, which is the biggest threat to global terrestrial biodiversity. Reducing habitat fragmentation and loss of migratory corridors would, in turn, help species adapt more "naturally" via migration and dispersion, and also conserve carbon stores and sinks (for sequestration of carbon removed from the atmosphere) and, thereby, aid mitigation.[25]
- As discussed below, reduced demand for agricultural water will help overcome what could be the major future constraint on meeting global food needs — insufficient water[26] — and reduce pressure on global freshwater biodiversity.

"Reducing agricultural water use 18 percent would double the availability of water for all other uses."

Water Shortages. Today, 1.75 billion people face shortages of fresh water suitable for irrigation or industrial and household uses. This is expected to increase to 6.5 billion people by 2085, due to the increasing population of poorer countries. Global warming may increase the number at risk by nearly 13 percent (862 million) in 2085 — or it may have a positive effect, cutting the population at risk by more than a third (37 percent), or 2.4 billion people. Mitigation will produce, at best, marginal benefits, but may do more harm than good:

- Meeting the Kyoto Protocol's emission reduction targets would, at best, reduce the population facing water shortages by 1 percent in 2085 — and could, in fact, exacerbate the problem.
- Stabilizing CO_2 emissions at 550 ppm would, at best, reduce the population facing water shortages in 2085 by 860 million, but could increase the population at risk by 2.4 billion.

Table II indicates that warming might, in fact, reduce water shortages in some areas. The actual affect depends on changes in weather patterns that occur with global warming, which climate models are currently unable to project accurately on a regional basis. Thus mitigation would make matters worse for people in these areas — reducing, if not eliminating, net water-related benefits from mitigation. This unfortunate outcome also holds for other hazards for which warming results in a mix of positive and negative outcomes, such as food production. By contrast, adaptation allows communities to capture the benefits of warming while reducing, if not avoiding, the downsides. And measures taken to reduce water shortages now will also help relieve them in the future.

Measures that would help societies cope with present and future water shortages regardless of cause include institutional reforms to treat water as an economic commodity by allowing market pricing and transferable property rights to water. Such institutional reforms should stimulate widespread adoption of existing but underused conservation technologies, and lead to more

private sector R&D investment that would reduce the demand for water by all sectors — for example, by developing new or improved crops and techniques to increase agricultural water use efficiency. Private sector spending should be supplemented by additional public sector resources.

Improvements in water conservation following such reforms are likely to be most pronounced for the agricultural sector, which is responsible for 85 percent of global water consumption.[27] An 18 percent reduction in agricultural water consumption would, on average, *double* the amount of water available for all other uses, including household, industry and in-stream uses (such as recreation and conservation of aquatic species). The last would reduce pressures on freshwater biodiversity due to water diversion, which, as noted, is the greatest threat to freshwater biodiversity.

"Coastal barriers and planned retreat would address flooding at a cost of $1 billion a year."

Coastal Flooding. Today, 10 million people are at risk of coastal flooding, and this number is projected to increase by 3 million by 2085 as coastal populations increase. If there is any hazard for which emission reductions ought to be more cost-effective than adaptation, it is coastal flooding. By 2085, the studies underlying Table II project that unmitigated warming will raise the global sea level by 0.41 meters (16 inches)[28] — due to such factors as melting ice sheets, storm surges and thermal expansion — putting an additional 81 million people at risk and thus contributing 86 percent of the total global population at risk of coastal flooding. However, the risk of flooding to coastal population can be reduced, if not eliminated, for relatively little additional investment:

- Meeting the Kyoto Protocol's emission reduction targets would reduce the total population at risk from coastal flooding in 2085 by 18 percent
- Stabilizing CO_2 emissions at 550 ppm would reduce the total population at risk from coastal flooding by approximately 80 percent in 2085.[29]
- By contrast, investing an additional $1 billion annually in preventive measures — like building sea walls and other hardened structures and an orderly relocation of coastal populations — would address this problem just as well, if not more effectively.[30]

Thus significant emission reductions would not only cost more but could also provide less protection in 2085 than an adaptive approach that would protect against flooding.

Pressures on Natural Systems: Global Forests and Coastal Wetlands. Table III compares projected changes in the global area of forests and coastal wetlands with and without unmitigated climate change. Due to development and agriculture, the forested area of the world is expected to fall 25 percent to 30 percent by 2050 and the area of coastal wetlands are expected to decline 40 percent by 2085. The major risk to biodiversity is the loss of natural habitat to development. Increased levels of atmospheric CO_2 favor plant

"Development and agriculture could cause a greater reduction in global forests and wetlands than global warming for the foreseeable future."

TABLE III

Projected Changes in Extent of Various Ecosystems, with and without Climate Change

(relative to 1990)

Ecosystem	Change in Baseline (no climate change)	Impact of Unmitigated Climate Change (excluding land use changes)
Potential Forests (global area)	Decrease 25-30% in 2050	Increase by 5% in 2085
Coastal Wetlands (global area)	Decrease by 40% in 2085	Decrease by 13% in 2085

Sources: N.W. Arnell, et al., "The Consequences of CO_2 Stabilization for the Impacts of Climate Change," *Climatic Change*, Vol. 53, No. 4, June 2002; and, for 2050 decrease in forests, Intergovernmental Panel on Climate Change, *Climate Change 1995: Impacts, Adaptation, & Mitigation of Climate Change* (New York: Cambridge University Press, 1996), pages 95-129, 492-496.

growth; however, the effects of global warming on sea levels and weather patterns could reduce wetland areas. Between now and 2085, global warming could increase forested areas by 5 percent; but it could reduce the area of coastal wetlands another 13 percent. Whether increases in global forest area can be sustained beyond that under the unmitigated emissions scenario is another matter.

Table III also indicates that unless baseline problems are addressed relatively quickly, a substantial portion of currently existing global forests and wetlands might be converted to other uses, and the benefits of mitigation may arrive too late to stem the loss of habitat (and biodiversity).

As previously noted, many steps taken now to reduce hunger and water shortage — such as enhancing food productivity per unit of land and water — would in fact decelerate, if not forestall, further diversion of land and water to human uses and reduce habitat fragmentation. This is illustrated for land conversion by Figure I, which indicates the inverse relationship between cropland demand and increases in average annual agricultural productivity. It shows that if agricultural productivity increases by 1.0 percent per year between 1990 and 2085, rather than the 0.84 percent estimated under the unmitigated emissions scenario, the area devoted to cropland could be reduced by 13.7 percent without worsening global hunger, all else being equal. [31]

Enhancing agricultural productivity would, therefore, reduce the socioeconomic cost of setting aside any land or water for *in situ* conservation,[32] which is one of the goals of the 1992 UN Convention on Biological Diversity. It would also reduce the costs associated with carbon sequestration. More-

over, reducing habitat loss and fragmentation would advance one of the principal objectives of the UN Framework Convention on Climate Change enshrined in Article 2, namely, to allow ecosystems to adapt naturally to climate change.

It is often argued that adaptation is inferior to mitigation because the former does not adequately reduce the impacts of climate change on natural systems.[33] But, as the foregoing discussion indicates, adaptation can, indeed, relieve pressures on natural systems. Over the next few decades adaptive steps taken now could more effectively conserve biodiversity than any mitigation efforts.[34]

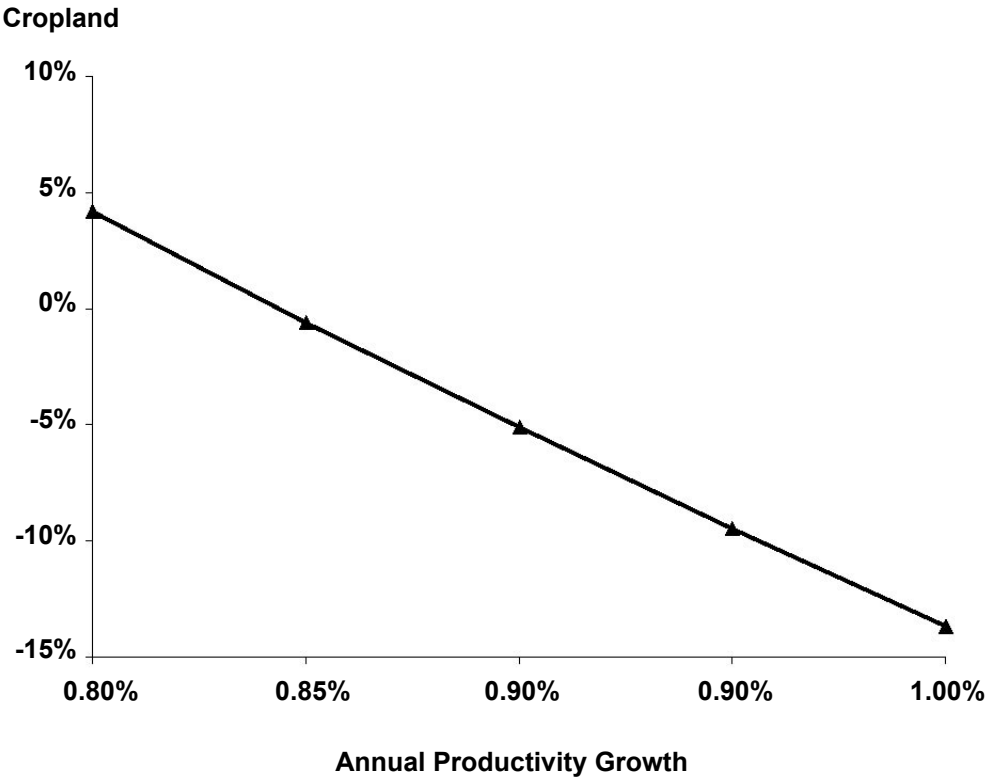
Integrating Mitigation, Adaptation and Sustainable Development

We have examined two approaches to address warming through the foreseeable future. The first, mitigation, would modestly reduce positive and

"Increasing farm productivity would reduce the area devoted to agriculture and limit habitat loss more effectively than reducing global warming."

FIGURE I

Decline in Cropland Needed in 2085 versus Annual Productivity Growth



Note: The potential decline in cropland by 2085 depends on the average annual agricultural productivity increase between 1990 and 2085. The figure assumes that food production in 2085 will be maintained at the same level as projected under the "unmitigated emissions" case.

negative impacts across the board. It entails significant near-term costs, but a delayed pay-off. The second approach, "focused adaptation," would reduce vulnerability to climate-sensitive hazards now and through 2085 by pursuing measures focused on reducing each of these hazards at the present time.

However, developing countries are most vulnerable to warming because they lack the adaptive capacity needed to cope with the adverse impacts of climate change; therefore a third approach to address climate change is to increase their adaptive capacity by enhancing economic development and human capital. That, of course, is precisely the point of sustainable development.[35] Moreover, the determinants of adaptive and mitigative capacity[36] — economic development, human capital and a propensity for technological innovation — are largely the same. Thus enhancing adaptive capacity should also boost mitigative capacity.[37]

An integrated strategy — simultaneously pursuing sustainable development while advancing the capacity to adapt to and/or mitigate climate change — can be pursued through the United Nations' Millennium Development Goals (MDGs), which were explicitly devised to advance sustainable development in poorer countries. The MDGs are: cutting global poverty, hunger, and lack of access to safe water and sanitation in half; reducing child and maternal mortality by two-thirds or more; achieving universal primary education; and reversing the growth of malaria, AIDS/HIV, and other major diseases. The benefits of achieving the millennial goals would generally exceed those flowing from focused adaptation or even the deepest mitigation. Yet, the additional annual cost to the richest countries of attaining the MDGs by 2015 is pegged by the U.N.'s Millennium Project at about 0.5 percent of their GDP.[38] That is approximately the same cost as that of the barely-effective Kyoto Protocol, and much less than the cost of stabilization at either 750 or 550 ppm.

"Economic growth would help developing countries solve existing problems and adapt to climate change."

Moreover, in addition to costing less, an integrated approach would yield benefits sooner and, because of the uncertainties related to warming and its impacts, far more certainly than mitigation alone. In addition, increased adaptive capacity would either raise the level at which greenhouse gases would need to be stabilized to forestall warming from becoming "dangerous," or allow mitigation to be postponed, or both. In any case, costs associated with any eventual stabilization could be reduced, particularly if, in the interim, resources are expended to improve the cost-effectiveness of mitigation options. And, as noted, such an approach would be entirely consistent with Kyoto's objectives, outlined in Article 2, "to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner."

Finally, mitigation proponents argue that climate change would otherwise hinder sustainable development and lock developing nations into poverty.[39] However, through 2085, the impacts of unmitigated warming are either

smaller than the baseline problems that would exist in the absence of warming or it is more cost-effective to reduce the magnitude of the total problem via adaptation than through mitigation. Thus, even if mitigation is inevitable in the longer term — beyond 2085 — the problem *through the foreseeable future* is not that climate change will perpetuate poverty and hinder sustainable development, but that the lack of sustainable economic development will impede developing countries' ability to cope with all manner of adversity, including climate change.[40]

Conclusion: Solving Today's Problems without Ignoring Tomorrow's

Many scientists and politicians have declared that global warming is the most important environmental challenge facing the globe.[41] British Prime Minister Tony Blair and French President Jacques Chirac in a joint declaration proclaimed that "Climate change is the world's greatest environmental challenge."[42] Contrary to these claims, the magnitude of the problems caused by unmitigated climate change is generally smaller than the magnitude of the problems due to non-climate-change related factors over the foreseeable future; and where it is not, as in the case of coastal flooding, adaptation is a more economical remedy. Therefore, global warming is unlikely to be the most important environmental problem facing the world, at least for most of the remainder of this century.

"Sustainable economic development would benefit societies now, as well as in the future."

For the next several decades, any mitigation scheme, whether it is as modest in its effect as the Kyoto Protocol or as ambitious as stabilizing CO_2 concentrations, would expend scarce resources without commensurate improvements in global well-being. Despite the claim that mitigation would help developing nations in particular, it would not cost-effectively reduce the enormous present-day risks to the health and well-being of their populations that climate change could exacerbate. On the other hand, increasing adaptive capacity is likely to reduce these risks faster, more cost-effectively and by a greater amount. Equally important, various indicators of human well-being that aren't sensitive to climate change would also be advanced much further, faster and more economically by advancing sustainable development and/or reducing current vulnerabilities to urgent climate-sensitive problems. These measures would, incidentally, also contribute to mitigation and to an increase in mitigative capacity.

Some have argued for some mitigation as an insurance policy. But enhancing adaptive capacity is better than a climate insurance policy. By addressing urgent and larger baseline problems, it will pay handsome dividends whether or not climate changes. And if climate does change, it will help reduce attendant risks much more contemporaneously with incurred costs than is possible through mitigation.

Assuming it takes 50 years to replace the energy infrastructure, we have at least 30 years (2085 - 50 = 2035) before deciding on targets and timetables for emission cuts. In the meantime, we should focus on increasing adaptive capacity over all time horizons. This could raise the level at which greenhouse gas concentrations could become "dangerous" and/or allow mitigation to be postponed. Simultaneously, we should strive to make mitigation more cost-effective so that, if or when mitigation becomes necessary, net costs would be lower even if emission reductions have to be more drastic.

Accordingly, we should first and foremost pursue a broad adaptive strategy based on advancing sustainable development. Second, we should take measures to reduce vulnerability to today's urgent climate-sensitive risks — hunger, malaria, water shortages, coastal flooding, and pressures on biodiversity — that warming could exacerbate. Together, these efforts would improve human well-being and enhance adaptive capacity of vulnerable developing countries. This can be accomplished while incidentally advancing sequestration and enhancing mitigative capacity more broadly by augmenting economic resources and human capital.

"Developing the economies of poor countries is the best insurance against climate change."

Third, we should implement "no-regret" mitigation measures — for example, eliminating subsidies for energy consumption, land conversion and agricultural overproduction in developed countries — while constantly expanding the universe of such measures through R&D designed to improve their cost-effectiveness. Finally, we should continue to advance knowledge of climate change science, economics and responses to better evaluate and determine trade-offs and synergies between adaptation and mitigation. Meanwhile, we should continue to monitor trends to provide advance warning should the adverse impacts of warming occur faster, or threaten to be more severe or more likely than is currently projected.[43]

Such a climate policy would solve some of the most critical problems facing the world today and tomorrow while preparing it to address the uncertain problems of the day after tomorrow, of which climate change is but one among many.

NOTE: Nothing written here should be construed as necessarily reflecting the views of the National Center for Policy Analysis or as an attempt to aid or hinder the passage of any bill before Congress.

Notes

[1] Views expressed here are the author's. This paper draws on a presentation at the Symposium sponsored by the U.K. Department for Environment, Food and Rural Affairs, "Avoiding Dangerous Climate Change," Exeter, February 1 to 3, 2005.

[2] Indur M. Goklany, "Relative Contributions of Global Warming to Various Climate Sensitive Risks, and Their Implications for Adaptation and Mitigation," *Energy & Environment,* Vol. 14, No. 6, November 1, 2003, pages 797-822.

[3] IPCC, *Climate Change 2001: Synthesis Report* (New York: Cambridge University Press, 2001).

[4] The cumulative GDP of Annex I countries in 2003 was $29 trillion in 2003 dollars; World Bank, World Development Indicators Online (Washington, D.C.: World Bank, April 2005). Available at http://www.worldbank.org/data/wdi2005/wditext/Cover.htm. By 2010 their GDP should be $33 trillion (also in 2003 dollars), assuming that they continue to grow at the same rate as they did between 1996 and 2003.

[5] Robert T. Watson, et al., Intergovernmental Panel on Climate Change, *Climate Change 2001: Synthesis Report* (New York: Cambridge University Press, 2001), page 100.

[6] Martin L. Parry, et al., "Millions at Risk: Defining Critical Climate Change Threats and Targets," *Global Environmental Change,* Vol. 11, No. 3, October 9, 2001, pages 181-183; David A. King, "Climate Change Science: Adapt, Mitigate, or Ignore?" *Science,* Vol. 303, No. 5655, January 9, 2004, pages 176-177.

[7] N.W. Arnell, et al., "The Consequences of CO2 Stabilization for the Impacts of Climate Change," *Climatic Change,* Vol. 53, No. 4, June 2002, pages 413-446.

[8] U.K. Department for Environment, Food and Rural Affairs (DEFRA), *Scientific and Technical Aspects of Climate Change, Including Impacts and Adaptation and Associated Costs* (London: DEFRA, September 2004). Available online at www.defra.gov.uk/environment/climatechange/pdf/cc-science-0904.pdf.

[9] Martin L. Parry, et al., "A New Assessment of the Global Effects of Climate Change," *Global Environmental Change,* Vol. 9, Supplement 1, October 25, 1999, pages S51-S67; N.W. Arnell, et al., "The Consequences of CO2 Stabilization for the Impacts of Climate Change," *Climatic Change,* Vol. 53, No. 4, June 2002, pages 413-446.

[10] Martin L. Parry, et al., "Millions at Risk: Defining Critical Climate Change Threats and Targets," *Global Environmental Change,* Vol. 11, Issue 3, October 9, 2001, pages 181-183; N.W. Arnell, et al., "The Consequences of CO2 Stabilization for the Impacts of Climate Change," *Climatic Change,* Vol. 53, No. 4, June 2002, pages 413-446; David A. King, "Climate Change Science: Adapt, Mitigate, or Ignore?" *Science,* Vol. 303, No. 5655, January 9, 2004, pages 176-177.

[11] Indur M. Goklany, "Potential Consequences of Increasing Atmospheric CO_2 Concentration Compared to Other Environmental Problems," *Technology,* Vol. 7, Supplement 1, 2000, pages 189-213; Indur M. Goklany, "Economic Growth and the State of Humanity," Political Economy Research Center, Policy Series No. 21, April 2001.

[12] Ibid.

[13] Indur M. Goklany, "Relative Contributions of Global Warming to Various Climate Sensitive Risks, and Their Implications for Adaptation and Mitigation," *Energy & Environment,* Vol. 14, No. 6, November 1, 2003, pages 797-822.

[14] The increases under all scenarios but the Kyoto Protocol are based on Martin L. Parry, et al., "Millions at Risk: Defining Critical Climate Change Threats and Targets," *Global Environmental Change,* Vol. 11, Issue 3, October 9, 2001, pages 181-183. The temperature increase under the Kyoto Protocol is assumed to be 7 percent below the uncontrolled case, which is an overestimate. See Indur M. Goklany, "Relative Contributions of Global Warming to Various Climate Sensitive Risks, and Their Implications for Adaptation and Mitigation," *Energy & Environment*.

[15] Robert T. Watson, et al., Intergovernmental Panel on Climate Change, *Climate Change 2001: Synthesis Report* (New York: Cambridge University Press, 2001).

[16] World Health Organization, *World Health Report 1999* (Geneva: World Health Organization, 1999).

[17] World Health Organization, *World Health Report 1999* (Geneva: World Health Organization, 1999) specifies that malaria deaths could be halved at a cost of less than $1.25 billion. The $1.5 billion is calculated assuming that WHO's estimates are in terms of 1995 dollars and that average inflation rate between 1995 and 2003 is 2 percent per annum, which is relatively close to the GDP deflator for the United States per the World Bank, *World Development Indicators Online* (Washington, D.C.: World Bank, April 2005). Available at http://www.worldbank.org/data/wdi2005/wditext/Cover.htm.

[18] Indur M. Goklany, "Potential Consequences of Increasing Atmospheric CO_2 Concentration Compared to Other Environmental Problems," *Technology*; Indur M. Goklany, "Economic Growth and the State of Humanity," Political Economy Research Center, Policy Series No. 21, April 2001.

[19] This calculation assumes that changes in food production would be achieved through changes in productivity; that is, effectively increasing yields, rather than the area under cultivation.

[20] Indur M. Goklany, "Relative Contributions of Global Warming to Various Climate Sensitive Risks, and Their Implications for Adaptation and Mitigation," *Energy & Environment*.

[21] Ibid.

[22] Indur M. Goklany, "Saving Habitat and Conserving Biodiversity on a Crowded Planet," *BioScience,* Vol. 48, November 1998, pages 941-953; Indur M. Goklany, "Comparing 20th Century Trends in U.S. and Global Agricultural Land and Water Use," *Water International*, Vol. 27, No. 3, September 2002, pages 321-329.

[23] N.W. Arnell, et al., "The Consequences of CO2 Stabilization for the Impacts of Climate Change," *Climatic Change,* Vol. 53, No. 4, June 2002, pages 413-446.

[24] Indur M. Goklany, "Economic Growth and the State of Humanity," Political Economy Research Center, Policy Series, No. 21, April 2001.

[25] Indur M. Goklany, "Relative Contributions of Global Warming to Various Climate Sensitive Risks, and Their Implications for Adaptation and Mitigation," *Energy & Environment*.

[26] Indur M. Goklany, "Comparing 20th Century Trends in U.S. and Global Agricultural Land and Water Use," *Water International*, Vol. 27, No. 3, September 2002, pages 321-329; Indur M. Goklany, "Relative Contributions of Global Warming to Various Climate Sensitive Risks, and Their Implications for Adaptation and Mitigation," *Energy & Environment*.

[27] Indur M. Goklany, "Comparing 20th Century Trends in U.S. and Global Agricultural Land and Water Use," *Water International*, Vol. 27, No. 3, September 2002, pages 321-329.

[28] Mike Hulme, et al., "Climate Change Scenarios for Global Impact Studies," *Global Environmental Change,* Vol. 9, Supplement 1, October 25, 1999, pages S3-S19.

[29] Robert T. Watson, et al., Intergovernmental Panel on Climate Change, *Climate Change 2001: Synthesis Report*.

[30] Intergovernmental Panel on Climate Change, *Climate Change 1995: Economic & Social Dimensions of Climate Change* (New York: Cambridge University Press, 1996), page 191.

[31] N.W. Arnell, et al., "The Consequences of CO2 Stabilization for the Impacts of Climate Change," *Climatic Change*; and, for 2050 decrease in forests, Intergovernmental Panel on Climate Change, *Climate Change 1995: Impacts, Adaptation, & Mitigation of Climate Change*, pages 95-129, 492-496.

[32] Indur M. Goklany, "Saving Habitat and Conserving Biodiversity on a Crowded Planet," *BioScience*; Indur M. Goklany, "Comparing 20th Century Trends in U.S. and Global Agricultural Land and Water Use," *Water International*; Indur M. Goklany, "Relative Contributions of Global Warming to Various Climate Sensitive Risks, and Their Implications for Adaptation and Mitigation," *Energy & Environment*.

[33] Robert T. Watson, et al., Intergovernmental Panel on Climate Change, *Climate Change 2001: Synthesis Report*; T.J. Wilbanks, et al., "Possible Responses to Global Climate Change: Integrating Mitigation and Adaptation," *Environment*, Vol. 45, June 2003, pages 28-38.

[34] Goklany, manuscript in preparation.

[35] Indur M. Goklany, "Strategies to Enhance Adaptability: Technological Change, Economic Growth and Free Trade," *Climatic Change,* Vol. 30, 1995, pages 427-449; Indur M. Goklany, "Potential Consequences of Increasing Atmospheric CO2 Concentration Compared to Other Environmental Problems," *Technology,* Vol. 7, Supplement 1, 2000, pages 189-213; Indur M. Goklany, "Economic Growth and the State of Humanity," Political Economy Research Center, Policy Series No. 21, April 2001.

[36] Robert T. Watson, et al., Intergovernmental Panel on Climate Change, *Climate Change 2001: Synthesis Report*; Gary W. Yohe, "Mitigative Capacity: The Mirror Image of Adaptive Capacity on the Emissions Side," *Climatic Change*, Vol. 49, No. 3, May 2001, pages 247-262.

[37] Indur M. Goklany, "Strategies to Enhance Adaptability: Technological Change, Economic Growth and Free Trade," *Climatic Change*. See also Goklany, manuscript in preparation.

[38] UN Millennium Project, *Investing in development: A practical plan to achieve the Millennium Development Goals* (New York: EarthScan and UN Millennium Project, 2005).

[39] R. Watson and I. Johnson, "Developing Countries Face Worst in Global Warming," *Business Day* (Johannesburg), July 23, 2001. Available online at www.allafrica.com/stories/200107230695.html; Andrew Simms, et al., *Up in Smoke: Threats from, and Responses to, the Impact of Global Warming on Human Development* (London: New Economics Foundation, October 20, 2004).

[40] Julian Morris, *Sustainable Development: Promoting Progress or Perpetuating Poverty* (London: Profile Books, 2002); Indur M. Goklany, "Economic Growth and the State of Humanity," Political Economy Research Center.

[41] Cordis News, "Reducing Global Warming Is Our Priority, Say Chirac and Blair," Cordis News, November 19, 2004; David A. King, "Climate Change Science: Adapt, Mitigate, or Ignore?" *Science*, Vol. 303, No. 5655, January 9, 2004, pages 176-177.

[42] Cordis News, "Reducing Global Warming Is Our Priority, Say Chirac and Blair," Cordis News, November 19, 2004.

[43] Indur M. Goklany, "Relative Contributions of Global Warming to Various Climate Sensitive Risks, and Their Implications for Adaptation and Mitigation," *Energy & Environment*.

About the Author

Indur M. Goklany has 30-plus years in federal and state governments, and the private sector, during which he has written more than one hundred monographs, book chapters and papers on topics ranging from climate change, human well-being, economic development, technological change and biotechnology to sustainable development. He has been a visiting fellow with the American Enterprise Institute, and was the first Julian Simon Fellow at the Political Economy Research Center in Bozeman, Montana. Working for the U.S. Department of the Interior, he has represented the United States at the International Panel on Climate Change and in the negotiations leading to the United Nations Framework Convention on Climate Change. He received his Ph.D. and other degrees in electrical engineering from the Indian Institute of Technology, Bombay, and Michigan State University. He is also the author of *Clearing the Air: The Real Story of the War on Air Pollution* and *The Precautionary Principle*, both published by the Cato Institute. His next book, *Extending the Limits: Improving the State of Humanity and the Environment*, is due out next year. Opinions and views expressed by Dr. Goklany are his alone, and not necessarily those of any institution with which he is associated.

About the NCPA

The NCPA was established in 1983 as a nonprofit, nonpartisan public policy research institute. Its mission is to seek innovative private sector solutions to public policy problems.

The center is probably best known for developing the concept of Medical Savings Accounts (MSAs), now known as Health Savings Accounts (HSAs). The *Wall Street Journal* and *National Journal* called NCPA President John C. Goodman "the father of Medical Savings Accounts." Sen. Phil Gramm said MSAs are "the only original idea in health policy in more than a decade." Congress approved a pilot MSA program for small businesses and the self-employed in 1996 and voted in 1997 to allow Medicare beneficiaries to have MSAs. A June 2002 IRS ruling frees the private sector to have flexible medical savings accounts and even personal and portable insurance. A series of NCPA publications and briefings for members of Congress and the White House staff helped lead to this important ruling. In 2003, as part of Medicare reform, Congress and the President made HSAs available to all non-seniors, potentially revolutionizing the entire health care industry.

The NCPA also outlined the concept of using tax credits to encourage private health insurance. The NCPA helped formulate a bipartisan proposal in both the Senate and the House, and Dr. Goodman testified before the House Ways and Means Committee on its benefits. Dr. Goodman also helped develop a similar plan for then presidential candidate George W. Bush.

The NCPA shaped the pro-growth approach to tax policy during the 1990s. A package of tax cuts, designed by the NCPA and the U.S. Chamber of Commerce in 1991, became the core of the Contract With America in 1994. Three of the five proposals (capital gains tax cut, Roth IRA and eliminating the Social Security earnings penalty) became law. A fourth proposal — rolling back the tax on Social Security benefits — passed the House of Representatives in summer 2002.

The NCPA's proposal for an across-the-board tax cut became the focal point of the pro-growth approach to tax cuts and the centerpiece of President Bush's tax cut proposal. The repeal by Congress of the death tax and marriage penalty in the 2001 tax cut bill reflects the continued work of the NCPA.

Entitlement reform is another important area. With a grant from the NCPA, economists at Texas A&M University developed a model to evaluate the future of Social Security and Medicare. This work is under the direction of Texas A&M Professor Thomas R. Saving, who was appointed a Social Security and Medicare Trustee. Our online Social Security calculator, found on the NCPA's Social Security reform Internet site (www.TeamNCPA.org) allows visitors to discover their expected taxes and benefits and how much they would have accumulated had their taxes been invested privately.

Team NCPA is an innovative national volunteer network to educate average Americans about the problems with the current Social Security system and the benefits of personal retirement accounts.

In the 1980s, the NCPA was the first public policy institute to publish a report card on public schools, based on results of student achievement exams. We also measured the efficiency of Texas school districts. Subsequently, the NCPA pioneered the concept of education tax credits to promote competition and choice through the tax system. To bring the best ideas on school choice to the forefront, the NCPA and Children First America published an *Education Agenda* for the new Bush administration,

policy makers, congressional staffs and the media. This book provides policy makers with a road map for comprehensive reform. And a June 2002 Supreme Court ruling upheld a school voucher program in Cleveland, an idea the NCPA has endorsed and promoted for years.

The NCPA's E-Team program on energy and environmental issues works closely with other think tanks to respond to misinformation and promote commonsense alternatives that promote sound science, sound economics and private property rights. A pathbreaking 2001 NCPA study showed that the costs of the Kyoto agreement to halt global warming would far exceed any benefits. The NCPA's work helped the administration realize that the treaty would be bad for America, and it has withdrawn from the treaty.

NCPA studies, ideas and experts are quoted frequently in news stories nationwide. Columns written by NCPA scholars appear regularly in national publications such as the *Wall Street Journal*, the *Washington Times*, *USA Today* and many other major-market daily newspapers, as well as on radio talk shows, television public affairs programs, and in public policy newsletters. According to media figures from Burrelle's, nearly 3 million people daily read or hear about NCPA ideas and activities somewhere in the United States.

The NCPA home page (www.ncpa.org) links visitors to the best available information, including studies produced by think tanks all over the world. Britannica.com named the ncpa.org Web site one of the best on the Internet when reviewed for quality, accuracy of content, presentation and usability.

What Others Say about the NCPA

"...influencing the national debate with studies, reports and seminars."

- TIME

"Oftentimes during policy debates among staff, a smart young staffer will step up and say, 'I got this piece of evidence from the NCPA.' It adds intellectual thought to help shape public policy in the state of Texas."

- Then-GOV. GEORGE W. BUSH

"The [NCPA's] leadership has been instrumental in some of the fundamental changes we have had in our country."

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