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PREPARING FOR CLIMATE CHANGE: ADAPTATION POLICIES AND PROGRAMS

HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY AND ENVIRONMENT

OF THE

COMMITTEE ON ENERGY AND COMMERCE

HOUSE OF REPRESENTATIVES

ONE HUNDRED ELEVENTH CONGRESS

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PREPARING FOR CLIMATE CHANGE: ADAPTATION POLICIES AND PROGRAMS

WEDNESDAY, MARCH 25, 2009

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY AND ENVIRONMENT,
COMMITTEE ON ENERGY AND COMMERCE,
Washington, DC.

The subcommittee met, pursuant to call, at 9:30 a.m., in Room 2123 of the Rayburn House Office Building, Hon. Edward J. Markey (chairman) presiding.

Members present: Representatives Markey, Inslee, Butterfield, Melancon, Matsui, McNerney, Welch, Dingell, Green, Capps, Harman, Baldwin, Barrow, Upton, Hall, Stearns, Shimkus, Pitts, Walden, Sullivan, Burgess, Scalise, and Barton (ex officio).

Staff present: Matt Weiner, Legislative Clerk; Melissa Bez, Professional Staff; Michael Goo, Counsel; Lindsay Vidal, Press Assistant; Amanda Mertens Campbell, Minority Counsel; Peter Spencer, Minority Professional Staff; Andrea Spring, Minority Professional Staff; and Garrett Golding, Minority Legislative Analyst.

OPENING STATEMENT OF HON. EDWARD J. MARKEY, A REPRESENTATIVE IN CONGRESS FROM THE COMMONWEALTH OF MASSACHUSETTS

Mr. MARKEY. Welcome, ladies and gentlemen, to the subcommittee on Energy and Environment. Today's hearing is on Adaptation Programs and Policies as we prepare to deal with inexorable, inevitable consequences of climate change.

Nearly 20 years ago, Congress passed the Global Change Research Program Act of 1990, which requires the preparation of a national assessment of the consequence of climate variability and change. This assessment was designed to help understand the impacts of climate change in the United States.

A distinguished panel of experts completed that assessment in 2000. One of the lead authors, Dr. Tom Karl, is with us here today. On the front cover of the report were these prophetic words: "Humanity's influence on the global climate will grow in the coming century. Increasingly there will be significant climate change related problems that will affect each one of us." We must begin now to consider our responses as the actions taken today will affect the quality of life for us and for future generations.

In the decade since that report was completed, global warming has not waited. It has accelerated. Climate change is occurring as we speak, and the greenhouse gases already in the atmosphere will continue to warm the planet for decades.

In the United States and the world, we must work together to successfully combat climate change. Mitigation, the act of reducing greenhouse gas emissions, will not be enough. Our country and other nations must also implement adaptation policies to respond to changes in our climate, in our ecosystems, and in our infrastructure.

The many changes predicted in the national assessment are already happening, and they are happening faster than expected. An updated 2008 assessment of the 2007 report of the Intergovernmental Panel on Climate Change documented many of these changes. According to the UN Panel, North America has experienced locally severe economic damage plus substantial ecosystem, social, and cultural disruption from recent weather-related extremes, including hurricanes, other severe storms, floods, droughts, heat waves, and wild fires.

Whether it is the eroding coastal areas of Louisiana, Texas, or the Atlantic states, the floods in the Midwest, hurricanes in Florida, wildfires in California, or the loss of snow pack in the Pacific Northwest, I am sure that every member of the subcommittee has their own story of how a changing climate has affected their area.

North America is not the only continent facing adaptation challenges. Internationally, low-lying island states like the Maldives could literally go under as sea levels rise. As a result, the president of the Maldives is considering purchasing land to prevent his population from becoming "climate refugees living in tents for decades."

In Africa, the UN Panel projected that by 2020, 250 million people will be exposed to increased water stress due to climate change and yields from rain-fed agriculture could be reduced by up to 50 percent, severely compromising food production.

This, in turn, could lead to significant national security issues for the United States. The UN Panel also noted that if warming continues unabated, 30 to 40 percent of all the species on the planet will be at risk of extinction.

In the climate change bill I introduced last year, I included provisions for a national climate service. A national climate service would create a central source of federal information on climate change, ranging from projections of additional sea level rise to mapping the nation's best sites for solar and wind power. This information will be vital in the years ahead and will reap tremendous long-term dividends. I look forward to hearing from NOAA to discuss their plans to implement this much-needed program.

Adaptation alone cannot solve climate change. We can and must take actions to reduce emissions. Yet as we enter the warming world that we have now created for ourselves, we must recognize that we, as humans, have worldwide responsibilities for all of God's creatures, both human and animal, many of whom have little or no ability to adapt to climate change on their own. They will need our help, and we should be prepared to provide it as best we can.

I hope that that will be our goal as we craft our ongoing adaptation policies. I look forward to our witnesses' testimony.

[The prepared statement of Mr. Markey follows:]

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Opening Statement of Chairman Ed Markey
As Prepared for Delivery on March 25, 2009
"Preparing for Climate Change: Adaptation Programs and Policies"
Before the Subcommittee on Energy and Environment

This hearing will come to order.

Nearly 20 years ago, Congress passed the Global Change Research Program Act of 1990, which required the preparation of a "National Assessment of the Consequences of Climate Variability and Change." This assessment was designed to help us understand the impacts of climate change in the United States.

A distinguished panel of experts completed that assessment in 2000. One of the lead authors, Dr. Tom Karl, is with us here today.

On the front cover of the report were these prophetic words: "Humanity's influence on the global climate will grow in the coming century. Increasingly there will be significant climate-related changes that will affect each one of us. We must begin now to consider our responses, as the actions taken today will affect the quality of life for us and for future generations."

In the decade since that report was completed, global warming has not waited. It has accelerated.

Climate change is occurring as we speak and the greenhouse gases already in the atmosphere will continue to warm the planet for decades.

If the United States and the world are going to successfully combat climate change, mitigation—the act of reducing greenhouse gas emissions—will not be enough. Our country and other nations must also implement adaptation policies to respond to changes in our climate, in our ecosystems and in our infrastructure.

The many changes predicted in the National Assessment are already happening and they are happening faster than expected.

An updated 2008 Assessment and the 2007 Report of the Intergovernmental Panel on Climate Change documented many of these changes. According to the UN panel:

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"North America has experienced locally severe economic damage, plus substantial ecosystem, social and cultural disruption from recent weather-related extremes, including hurricanes, other severe storms, floods, droughts, heat waves and wildfires."

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North America is not the only continent facing adaptation challenges. Internationally, low-lying island states like the Maldives could literally "go under" as sea level rises. As a result, the President of the Maldives is considering purchasing land to prevent his population from becoming, I quote, "climate refugees living in tents for decades."

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A National Climate Service would create a central source of federal information on climate change ranging from projections of additional sea level rise to mapping the nation's best sites for solar and wind-power.

This information will be vital in the years ahead and will reap tremendous long-term dividends. I look forward to hearing NOAA discuss their plans to implement this much-needed program.

Adaptation alone cannot solve climate change. We can and must also take actions to reduce emissions.

Yet as we enter the warming world that we have now created for ourselves, we must recognize that we as humans have worldwide responsibilities for all of God's creatures, both human and animal, many of whom have little or no ability to adapt to climate change on their own.

They will need our help and we should be prepared to provide it as best we can.

I hope that will be our goal as we craft our ongoing adaptation policies.

I look forward to hearing the witnesses' testimony.

Mr. MARKEY. I turn now to recognize the ranking member of the subcommittee, the gentleman from Michigan, Mr. Upton.

OPENING STATEMENT OF HON. FRED UPTON, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF MICHIGAN

Mr. UPTON. Well, thank you, Mr. Chairman. As you said, our hearing today is on climate change adaptation policies. And I view, as you know, cap and tax as a policy that requires adaptation. How will Americans adapt to losing their jobs? How do we adapt to increased energy costs? How do we adapt to a legislatively imposed economic recession? How does the nation adapt to losing its superpower status?

Cap and tax isn't our only option. We can pursue policies that will both help the environment and our economy. And by design, a cap and tax can only hurt the economy while providing a questionable environmental benefit. It is indeed a scheme. Absent of global agreement that includes the heavy emitting developing countries, cap and tax will only send energy costs up while sending employment numbers down or some place else.

This year, the U.S. will reduce its greenhouse gas emissions. We will reduce them, and we will do it without cap and tax. Emissions are way down in Michigan this year, but emissions levels haven't even dropped to the 1990 levels, and folks are asking for 80 percent below those levels by the year 2050 perhaps.

How do we get those reductions down so far? Unemployment in Michigan is already about 13 percent. 15 percent perhaps isn't too far away with greater reductions in emissions. But in this debate over climate change, we have lost sight of our real goal. We have lost sight of what our policy should achieve. The focus has become a cap and tax as an end in itself. What about reducing global temperatures?

As one who believes that climate change must be dealt with on a global scale, I have advocated a no-regrets policy that will achieve the same, if not better, results as an arbitrary cap-and-tax scheme at a fraction of the cost.

In fact, there are policy options available that would have a net economic and societal benefit while at the same time, cutting emissions. We have lost too many jobs already. We shouldn't pursue options that will make matters worse.

If we are going to pass climate change legislation, it should adhere to the following five principles. One, provide a tangible environmental benefit to the American people. Two, advance technology and provide the opportunity for export. Three, protect American jobs. Four, strengthen U.S. energy security. And five, require global participation.

These principles deal with the issue of cost versus benefit, the cost of action as well as inaction. Cap-and-tax schemes simply don't meet that criteria. We don't need costly mandates if we invest in clean coal technology, remove the regulatory barriers to nuclear power, reward efficiency gains and allow a technology to succeed in a marketplace. And we won't need the developing world to remain in the Stone Age, if we want to export American technology. We don't need to lose millions of jobs if we help our energy-intensive

industries in domestic auto manufacturers with their R and D investments.

Climate change is a global problem, and it requires a global solution. And without joint international action, jobs and emissions will simply ship some place else overseas to countries that require few, if any, environmental protections, harming the global environment as well as the United States economy. And I yield back.

Mr. MARKEY. Gentleman's time has expired. The chair recognizes the gentleman from Michigan, Mr. Dingell.

OPENING STATEMENT OF HON. JOHN D. DINGELL, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF MICHIGAN

Mr. DINGELL. Thank you, and I commend you for holding this hearing. It is important. You are building a record which I hope will be very important as we go through the consideration of climate change legislation.

Today's hearing is also on a matter that is important. The funds generated by an auction are already in great demand for all manner of things, some with great merit, some with rather less, and some with quite frankly, none. As we have already seen in the President's budget, the funds generated from an auction are being counted on for budget purposes.

I note that the fourth assessment report of the Intergovernmental Panel on Climate Change noted "observational evidence from all continents and most oceans shows that many natural systems are being affected by climate changes, particularly temperature increases." In the same report, we are warned that in the lifetime of a child born today, 20 to 30 percent of the world's plant and animal species will be on the brink of extinction if we don't take action now.

I would note that the wild lands that we have a chance to save here are of immense value, not just to the future of society, but also to the purpose which we have, which is protecting us against climate change. So we must consider the value of marshes, mountains, forests, and ecosystems which can serve both as carbon sumps and also as opportunities for conservation in the traditional sense.

A great conservationist, one that we all admire, the 26th president of the United States, Theodore Roosevelt, taught us that conservation is also a great moral issue. That it is our duty as it ensures safety and continuity for this nation.

So, Mr. Chairman, as we move forward, I remain committed to securing a dedicated fund for natural resource adaptation. I encourage the members of this subcommittee to look at subtitle B of the Dingell-Boucher draft released last year, which has in it carefully crafted natural resource adaptation language that was written by my staff and the staff of the natural resources committee. And it has the support of most, if not all, the conservation community.

Similar actions are going to be taken by the committee on natural resources. So I want to thank you for holding this hearing today, Mr. Chairman. And I hope that my colleagues will join me in saving some of the precious treasures that we can save, using the resources and the finances generated by the auctions, which

will take place for the monies that we can produce for a very important cause. I thank you, and I yield back the balance of my time.

[The prepared statement of Mr. Dingell follows:]

News From Congressman John D. Dingell
Serving Michigan's 15th Congressional District
http://www.house.gov/dingell/
Wednesday, March 25, 2009
Contact: Adam Benson, 202.225.4071 (office) / 202.271.8587 (cell)

NEWS RELEASE

Dingell on Climate Change

Washington, DC – Congressman John D. Dingell (D-MI15) made the following opening statement this morning at the Committee on Energy & Commerce Subcommittee on Energy and Environment hearing titled "Preparing for Climate Change: Adaptation Policies and Programs":

"Mr. Chairman, thank you for holding this important hearing today. You are to be commended for the strong record you continue to build as we move toward comprehensive climate change legislation.

"Today's hearing is of a subject matter that is important. The funds generated by an auction are already in great demand for all manner of things, some more meritorious than others. As we have already seen in the President's budget, the funds generated from an auction are being counted on for budget purposes.

"As the Fourth Assessment Report of the Intergovernmental Panel on Climate Change noted, "observational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, particularly temperature increases."

"In that same report, we are warned that in the lifetime of a child born today, 20 to 30 percent of the world's plant and animal species will be on the brink of extinction if we don't take action now.

"The great conservationist and the 26th President of these United States, Theodore Roosevelt, taught us that conservation is a great moral issue – that it is our duty, as it insures the safety and continuance of the nation.

"So, Mr. Chairman, as we move forward, I remain committed to securing a dedicated fund for natural resource adaptation. I encourage the members of the Subcommittee to look at Subtitle B of the Dingell - Boucher draft which is carefully crafted Natural Resource Adaptation language that was written by my staff and the staff at the Natural Resources Committee and has the support of most if not all in the conservation community.

"Again, Mr. Chairman, thank you for holding this hearing. I look forward to hearing from the witnesses today."

www.house.gov/dingell

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Mr. MARKEY. We thank the gentleman. The chair recognizes the gentleman from Illinois, Mr. Shimkus.

OPENING STATEMENT OF HON. JOHN SHIMKUS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ILLINOIS

Mr. SHIMKUS. Thank you, Mr. Chairman. The right of free speech is a great right that we have in this country. Very few times we use it to espouse our theological religious beliefs, but we do have members of the clergy here as members of the panel. So I want to start with Genesis 8, verses 21 and 22. "Never again will I curse the ground because of man even though every inclination of his heart is evil from childhood, and never again will I destroy all living creatures as I have done. As long as the earth endures, seed time and harvest, cold and heat, summer and winter, day and night will never cease." I believe that is the infallible word of God, and that is the way it is going to be for his creation.

The second verse comes from Matthew 24. "And he will send his angels with a loud trumpet call, and they will gather his elect from the four winds, from one end of the heavens to the other." The earth will end only when God declares it is time to be over. Man will not destroy this earth. This earth will not be destroyed by a flood.

And I appreciate having panelists here who are men of faith, and we can get into the theological discourse of that position. But I do believe God's word is infallible, unchanging, perfect.

Two other issues, Mr. Chairman. Today we have 388 parts per million in the atmosphere. I think in the age of the dinosaurs when we had the most flora and fauna, we were probably at 4,000 parts per million. There is a theological debate that this is a carbon-starved planet, not too much carbon. And the cost of a cap-and-trade on the poor is now being discovered. These miners lost their jobs through the last—and Mr. Chairman, we have talked about this job lost. I have an IDNR report, Illinois Department of Natural Resources, that points to four mines that were closed specifically because of Clean Air Act amendments in 1990. I am going to share those with you later because we did have that discussion, and I do appreciate that.

Appreciate the hearing, and I look forward to the questions. Thank you, Mr. Chairman.

Mr. MARKEY. We thank the gentleman. The chair recognizes the gentlelady from California, Ms. Matsui.

OPENING STATEMENT OF HON. DORIS O. MATSUI, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Ms. MATSUI. Thank you, Mr. Chairman, and thank you very much for this hearing today. I am eager to hear from today's witnesses about how our communities and our world can adapt to climate change, and adapt we must.

California's Department of Water Resources projected that the Sierra Nevada snow pack will experience a 25 to 40 percent reduction by 2050. These are not empty numbers. They represent real impacts of climate change that translate into serious risks for my constituents.

As California's climate warms, more of the Sierra Nevada's watersheds will contribute to peak storm runoff. High frequency flood events are projected to increase as a result. We have no choice but to adapt to these changing realities.

In Sacramento, we live by two beautiful rivers, the Sacramento and the American. As global warming intensifies, scientists predict greater storm intensity that could forever change these rivers' flow patterns. This means that my district will have to cope with more direct runoff and more flooding.

California has not hid from these changes. Instead, we are leading the way in cutting greenhouse gas emissions. We are developing a comprehensive climate adaptation strategy. However, California and the entire United States will need additional resources to adapt to the realities of climate change. Water resource adaptation strategies will need to be coordinated between local, state, and federal leaders. And states with strained budgets and growing needs will require federal funding in order to adapt and protect our communities. That is why upcoming climate legislation must be bold and resourceful when it comes to adaptation policy.

I thank you, Mr. Chairman, for this hearing, and I look forward to today's testimony. I yield back the balance of my time.

Mr. MARKEY. We thank the gentlelady. Chair recognizes the gentleman from Pennsylvania, Mr. Pitts.

OPENING STATEMENT OF HON. JOSEPH R. PITTS, A REPRESENTATIVE IN CONGRESS FROM THE COMMONWEALTH OF PENNSYLVANIA

Mr. PITTS. Thank you, Mr. Chairman. Thank you for convening today's hearing on this important topic. I believe it is imperative to look at the role of adaptation as we continue to discuss cap-and-trade legislation. Human beings are designed to be able to adapt to changing climate temperatures, and there are repeated examples in history of mankind being able to adapt when temperatures have fluctuated.

However, adapting to drastic job losses and a failing economy due to burdensome cap-and-trade or massive bureaucratic regulations or a national energy tax scheme will be incredibly difficult for all Americans. A March 2009 National Public Radio survey said that Americans' top concern is the decline in the stock market and investment losses. The second highest concern is job losses.

Every American realizes that we are in a time of economic trouble. So we must ask the question. Is it prudent to pass a cap-and-trade bill which will increase the cost of energy and conceivably cause 3.75 million job losses? What is more, is it prudent to pass legislation that will make matters even worse by levying a new national energy tax that could cost families up to $3,100 per year?

Mr. Chairman, we need to carefully consider the negative impact a cap-and-trade bill with the a national energy tax will have on our economy. I do not believe it is in the best interest of American families to pass a bill that will make their way of life harder and more challenging.

Instead, we should focus on investment in economic growth and direct actions to adapt to climate change as better alternatives. I look forward to hearing our witnesses today and yield back.

Mr. MARKEY. Thank the gentleman. The chair recognizes the gentleman from Texas, Mr. Green.

OPENING STATEMENT OF HON. GENE GREEN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TEXAS

Mr. GREEN. Thank you, Mr. Chairman, and I appreciate you calling this hearing on adaptation policies and programs. One of the things I would like to say is I hope whatever this committee creates, cap-and-trade, that those dollars that are generated from it would be designated for the direct utility consumer assistance and not be used as a piggy bank for the U.S. government. We need to make sure that we deal with the policies that we really are trying to protect.

While Congress continues to debate how to address future greenhouse gas emissions, many scientists believe we must learn to adapt to changes in the earth's climate caused from emissions existing in the atmosphere today. Human beings have been adapting in our world for literally millions of years. Altered climate systems may have impacts on our environmental economic well being, and agencies at all levels of the government must be tasked when implementing adaptation policies to respond to real or potential climate change threats.

This is not an easy task. Previous natural disasters in the U.S. have shown how woefully ill-prepared our nation is in responding to natural events. A hurricane in the Gulf of Mexico is not unusual, whether it was Hurricane Katrina or Rita, or the most recent was Hurricane Ike that was the first hurricane to hit the Houston that I represent for 25 years. Thousands of homes were destroyed. Vast areas of our community were left for weeks without power, and many areas were short on essentials, food, ice, or water supplies.

We must avoid the mistakes of the past and create more efficient and responsive federal recovery efforts for natural events. Coordinating climate research and monitoring across the federal government will be challenging, and I hope to learn more about NOAA's efforts to provide policymakers with the latest climate information and assessments.

Perhaps most important will be preparing officials for decision-making and future planning based on unknown or unreliable factors. According to the National Research Council the decision rules that assume a stationary climate are no longer valid.

I hope we can create the tools and provide the resources necessary to assist officials in preparing for outside-the-box thinking to address these future conditions. State and local governments would also be provided assistance to perform local assessments at climate impact related preparation efforts such as updating flood plain maps and reinforcing levees and flood drainage systems, conditions to survive for those vulnerable to climate change, particularly low-income Americans with insufficient resources to prepare or adapt to the changing environmental conditions.

And thank you again for the hearing, Mr. Chairman. I yield back my time.

Mr. MARKEY. Great. Thank the gentleman. The chair recognizes the gentleman from Texas, Mr. Burgess.

OPENING STATEMENT OF HON. MICHAEL C. BURGESS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TEXAS

Mr. BURGESS. Thank you, Mr. Chairman, and I certainly look forward to hearing from our witnesses today. I think we have a very varied and potentially a very lively panel, and I am sure it will be very enlightening as well as very entertaining.

Now, I am not sure how the climate is going to change in the future or necessarily what effect our behaviors today are going to have on the planet, but one thing I do know is we need to do a better job ensuring that people are prepared for changes, changes in the weather, changes in natural disasters.

This is something we can address without necessarily taxing carbon or proposing or imposing a cap on carbon or establishing a trading platform where sophisticated investors can work up exotic carbon options and manipulate the market and make great sums of money.

Now, next month in my district, I will be hosting an emergency preparedness summit. I want to ensure that I am providing the people in my district with information and resources that they need to survive and overcome changes in the environment. I don't have to tell my constituents because the weather in Texas is legendary. It changes constantly, and we have some of the most varied weather between hurricanes, tornadoes, hailstorms, snow, sleet, dust storms. We have some of the most varied cosmological conditions on the planet.

But taking the time to prepare and plan ahead does save money and does save lives. And that leads me to the point of today's hearing. Preparing for any potential effects of climate change would be far less costly to the economy than mandating a carbon cap. And I have said it before this committee. Strong and growing economies are more likely to develop the technology and the breakthroughs that we need to spur the next wave in energy innovation.

Stifling the economy with carbon mandates may actually stifle our ability to solve this very problem. And yesterday, in the "Washington Post" the second editorial, I believe, dealt with just that issue. That it would be more straightforward and more honest of this committee to be talking about a carbon tax as opposed to a cap-and-trade. I don't support a carbon tax. I think it is the wrong idea, but let us not hide behind this cloud of obfuscation with a cap-and-trade when really what we are going to do is tax energy, tax jobs, and tax carbon. I will yield back.

Mr. MARKEY. Okay, the gentleman's time has expired. The chair recognizes the gentlelady from California, Ms. Harman.

OPENING STATEMENT OF HON. JANE HARMAN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Ms. HARMAN. Thank you, Mr. Chairman. Global warming needs a two-pronged approach. One, mitigation and two, as we have been discussing this morning, adaptation. We are just beginning to understand that even if we implement an aggressive mitigation policy and significantly begin to reduce greenhouse gases, our nation and the world will still confront the impacts of global warming, including changes in weather patterns, deadly heat waves, and increasing infectious disease outbreaks.

This is why any climate bill passed from this committee must address adaptation. California is already in the process of developing a statewide adaptation strategy because of its vulnerability to global warming. For example, my district includes a breathtaking part of the California coast, one of our nation's most beautiful natural resources. As a result of rising sea levels and increased storm intensity, we could lose the beaches. This not only affects the quality of life for me and my constituents but will have a huge financial impact with the loss of tourism dollars.

My district will also confront other California-wide impacts such as a reduced water supply as salt water mixes with our fresh water sources, increased air pollution, and more days with temperatures over 100.

The consequences of global warming will also lead to major national and global security concerns. And as someone who focuses on security, this is where, I think, we all need to focus. They include large scale human migration due to resource scarcity, increased competition for food, water, and other resources, increased frequency and severity of disease outbreaks. The impact of climate change, such as desertification in the horn of Africa, could lead to conflicts and push countries to the brink of collapse. This could strengthen terror groups that are already active in the region and could be a central breeding ground and safe haven for jihadists.

That is why I am pleased that we are studying climate change as a part of our national intelligence estimates, and I think it is absolutely critical, Mr. Chairman, to focus on adaptation here as one of the strategies that will hopefully keep our country and the world safer. I yield back.

Mr. MARKEY. Okay, we thank the gentlelady. The chair recognizes the gentleman from Louisiana, Mr. Scalise.

OPENING STATEMENT OF HON. STEVE SCALISE, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF LOUISIANA

Mr. SCALISE. Thank you, Mr. Chairman. This is an important hearing, and I appreciate the panel's participation today. It is the job of Congress to seek ways to promote our country's economy prosperity and to support policies that protect our country's national security interests. It is my opinion that a cap-and-trade energy tax does neither and runs contrary to where our focus should be in these tough economic times.

The members of this subcommittee do not all agree on the causes of climate change, nor have all of the experts that have come before our group. While the debates on the causes of climate change have not been settled, what also has not been called into question is the fact that a cap-and-trade energy tax will cost this country millions of good jobs and will force the average American family to pay thousands of dollars in increased energy costs.

President Obama's budget director, Peter Orszag, has even testified that energy taxes designed to decrease carbon emissions will be passed on to American families. According to Mr. Orszag, the average American household, the cost to them would be about $1,300 a year for a 15 percent cut in CO_2 emissions. He admitted to Congress last year that the price increases borne by consumers

are essential to the success of a cap-and-trade energy tax. If the idea is to promote clean energy, why do we continue to reject nuclear power as an alternative source of energy? Energy production and development in our country has come a long way over the past few decades.

Instead of taxing American families and the small businesses that create wealth in this country, we should promote policies that encourage the development of new, cleaner technologies. That is the direction and the course that we are currently on, and we should continue to travel that path instead of crippling our economy when we can least afford it.

There are countless small businesses across America that are watching the subcommittee's action very closely to determine their future in our country. They employ millions of Americans and want to continue to invest here, but if we act irresponsibly, these firms will pack up and ship their investment and American jobs overseas.

And to add insult to injury, many of the countries where these companies will relocate do not have the environmental standards that we already have today in America.

These are important issues we need to discuss, and I look forward to hearing from the panel. Thank you, Mr. Chairman.

Mr. MARKEY. Great. We thank the gentleman. Chair recognizes the gentleman from Louisiana, Mr. Melancon.

OPENING STATEMENT OF HON. CHARLIE MELANCON, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF LOUISIANA

Mr. MELANCON. Thank you, Mr. Chairman. I would like to thank you for holding this hearing today, and I appreciate the conversations we have had and your decisions to try and look at all energy sources. I appreciate the ability of you to recognize that we need to explore all avenues.

We are here today to talk about the effect of climate change in the world around us, and I find it interesting that some people say it is a world problem now since we didn't participate in Kyoto. We should have been there at that point in time so we wouldn't be discussing what we need to be doing, which is different now.

Even if this Congress enacted climate change legislation tomorrow, it would be impossible to avoid the consequences related to the early effects of climate change. In fact, my district has felt the effects of warm ocean waters firsthand. Three years ago, Hurricanes Katrina and Rita made landfall on the coast of Louisiana and leveled entire cities. Nearly 2,000 lost their lives to those storms, and tens of thousands more lost everything else.

The widespread devastation from the greatest natural disaster this country has ever seen is still evident today. Communities across the Gulf are facing rising tides, increased temperatures in the Gulf, which leads to stronger hurricanes. And in the case of Louisiana, the fastest sinking coastline in the country. Louisiana has lost over 1,900 square miles of land since the 1930s. That is more land than the entire state of Rhode Island.

This country can't survive without coastal communities. These are the people that provide the seafood that we eat, the energies

that drives our economy, and the labor that keeps our exports flowing to buyers around the world. Keeping our coastal communities alive ensures the health of the rest of the country, and to help these coastal communities preserve as the vibrant hubs of hard work and the culture that they are, we must all work together to find creative ways to adapt to the world that is always changing around us.

Again thank you for your interest and your help in this matter.

Mr. MARKEY. We thank the gentleman. The chair now recognizes the gentleman from Texas, Mr. Barton.

OPENING STATEMENT OF HON. JOE BARTON, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TEXAS

Mr. BARTON. Thank you, Mr. Chairman. I want to again commend you and Chairman Waxman for holding these series of hearings. They are very informational and informative, and most of the time, they are even entertaining. So I am grateful, as always for this regular order.

I especially want to thank Lord Monckton for testifying. He is generally as one of the most knowledgeable, if not the most knowledgeable experts from a skeptical point of view on this issue of climate change. And we are very glad that he could stay over this week in the United States and testify at this important hearing.

Today's hearing is about adaptation. Adapting is a common natural way for people to adapt to their environment. I believe that the earth's climate is changing, but I think it is changing for natural variation reasons. And I think mankind has been adapting to climate as long as man has walked the earth. When it rains, we find shelter. When it hot, we get in shade. When it is cold, we find a warm place to stay. Adaptation is a practical, affordable, utterly natural reflex response to nature when the planet is heating or cooling, as it always is doing one or the other.

As Lord Monckton will testify, in the Middle Ages, it was warmer almost everywhere in the world than it is today. Some of our ancestors grew grapes in Britain. Others sailed ice-free seas to settle northern places like Newfoundland and Greenland. This period used to be known as the Medieval Warm Period. It was followed by the Little Ice Age, the Period of Dramatic Cooling, which lasted until the middle of the 19th Century.

During the Little Ice Age, both the Vikings and the British adapted to the cold by changing. I suppose that one possible adaptation response of Viking retrenchment and British expansion is that we are conducting the hearing today in English instead of Norwegian.

In the Chesapeake Bay and the Piedmont Marsh, the lower Hudson Valley, layers of sediment reflect what happened to the North American continent. That history shows that the nature of the climate is to change and to make organic shifts in temperature regardless of mankind's presence or supposed influence.

Nature doesn't seem to adjust to people as much as people seem to adjust to nature. I think that it is inevitable that humanity will adapt to global warming. I also believe the longer we postpone finding ways to do it successfully, the most expensive and unpalatable the adjustment will become.

Adaptation to shifts in temperature is not that difficult. What will be difficult is the adaptation to rampant unemployment, enormous, spontaneous, and avoidable changes to our economy if we adopt such a reckless policy as cap and tax or cap-and-trade. That will devastate our economy, and we will have great difficulty adapting to that.

The majority of this committee has promised, and I hope this is a promise they don't meet, to introduce an economy-wide cap-and-trade bill in the next month no matter that the past seven years have witnessed a cooling period. Europe just experienced its coldest winter in the last 20 years last winter.

In the name of the house of cards posing as scientific certainty and an alarmist policy asserted by its followers with a religious fervor, the Democratic majority apparently is hell-bent to propose to cap our economy and trade away our jobs. Some of us on this committee are going to try to stop that or at least deflect it.

On top of the very real threat of job losses caused by closed factories, shut down mines, vacant power plants rendered uncompetitive under an American cap-and-trade scheme, the new majority's cap-and-trade goal is to make our electricity so expensive, our gas so pricey, and our food so dear that we will be forced to change the way we live. We will literally be forced to change the American way of life.

We have had hearing after hearing where armies of witnesses representing both sides of the debate have warned us that the impact of cap-and-trade on everybody in this country but the megarich. The people at greatest risk are low income, middle income families, blue-collar workers, the elderly, and those whose jobs will be destroyed—and I say will be, not may be, will be destroyed if we adopt a cap-and-tax policy.

The question is not how Americans will adapt to cap-and-trade legislation. The question is if and how we will survive when blackouts, rampant job loss, and empty cupboards threaten out very way of life. With those cheery words, Mr. Chairman, I yield back, and I look forward to this hearing.

Mr. MARKEY. And we thank the gentleman. The chair recognizes the gentleman from Georgia, Mr. Barrow. The gentleman's time will be reserved. The chair recognizes the gentlelady from Wisconsin, Ms. Baldwin.

OPENING STATEMENT OF HON. TAMMY BALDWIN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF WISCONSIN

Ms. BALDWIN. Thank you, Mr. Chairman. I woke up this morning and watched a little bit of the morning news, and the headlines were about very unnatural adaptation that is going on in North Dakota. Apparently hundreds of citizens spent the night last night filling over a million bags with sand as they are trying to race against time to keep the Red River within its bank. It is now twice its natural level, and, of course, our thoughts go out to them.

Last year, I witnessed firsthand the extreme rain and flooding and devastation that people in my district and across the upper Midwest experienced as a result of intense rainfall. We lost homes and businesses and farmland, not to mention millions of dollars of

productivity. Wisconsinites also will not soon forget the severe winter storms that we shoveled our way out of a year ago. My hometown had more snow than had ever been recorded since such measurements began to be taken decades and decades ago. And in fact, we beat the old existing record by 40 percent approximately.

Many, including leading experts on climate change, fear that, as a result of unabated increases in greenhouse gas emissions, this record rain and snowfall will become the norm. These events used to be called 100 year events or 500 year events, and we find them happening separated only by years or decades these days.

And as the various regions across the country and the world experience sweeping changes in precipitation and weather patterns, not only is the environment at risk, but also food and water supplies, ecosystems, social structure and national security.

Fortunately, adaptation efforts are occurring to minimize both the cost and severity of climate change. In Wisconsin, local communities like Dane County are assessing lake levels to minimize property damage. Funding wetland restoration efforts and updating the hazardous mitigation plan, which identifies potential impacts of natural hazards.

Smart planning is essential to ensuring that the most vulnerable regions and populations are protected. I expect our witnesses today will inform us about other adaptation practices taking place around the globe.

Finally, let me state what I hope many here will agree with, that the impacts of climate change vary greatly from area to area. As such, to the extent that future proceeds are directed to support adaptation strategies, we must recognize that states and localities are best equipped to make decisions about how to effectively and efficiently invest in these practices. I hope we keep that in mind as we craft our bill. And thank you, Mr. Chairman. I yield back the balance of my time.

Mr. MARKEY. The gentlelady's time has expired. The chair recognizes the gentleman from Florida, Mr. Stearns.

OPENING STATEMENT OF HON. CLIFF STEARNS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF FLORIDA

Mr. STEARNS. Mr. Chairman, thank you and my good friend Mr. Upton for having this hearing. It is nice to have, as Mr. Barton mentioned, Lord Monckton here. He was a policy advisor to the Prime Minister Margaret Thatcher. And so he is a very good witness for us to have, Mr. Chairman. And I would like to welcome Dr. Beisner from Florida from Broward County. Dr. Beisner is a welcome witness here from my home state.

We have gone through this whole idea of cap-and-trade here and is a mantra for global warming and now is a mantra for cap-and-trade. But if you said to yourself is there any country in the world who is doing cap-and-trade? Well, there is. The European Union has put in place cap-and-trade. Phase one was tried, and now they are into phase two. As I understand it, they had to suspend the cap-and-trade commodity exchange because of very serious problems on ethics.

And I think, Mr. Chairman, in all deference to you, I think we should also have a hearing on how cap-and-trade is working in the

European Union because if you have something that is actually being implemented somewhere, then it does not become theoretical. It becomes pragmatic and actual. And so, at this point, we can theorize here, but the bottom line is let us see how it is working in Europe.

Now, I can quote obviously statistics to show—but the bottom line is that where are your statistics to show this enormous increase in jobs because of the greening or the cap-and-trade? So I think you have to show us that. We can show you statistics that we are going to lose jobs. It is going to increase taxes, but I think it is incumbent upon you folks when you talk about all these new jobs from the greening of America, where are they coming from? And what kinds of jobs are they? And I yield back. Thank you, Mr. Chairman.

Mr. MARKEY. We thank the gentleman. The chair recognizes the gentleman from North Carolina, Mr. Butterfield.

OPENING STATEMENT OF HON. G.K. BUTTERFIELD, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NORTH CAROLINA

Mr. BUTTERFIELD. Thank you very much, Mr. Chairman, for convening this important hearing and particularly to the seven witnesses. Thank you for coming forward today.

Mr. Chairman, the effects of climate change at times now seem distant compared to the pressing matters of restoring our economy, dealing with AIG bonuses and the like and, of course, attending to our budget. But ignoring this issue would be a terrible, terrible mistake. Regardless of our success at curbing greenhouse gas emissions, the global temperatures will continue to rise in the coming decades.

Consequentially, we face rising sea levels, increased tropical storm activity, more precipitation in wetter areas and less in dryer areas, and increased spread and range of disease. This will affect immunities domestically and abroad. And low-income communities will be at greatest risk.

It would be my hope, Mr. Chairman, that in a cap-and-trade bill to see regular funding generated from auction revenue dedicated to 2 to 3 percent each for both domestic and international adaptation efforts annually.

Domestically, the Department of Interior and the U.S. Army Corps of Engineers should administer these funds to deal with sea level rise and flood reduction and wise water use. Internationally, the U.S. Agency for International Development, as we call it, USAID, should administer the funds to promote ecosystem-based adaptation.

Further, investments in deploying technology to developing countries, aiding farmers who face shifting weather patterns, and responding to increases in tropical-borne disease are imperative to confronting the coming problems rather than reacting to them.

Again, Mr. Chairman, thank you for convening this hearing. I yield back the balance of my time.

Mr. MARKEY. Okay, gentleman's time has expired. All time for opening statements has been completed. We are now going to turn to our very distinguished witness panel. I will advise the panelists

before we begin that I am going to strictly enforce the 5-minute rule. So my advice to you would be this. I am going to introduce you so everyone will know who you are. You will not have to re-introduce yourself. If you have three key points and they are on page three of your testimony, move them up to the top, and then at the very end, if there is time left over, you can tell us more about your wonderful organizations.

Okay, but get to your key points. I will be tapping the gavel right at 5 minutes, so please try to make sure that you think in those terms as we are going along.

Our first witness is Mr. Thomas Karl, director of the National Oceanic and Atmospheric Administration, National Climate Data Center. Dr. Karl has had a distinguished scientific career and has served as lead author on many key scientific reports including as a lead author on the recent fourth assessment of the Intergovernmental Panel on Climate Change, and as the co-chair of the National Assessment on Climate Variability and Change. We thank you for joining us, Mr. Karl. Whenever you are ready, please begin.

STATEMENTS OF THOMAS KARL, DIRECTOR OF THE NATIONAL CLIMATIC DATA CENTER, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION; JOHN STEPHENSON, DIRECTOR OF NATURAL RESOURCES AND ENVIRONMENT, GOVERNMENT ACCOUNTABILITY OFFICE; LARRY SCHWEIGER, PRESIDENT AND CEO, NATIONAL WILDLIFE FEDERATION; E. CALVIN BEISNER, THE CORNWALL ALLIANCE FOR THE STEWARDSHIP OF CREATION; LORD CHRISTOPHER MONCKTON, THIRD VISCOUNT MONCKTON OF BRENCHLEY; DAVID WASKOW, CLIMATE CHANGE PROGRAM DIRECTOR, OXFAM AMERICAN; AND BISHOP CALLON HOLLOWAY, EVANGELICAL LUTHERAN CHURCH IN AMERICA, ON BEHALF OF THE NATIONAL COUNCIL OF CHURCHES

STATEMENT OF THOMAS KARL

Mr. KARL. Thank you, Chairman Markey, Ranking Member Upton, and members of the committee. I appreciate the opportunity to testify before you today. First I do want to make note that Dr. Lochanko, our new administer for NOAA, sends her regrets for not being able to be here today. This is her third day on the job, and she looks forward to working with the committee in the future.

I wanted to mentioned that the Intergovernmental Panel on Climate Change definition of climate change refers to climate change over time, whether due to natural variability or the result of human activity. One of the things that we have already seen in many observed changes in the climate within the United States and globally.

These include changes in air and water temperature, sea level, fresh water, severity of intense hurricanes. These kind of changes are likely to increase and continue and have profound effects on the physical and biological environment, our economic prosperity, human health, and national security. There are typically two courses society can take to respond to climate-related impacts.

First is mitigation. Mitigation meaning options for reducing heat-trapping gases. Second is adaptation. Adaptation meaning changes

that can be made to better respond to present or future climate change and other environmental conditions, thereby reducing harm and taking advantage of whatever opportunities a changing economy may present.

Adaptation can include a wide variety of activities. Farmers deciding to grow crops in a different way. Moving business centers away from coasts, protecting coastlines. There are a countless number of adaptation plans that already have been devised. A few of them have actually been implemented but very few.

NOAA is the nation's provider of weather and climate data and information. We assemble this from a great variety of sources. NOAA's climate information services result from a long history of collaboration coordination with our sister agencies, NASA, USGS, USDA, National Science Foundation, other government agencies.

Climate information such as drought forecasts, long-term precipitation trends, fire forecasts, the frequency and intensity of coastal storms are all examples of the kinds of information that NOAA provides and will be useful for adaptation plans and strategies that will be developed by resource managers.

NOAA works with customers and stakeholders to ensure we are providing high-quality information that is user-friendly, responsive, relevant to the issues being addressed. Increasing demands today for adaptation information, however, are straining the ability of the agency to provide the kinds of information that is being requested at the appropriate space and time scales.

Some of the categories for climate information products and services, technical assistance, and training that NOAA provides today include scientific assessments of climate change and impacts, as the chairman has mentioned. We work with a number of partners in providing information services in support of adaptation. This would include applications to living green resources, applications to coastal communities, and applications to water resources just to name a few.

In closing, I wanted to mention that despite the substantial efforts that NOAA has had to date, there still remains significant knowledge gap, uncertainties for adaptation, as well as impediments to flows of knowledge information relevant for decision makers.

In addition, the scale at which reliable information is produced does not always match what is needed for adaptations decisions. We have considerable information about and confidence about changes in broad-scale aspects of climate change. Often questions are asked of us to provide local and regional information where the certainty is less apt to be as confidently applied as might otherwise be in a more general case. So there is clearly a need for some new tools and new science to ensure that adaptation progresses at the most appropriate pace.

An effective response to changing climate conditions is going to require integrated flexible and responsive government-wide approach. To help this need, NOAA has been working to build on existing capacities to create seamless integrated processes for transferring climate science information to society and allow for informed decision making in the development of adaptation activities at federal, state, and local levels.

I thank you for letting me have this opportunity today. I would be happy to answer questions subsequently.

[The prepared statement of Mr. Karl follows:]

WRITTEN TESTIMONY OF
THOMAS R. KARL, L.H.D.
DIRECTOR OF THE NATIONAL CLIMATIC DATA CENTER and
CLIMATE SERVICES LEAD
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S DEPARTMENT OF COMMERCE

HEARING ON
"PREPARING FOR CLIMATE CHANGE: ADAPTATION PROGRAMS AND POLICIES"

BEFORE THE
HOUSE COMMITTEE ON ENERGY AND COMMERCE
SUBCOMMITTEE ON ENERGY AND ENVIRONMENT

INTRODUCTION

Chairman Markey, Ranking Member Upton, and other members of the Committee, I am honored to speak with you today on climate adaptation. I am the Director of NOAA's National Climatic Data Center, a premier service organization dedicated to providing climatological services to every sector of the United States economy and to users world-wide. I am also the Lead for developing and executing NOAA's climate services. NOAA recognizes the importance of responding to the increasing demands for authoritative information and products to inform climate adaptation and mitigation activities. As such, we are working to improve NOAA's climate services to the Nation. Thank you for inviting me to testify on how NOAA works across all levels of government and with other partners to help the Nation address the challenges and potential opportunities of a changing climate.

The Intergovernmental Panel on Climate Change (IPCC)'s definition of climate change refers to any change in climate over time, whether due to natural variability or as a result of human activity. Many climate-related changes are already being observed globally and within the United States, including changes in: air and water temperatures; sea level; freshwater supply; frequency and/or severity of intense hurricanes and heavy downpours, loss of sea ice; etc. These changes are likely to increase and threaten to profoundly impact the physical and biological environment, economic prosperity, human health, and national security. These changes present a substantial challenge to the Nation and the world. Climate change influences events across timescales from months to a season (e.g., floods and droughts), year-to-year variability (e.g., El Nino-Southern Oscillation events), and longer term changes over centuries (e.g., sea level rise, elevated global temperatures and attendant changes in precipitation). While we must learn to adapt across all of these timescales, this is especially challenging because we are adapting to a "moving target."

There are two courses society can take to respond to climate-related impacts: (1) mitigation, meaning options for reducing heat-trapping emissions such as carbon dioxide, methane, nitrous oxide, and halocarbons; and (2) adaptation, meaning changes made to better respond to present

or future climatic and other environmental conditions, thereby reducing harm or taking advantage of opportunity. Most mitigation strategies concentrate on reducing greenhouse gas emissions through energy efficiency and the adoption and development of zero- or low-carbon technologies. The sooner mitigation strategies such as these are adopted, the sooner they will have an effect on long term climate change. However, while increased mitigation measures will likely reduce the need for future adaptation, the United States and the world will continue to experience changing climate conditions and resulting impacts[1]. Therefore, both mitigation and adaptation are essential for a comprehensive climate change response strategy.

While mitigation is vital, my testimony will focus on adaptation and describe NOAA's role in climate adaptation activities.

NEED FOR CLIMATE ADAPTATION

We face the challenge of adapting to multiple climate induced impacts including: sea level rise, ocean acidification, increased air temperature and changes in precipitation patterns (with implications for the availability of freshwater resources), increased frequency or intensity of extreme weather events (heat waves, coastal storms, droughts and heavy downpours), changing storm patterns, coastal erosion and inundation (and corresponding water quality problems, e.g., salt water intrusion), changes in crop yields, changes in ocean productivity (fisheries), and new human health problems (changes in the climate-sensitive diseases and pests). Our efforts to adapt to changing climate will be occurring at a time of changing population dynamics, along with the continued expectations of a higher standard of living for both current and future generations. Supporting proactive climate adaptation plans and programs will enhance the resilience of the nation's communities, businesses, and natural resources in the face of changing climate conditions. Climate adaptation efforts will also help to safeguard the U.S. economy, as many industries are sensitive to weather and general climate conditions.

Adaptation can include a wide range of activities. Examples include a farmer deciding to grow a different crop variety better suited to warmer or drier climate; a company relocating key business centers away from coastal areas vulnerable to sea level rise and hurricanes; a community altering its zoning and building codes to place fewer structures in harm's way; and development or modification of buildings and infrastructure to make these structures less vulnerable to damage from floods, fires, lightning, and other extreme events. Some adaptation options are currently being pursued in various regions and sectors to deal with climate change and/or other environmental issues, but there are limits to how much adaptation can achieve (e.g., adaptation will not be able to prevent species extinction, permanent loss of land due to sea level rise, etc.).

Humans have adapted to changing conditions in the past. In the future, however, adaptation will be particularly challenging because climate will be changing for the next several generations. Climate will be continually changing, moving at a relatively rapid rate, outside the range to

[1] Solomon, S.; Plattnerb, G.-K.; Knuttic, R.; and Friedlingsteind, P. *Irreversible climate change due to carbon dioxide emissions.* Proceedings of the National Academy of Sciences. Vol. 106(6): 1704-1709.

which society has adapted to in the past[2]. The precise amounts and timing of these changes can not be known with certainty. Because of this uncertainty, adaptation plans will need to be robust, flexible, and able to evolve over time.

Supporting the development of climate change adaptation plans and strategies requires information at temporal and spatial scales relevant for decision-making, and significant coordination and collaboration with a host of other federal, state and non-governmental entities. Consequently, understanding and responding to these information needs requires close collaboration between scientists and decision makers through a program of shared learning and joint problem solving. One adaptation strategy may call for specific modifications to existing infrastructure, while another might adopt a more general risk management approach as the best way to deal with climate change. Adaptation plans will likely span time scales from months to years to decades, and spatial scales from local to state, to regional, and to national. Decisions will need to be made based upon best available data and with knowledge of uncertainty about future climate change. Adaptation plans will need to be periodically evaluated and adjusted in light of new scientific findings and changing conditions.

NOAA'S ROLE – OUR WORK

NOAA is the nation's provider of weather and climate data and information assembled from a variety of sources, notably from NOAA and other agencies like the National Aeronautics and Space Administration (NASA) and the National Science Foundation (NSF), and from other countries such as France, Japan, and the United Kingdom. NOAA's climate information services result from a long history of NOAA collaboration and coordination with NASA, the U.S. Geological Survey, the U.S. Department of Agriculture, NSF, and other U.S. government agencies on weather and climate science based upon extensive observations, data stewardship, monitoring, research, modeling, predictions, projections, and assessments. Climate information such as drought forecasts, long-term precipitation trends, fire forecasts, and frequency and intensity of coastal storms, are all examples of information provided by NOAA that can inform the development of adaptation plans and strategies by resources managers. NOAA's National Weather Service is a vital component of its weather activities through the management and operation of its observing systems and the resulting observations, development of weather information on shorter time scales, and long standing information delivery infrastructure to communicate information to the public. NOAA works with customers and stakeholders to ensure we are providing high quality information that is user-friendly, responsive, and relevant to the issues being addressed. Increasing demands for integrated climate change information for adaptation however is now straining NOAA's ability to provide adequate climate change services.

NOAA has a strong resource management mission that requires timely, reliable, and authoritative information on climate change impacts. NOAA has both direct and indirect stewardship responsibilities, which are mandated or authorized by existing laws such as the *Magnuson-Stevens Fisheries Conservation and Management Reauthorization Act*, the *Coastal*

[2] IPCC, 2007: *Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, Pachauri, R.K. and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104 pp.

Zone Management Act, the *Marine Mammal Protection Act*, the *National Marine Sanctuaries Act*, the *Endangered Species Act*, and others. NOAA also has responsibilities associated with the maintenance of coastal economies including maritime transportation under the *Coast and Geodetic Survey Act* and the *Hydrographic Services Improvement Act*. As part of these mandates, NOAA managers need to account for the effects of climate variability and change on coastal and marine ecosystems, living marine resources and communities, and adapt their management practices accordingly. A changing climate impacts numerous physical and biological conditions and processes, including ocean temperatures and pH levels, relative water levels in coastal regions and the Great Lakes, sea and lake ice cover, ocean current patterns, freshwater supply, saltwater intrusion, ecological services, biological diversity and distributions, changing patterns of disease, and atmospheric extremes.

As both a producer and user of weather and climate information, NOAA is well positioned to meet its mandates by integrating all climate, coastal, and marine ecosystem observations and predictions, improving delivery of integrated regionally-focused climate information to ocean and coastal decision-makers, and providing tools to effectively use this information to assess risks and implement effective management strategies. Existing NOAA programs provide a critical backbone for effective adaptation:

- NOAA provides operational, sustained weather, climate, and ocean observing networks and monitoring for the state of the ocean, coasts, and atmosphere;
- NOAA is the steward of climate-related data and information;
- NOAA provides critical weather and climate predictions, projections, and key climate model simulations for national and international climate assessment programs such as the IPCC and to those within other federal agencies for their use in development of revised management plans and adaptation strategies;
- NOAA provides predictions and projections of the future state of the climate;
- NOAA develops and delivers products, services, and technical assistance that respond to the needs of decision makers, resource managers, scientists, and the general public;
- NOAA participates in and leads many state of knowledge assessments for specific user-focused issues (e.g., water resource management, marine and coastal resources, disaster management); and
- NOAA has a growing number of collaborative efforts with other federal agencies to produce more effective decision support tools.

The following sections provide some illustrative highlights of climate information, products, services, technical assistance, and training that NOAA provides to the Nation as we address the challenges of a changing climate:

Scientific assessments of climate change impacts and science:

- NOAA is one of several agencies providing authors and review editors, observations, data, model simulations, and analysis, to develop IPCC Assessment Reports.
- NOAA is one of 13 federal agencies involved the U.S. Climate Change Science Program and led the development of nine of the CCSP's Synthesis and Assessment Products. NOAA is currently involved in the development of the CCSP's *USP for Global Climate*

Change Impacts in the USA. The *USP*, when finalized, will be a compilation of the Synthesis and Assessment Products, a series of assessments integrating the current science and information on key climate issues of concern for decision makers (e.g., Synthesis and Assessment Product 3.3 provides a comprehensive analysis of observed and projected changes in weather and climate extremes in North America and U.S. territories).

- NOAA and many federal agencies contributed to the development of the Arctic Climate Impact Assessment (2004), which synthesized the available information on climate variability and change in the Arctic region and analyzed potential climate-related impacts.
- NOAA provides global, North American, and U.S. assessments of the current state of the climate including analysis of temperature, precipitation, drought, significant events, extremes and hazards. Reports such as the intergovernmental and interagency U.S. and North American Drought Monitor and the National Climatic Data Center's State of the Climate Reports place the current state of the climate into the context of the historical climate and climate events.
- NOAA's National Climatic Data Center, with the University of North Carolina, Asheville, supported the production of *Adaptation Planning Handbook: Planning for a New Energy and Climate Future*, which was developed for the Professional Planner. This resource will be used in workshops across the country by State Climatologists and decision makers, to help cities and counties make informed decisions and adapt to climate change. (Anticipated to be published by the American Planning Association in 2009.)
- NOAA maintains key observing systems for monitoring climate change and climate impacts (e.g., ocean buoy and drifter systems, satellites, tide and water level gauges, and coastal land elevation monitoring systems for sea level rise, and the Climate Reference Network) to help decision makers design mitigation and adaptation strategies.
- NOAA develops regional and coastal climatologies such as the Pacific Region Integrated Climatologies Program, which focus on providing information on the patterns and impacts of storminess (high seas, strong winds, and heavy rain) that contribute to coastal inundation hazards.

<u>Partnerships and Applied Information Services in Support of Adaptation:</u>

- The Regional Integrated Sciences and Assessments (RISA) program supports research to address complex climate-sensitive issues of concern for decision-makers and policy planners at a regional level. The RISAs are primarily based at universities, though some members are based at government research facilities, non-profit organizations, or private sector entities. Research topics include agriculture, ecosystem restoration, fisheries, health, water, and wildfire.
    - The Climate Impacts Group RISA at the University of Washington (in partnership with several other entities) released a report exploring what climate change means for Washington State. The Washington Climate Change Impacts Assessment evaluates the impacts of climate change across eight sectors and considers options for adapting to climate change within each. This RISA was also involved with the development of a guidebook, *Preparing for Climate Change: A Guidebook for Local, Regional, and State Governments*. This guidebook is the product of a

collaborative effort between the RISA, King County, WA, and ICLEI – Local Governments for Sustainability, and provides information for regional, state, and local governments on adapting to climate change and its impacts.

- The Carolinas Integrated Sciences and Assessments RISA recently established a formal relationship with the regional Sea Grant programs, as a means to leverage the work of other programs into the RISA. The major objectives of this RISA are to develop, evaluate, and provide key information on how climatic conditions in the Coastal Carolinas may be changing at present and what may be expected to happen in the future. This information is being made available to the public, stakeholders, government agencies and educational programs. Differentiating regional climatic variability and changes from global changes will be a significant part of this undertaking.

- Regional Climate Centers have helped deliver much needed climate information to many of the stakeholders in their respective regions. For example, the Western Regional Climate Center worked with the major federal land management agencies within the Department of the Interior to develop climate-related decision-support tools. Land managers use these tools to support strategies to adapt to the impacts of climate and climate change on fire-vegetation. The Southern Regional Climate Center assisted the Louisiana Governor's Office of Homeland Security and Emergency Preparedness by interpreting climate scenarios of tropical storms. The Southern Regional Climate Center has helped to produce synthetic storm scenarios for emergency planning and exercises such as Hurricane Delaney and, more recently, Hurricane Pam (a study that illustrated the impact of a theoretical storm hitting metropolitan New Orleans and the Louisiana coast, prior to the appearance of Hurricane Katrina).

Partnerships and Applied Information Services in Support of Adaptation – Applications to Living Marine Resources and Habitats

Climate change information is being incorporated into coastal and ocean living marine resource and coastal ecosystem management decisions within NOAA through an increasing emphasis on an ecosystem approach to management and other efforts. NOAA works with federal agencies, state and local governments, nonprofit organizations, and the private sector to help coastal communities acquire, protect, conserve, and restore coastal habitats, not only for the aesthetic and natural habitat benefits, but also because they provide important services to reduce the impacts of storms, flooding, and other coastal hazards. NOAA's efforts include large-scale and regional efforts involving multiple projects, as well as individual and local projects designed to protect or restore coastal wetlands, rivers, and other habitats. NOAA recognizes it is imperative to work with other federal agencies, states, and community partners to develop ecosystem approaches to respond to the effects of changing climate conditions. A strong planning element, matched by determined local involvement leads to proactive adaptation.

- NOAA's Coastal and Estuarine Land Conservation Program provides a tool for states to address climate change and coastal hazards through cost-sharing land acquisition. In the spring of 2008, NOAA held two internal workshops, the *NOAA Climate and Living Marine Resources Workshop* and the *NOAA Workshop on Strengthening Capacity to*

Address the Impacts of Climate Change on Coastal Communities and Ecosystems. The goal of these two workshops was to bring together scientists, program managers, advisors, and staff from labs, offices, and centers across NOAA to discuss and outline strategies to better incorporate climate change information to "(1) fulfill NOAA's resource management responsibilities for living marine resources; and (2) strengthen NOAA and its partners' capacity to address climate impacts on coastal communities and ecosystems." A Technical Memorandum (NMFS-F/SPO-95) outlining the outcomes, possible near-term opportunities, and next steps were developed to capture many of the suggestions and recommendations presented by the participants in the workshops.

- NOAA's Coral Reef Watch satellite program produces near-real-time, web-accessible sea surface temperature products, which monitor for conditions conducive to coral bleaching around the globe. The data provide current reef conditions to quickly identify areas at risk, as well as archived information and retrospective analysis to be used for reef management, scientific research, and monitoring our changing climate.
- NOAA has worked with the Bureau of Reclamation and other agency projects on the impacts of long-term precipitation patterns on management of endangered salmon stocks on the West Coast.

Applied Partnerships and Information Services in Support of Adaptation – Applications to Coastal Communities

NOAA, through a federal-state partnership under its Coastal Zone Management Program, provides national leadership, technical assistance and funding to state and territory coastal management programs to plan for and adapt to climate change. Climate change related projects include creating sea level rise inundation models, developing plans for adapting to climate change, understanding changing ecosystem function and services, changes in ecosystem health and marine animal disease under existing and predicted climate change impacts, and establishing new guidelines for dealing with sea level rise.

- NOAA is engaged a collaborative effort with the U.S. Geological Survey to help the nation prepare coastal adaptation strategies by conducting workshops and fostering partnerships within and between states, regional governance structures, and federal agencies to facilitate adaptation to increased coastal inundation and sea level rise. These agencies are cooperating on joint coastal mapping efforts pursuant to the funding provided by the *American Recovery and Reinvestment Act.*
- NOAA is supporting the San Francisco Bay Conservation and Development Commission's regional planning efforts to adapt to climate change in the Bay Area. NOAA is helping the coastal management agency achieve the objectives of their adaptation plans by supporting their work on mapping shoreline areas vulnerable to sea level rise; organizing a regional program to address climate change in the Bay Area, and updating the San Francisco Bay Plan findings and policies to address global climate change effects on San Francisco Bay.
- NOAA is collaborating with state and academic partners to examine potential changes in the distribution and range of marine animals as well as marine pathogens in response to climate change. This will improve our understanding of how climate-related shifts in previously identified ranges may affect the risk of human exposure to certain pathogens.

Applied Partnerships and Information Services in Support of Adaptation – Applications to Water Resources

Climate variability and change affect the function and operation of existing water infrastructure — including hydropower, structural flood defenses, drainage, and irrigation systems — as well as water management practices. NOAA's climate programs provide the Nation with services and information to improve management of climate sensitive sectors such as water resources through observations, analyses and predictions, decision support tools, and sustained user interaction.

- As requested in the 2004 Western Governors' Association Report, *Creating a Drought Early Warning System for the 21st Century: The National Integrated Drought Information System (NIDIS)*, and codified by the 2006 NIDIS Act (Public Law 109-430), NIDIS is an interagency effort designed to serve as an early warning system for drought and drought related risks enabling society to respond to periods of short-term and sustained drought. The role of NIDIS is to develop the leadership and networks to implement an integrated drought monitoring and forecasting system at federal, state, and local levels; foster and support a research environment focusing on risk assessment, forecasting, and management; create an "early warning system" for drought to provide accurate, timely, and integrated information; develop interactive systems, such as the web-based U.S. Drought Portal, as part of the early warning system; and provide a framework for public awareness and education about drought. NIDIS is providing improved coordination and delivery of more comprehensive and timely drought information, impacts and forecasts, as well as decision support tools, for many users to help mitigate drought-related impacts.
    - NIDIS consolidates activities and inputs from the RISAs, Regional Climate Centers, etc, into an early warning information system for drought.
    - NIDIS has launched the U.S. Drought Portal as a clearinghouse for cross-agency drought related monitoring, forecasts, and impacts information.
    - NIDIS has begun development of the Colorado Basin Drought Information Portal and drought monitor (as a subset of the U.S. Drought Portal).

IMPROVING NOAA'S CLIMATE INFORMATION AND SERVICE FOR THE FUTURE

The above examples are only a small subset of NOAA's work in climate adaptation activities. In 2008, NOAA began an effort to improve its integrated climate services to: (1) develop and deliver a more broad range of operational climate information products and services; (2) in partnership with other federal agencies with trust resource mission mandates, to support research on the impacts of climate variability and change on human and natural environments; (3) support and preserve the climate data record; (4) support the development of assessments and adaptation strategies from international to local levels; and (5) collaborate with stakeholders on enhancing their capacity to use climate information and related decision-support resources.

Early activities of this effort include:

- NOAA offices working across the agency to begin to develop a single point of access for integrated data, models, tools, and information useful to understanding, mitigating, and adapting to a changing climate
- Exploration of high priority areas for climate product enhancement and services in areas such as ocean acidification and sea level;
- Continued development of integrated data products and decision support tools in response to the needs of climate sensitive communities, protected areas, and economic sectors.

CONCLUSION

Despite the substantial efforts by NOAA to date, there still remain significant knowledge gaps and uncertainties for adaptation, as well challenges in communicating knowledge and information relevant for decision makers. In addition, the scale at which reliable information is produced (i.e. global) does not always match what is needed for adaptation decisions (i.e. at the watershed and local levels). New information tools and planning processes are attempting to overcome these barriers at local, regional, and national levels in both developing and developed countries.

An effective response to changing climate conditions will require an integrated, flexible, and responsive Government-wide approach. To help fill this need, NOAA has been working with other agencies to build on existing capacities to create a seamless and integrated process for transferring climate science information to society to allow for informed decision-making and the development of adaptation activities at the federal, state, and local levels.

Mr. MARKEY. We thank you, Mr. Karl. Our next witness is Mr. John Stephenson. He is the director for Natural Resources and Environment for the Government Accountability Office. Mr. Stephenson has appeared many times before this committee to provide GAO's perspective on energy and environmental issues. We welcome you back, sir.

STATEMENT OF JOHN STEPHENSON

Mr. STEPHENSON. Thank you, Mr. Chairman, Mr. Upton, and members of the subcommittee. I am here today to give GAO's perspective on how the United States is adapting to actual and anticipated changes in the climate.

Thus far, attention and resources have focused largely on emissions reduction options, climate science research, and technology investment. However, adaptation is beginning to receive more attention because the greenhouse gases already in the atmosphere are expected to continue altering the climate system regardless of efforts to control emissions.

While it may be costly to build coastal dikes to protect community from sea level rise or to build higher bridges or to improve storm water systems, there is a growing recognition in the United States and elsewhere that the cost of inaction could be greater.

My testimony addresses the actions federal, state, local and international authorities are currently taking to adapt to changing climate, the key challenges these officials are facing in their efforts to adapt, and the actions that Congress and federal agencies could take to help address these challenges.

The information in my testimony is based largely on prior GAO work but also draws on our ongoing study for this subcommittee. In summary, we found that a variety of adaptation-related activities are underway at different levels of government including federal efforts like NOAA's to provide information and guidance to decision makers.

In addition, federal resource management agencies like the Departments of Interior and Agriculture are beginning to consider climate change in their planning activities. We also found that certain state, local, and international governments are developing and implementing climate change adaptation plans.

For example, we just completed a site visit exploring Maryland's strategy for reducing its vulnerability to climate change, focusing on sea level rise and coastal storms. We found that the state has completed an extensive mapping effort to identify coastal vulnerability and has begun educating coastal communities about changes that can be made to local ordinances to reduce coastal erosion and increase resilience.

Specifically, Maryland provided guidance to three coastal counties, recommending changes to planning documents, building codes, and local laws to address the risk resulting from sea level rise. We attended a public meeting held within the county threatened by sea level rise and observed how difficult it was to come to a resolution about the costs and trade-offs associated with taking versus not taking adaptive measures.

Several of our recent reports illustrate a number of challenges faced by government officials in attempting to address climate

change adaptation. First, climate change is one of many priorities competing for their attention. Second, a lack of guidance can constrain the ability of officials to consider climate change in management and planning decisions. Third, insufficient site-specific information can reduce the ability of officials to manage the effects of climate change on the resources they oversee. And finally, officials are struggling to make decisions based on projected future climate scenarios rather than past conditions.

On this last point, a recent report by the National Resource Counsel stated that decision makers are not prepared to manage or plan for adaptation because many of their usual practices assume a continuation of past climate conditions. According to the NRC, this assumption is no longer valid because climate change will create a new and constantly changing decision environment.

Our own 2000 report on FEMA's national flood insurance program, which insures properties against flooding, and USDA's federal crop insurance corporation, which insures crops against drought or other weather disasters, reached similar conclusions. Both highlighted how historical information may no longer be a reliable guide for decision making. Unlike private sector insurers, neither federal insurance program had considered how climate change could affect their portfolios over the near or long term, potentially exposing the programs and taxpayers to greater financial risk.

Our ongoing work for this committee will continue to explore these other adaptation issues and identify actions that can be taken to help move adaptation programs forward.

To date, preliminary observations suggest a need for, one, improving coordination among federal agencies and with state and local governments; two, preparing a national adaptation strategy and better guidance; and three, developing regional and sector-specific information on the impacts of climate change.

Some have also suggested the creation of a centralized government entity to collect and publicly share information about climate change impacts and adaptation strategies. We plan to continue to obtain information and perspectives from a broad range of federal, state, and local stakeholders, and later this year, issue a report to the committee on the results of our work. Mr. Chairman, that concludes my statement, and I will be happy to answer questions at the appropriate time.

[The prepared statement of Mr. Stephenson follows:]

United States Government Accountability Office

GAO

Testimony

Before the Subcommittee on Energy and Environment, Committee on Energy and Commerce, House of Representatives

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CLIMATE CHANGE

Observations on Federal Efforts to Adapt to a Changing Climate

Statement of John Stephenson, Director
Natural Resources & Environment

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GAO-09-534T

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Highlights

Highlights of GAO-09-534T, a testimony before the Subcommittee on Energy and Environment, Committee on Energy and Commerce, House of Representatives

Why GAO Did This Study

Changes in the climate attributable to increased concentrations of greenhouse gases may have significant environmental and economic impacts in the United States. For example, climate change could threaten coastal areas with rising sea levels, alter agricultural productivity, and increase the intensity and frequency of floods and storms.

Federal, state, and local agencies are tasked with a wide array of responsibilities that will be affected by a changing climate, such as managing natural resources. Furthermore, climate change could increase the cost of federal programs, such as crop and flood insurance, and place new stresses on infrastructure.

Greenhouse gases already in the atmosphere will continue altering the climate system into the future regardless of emissions control efforts. Therefore, adaptation—defined as adjustments to natural or human systems in response to actual or expected climate change—is an important part of the response to climate change.

Today's testimony summarizes GAO's prior and ongoing work examining (1) actions that federal, state, local, and international authorities are taking to adapt to a changing climate, (2) the challenges that federal, state, and local officials face in their efforts to adapt, and (3) actions that the Congress and federal agencies could take to help address these challenges.

View GAO-09-534T or key components. For more information, contact John Stephenson, (202) 512-3841, stephensonj@gao.gov.

March 25, 2009

CLIMATE CHANGE

Observations on Federal Efforts to Adapt to a Changing Climate

What GAO Found

Based on preliminary observations from GAO's ongoing adaptation work for the Select Committee on Energy Independence and Global Warming, certain federal, state, local, and international government authorities are beginning to consider and implement climate change adaptation measures. Some federal programs are already helping officials make decisions in response to a changing climate. For example, the National Oceanic and Atmospheric Administration's Regional Integrated Sciences and Assessments (RISA) program supports climate change research to meet the adaptation-related information needs of decision makers and planners at the regional level. In addition, certain state, local, and international governments are developing and implementing climate change adaptation plans. For example, GAO's recent site visit to Maryland examined the state's comprehensive strategy for reducing vulnerability to climate change focused on sea level rise and coastal storms. As part of ongoing work for the Select Committee, GAO plans to conduct four additional site visits to learn from international, federal, and local adaptation efforts.

Several of GAO's recent reports on climate change examined a num' of challenges faced by government officials in their efforts to adapt. First, climate change is one of many priorities competing for attention and resources. Second, a lack of guidance can constrain the ability of officials to consider climate change in management and planning decisions. Third, insufficient site-specific data, including a lack of local projections of expected changes, can reduce the ability of officials to manage the effects of climate change on the resources they oversee. Fourth, officials are struggling to make decisions based on future climate scenarios that may not reflect past conditions. Our ongoing work seeks to identify other challenges warranting the attention of policymakers.

Some of GAO's recent climate change-related reports offer clues on the types of actions federal agencies and the Congress could take to assist states and communities in their efforts to adapt. A recent GAO report on federal land management, for example, recommended that certain agencies develop guidance advising managers how to address the effects of climate change on the resources they manage. Furthermore, a recent GAO report on the economics of climate change identified actions the Congress and federal agencies could take, such as reforming insurance subsidy programs in areas vulnerable to hurricanes or flooding. GAO's current effort for the Select Committee, which focuses more directly on adaptation, will obtain information and perspectives from diverse groups of knowledgeable federal, state, and local officials, and in particular will seek to learn from the experience of practitioners on the front lines working to adapt to a changing climate. This work will be completed ' late 2009.

Mr. Chairman and Members of the Subcommittee:

I am pleased to be here today to provide observations on federal efforts to adapt to a changing climate. Changes in the earth's climate attributable to increased concentrations of greenhouse gases may have significant environmental and economic impacts in the United States and internationally.[1] Among other potential impacts, experts agree that climate change could threaten coastal areas with rising sea levels, alter agricultural productivity, and increase the intensity and frequency of floods and tropical storms. Federal, state, and local agencies are tasked with a wide array of responsibilities, such as managing natural resources, that will be affected by a changing climate. Furthermore, climate change has implications for the fiscal health of the federal government, affecting federal crop and flood insurance programs, and placing new stresses on infrastructure. The effects of increases in atmospheric concentrations of greenhouse gases and temperature on ecosystems and economic growth are expected to vary across regions, countries, and economic sectors (see table 1).

Table 1: Potential Impacts of Climate Change by Sector

Sector	Major projected impacts
Agriculture, forestry, and ecosystems	Increased yields in colder environments
	Decreased yields in warmer environments
	Increased insect outbreaks
	Increased danger of wildfires
	Damage to crops
	Waterlogging of soils
	Land degradation
	Increased livestock deaths
	Uprooting of trees
	Damage to coral reefs
	Salinization of irrigation water, estuaries, and freshwater systems

[1]Major greenhouse gases include carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and synthetic gases (hydrofluorocarbons [HFCs], perfluorocarbons [PFCs], and sulfur hexafluoride [SF6]).

Sector	Major projected impacts
Water resources	Effects on some water resources, such as increased salinization of groundwater and decreased availability of freshwater for humans and ecosystems
	Increased water demand
	Water quality problems
	Adverse effects on quality of surface and groundwater
	More widespread water scarcity
	Power outages causing disruption of public water supply
	Decreased freshwater availability due to saltwater intrusion
Human health	Reduced human mortality from decreased cold exposure
	Increased risk of heat-related mortality
	Increased risk of deaths, injuries, and infectious respiratory and skin diseases
	Increased risk of food and water shortage
	Increased risk of malnutrition
	Increased risk of water- and food-borne diseases
	Increased risk of deaths and injuries by drowning and floods
Industry, settlement, and society	Reduced energy demand for heating
	Increased energy demand for cooling
	Declining air quality in cities
	Reduced disruption to transport due to snow, ice
	Disruption of settlements, commerce, transport, and societies due to flooding
	Pressures on urban and rural infrastructures
	Water shortages for settlements, industry, and societies
	Reduced hydropower generation potential
	Potential for population migration
	Disruption by flood and high winds
	Withdrawal of risk coverage in vulnerable areas by private insurers
	Costs of coastal protection versus costs of land use relocation
	Potential for movement of populations and infrastructure

Source: IPCC, Working Group III, AR4, Summary for Policymakers

Proposed responses to climate change include reducing greenhouse gas emissions through regulation, the promotion of low-emissions technologies, and adapting to the possible impacts by planning and improving protective infrastructure. Thus far, government attention and resources have been focused on emissions reductions options, climate science research, and technology investment. In recent years, however, climate change adaptation—adjustments to natural or human systems in response to actual or expected climate change—has begun to receive more attention because the greenhouse gases already in the atmosphere are expected to continue altering the climate system into the future regardless of efforts to control emissions.

Policy makers are increasingly viewing adaptation as a risk-management strategy to protect vulnerable sectors and communities that might be affected by changes in the climate. It may be costly to raise river or coastal dikes to protect communities and resources from sea level rise, build higher bridges, or improve storm water systems. But there is a growing recognition, in the United States and elsewhere, that the cost of inaction could be greater.

My testimony today addresses (1) what actions federal, state, local, and international authorities are taking to adapt to a changing climate, (2) the challenges that federal, state, and local officials face in their efforts to adapt, and (3) actions that the Congress and federal agencies could take to help address these challenges. The information in this testimony is based largely on prior GAO work, including recent reports on climate change on federal lands, federal flood and crop insurance programs, and climate change economics.[2] In addition, certain information in this testimony was gathered through interviews of knowledgeable stakeholders and review of existing adaptation reports as part of our ongoing study of climate change adaptation for the Select Committee on Energy Independence and Global Warming (Select Committee). We conducted our work in accordance with GAO's Quality Assurance Framework, which requires that we plan and perform each engagement to obtain sufficient and appropriate evidence to meet our stated objectives and to discuss any limitations in our work. We believe that the information and data obtained, and the analyses conducted, provided a reasonable basis for the findings and conclusions in these reports.

Federal, State, Local, and International Efforts to Adapt to a Changing Climate

Based on preliminary observations from our ongoing adaptation work for the Select Committee, certain federal, state, local, and international government authorities are beginning to consider and implement climate change adaptation measures. A range of federal activities are underway, including efforts to provide information and guidance to decision makers. Certain federal programs are already helping officials make decisions in response to a changing climate. For example, two programs managed by the Department of Commerce's National Oceanic and Atmospheric

[2]See *Climate Change: Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources*, GAO-07-863, (Washington, D.C.: Aug. 7, 2007); *Climate Change: Financial Risks to Federal and Private Insurers in Coming Decades Are Potentially Significant*, GAO-07-285, Mar. 16, 2007; and *Climate Change: Expert Opinion on the Economics of Policy Options to Address Climate Change*, GAO-08-605, May 9, 2008.

Administration (NOAA) help policy makers and managers obtain the information they need to adapt to a changing climate. NOAA's Regional Integrated Sciences and Assessments program supports climate change research to meet the needs of decision makers and policy planners at the regional level. Similarly, NOAA's Sectoral Applications Research Program is designed to help decision makers in different sectors, such as coastal resource managers, use climate information to respond to and plan for climate variability and change, among other goals. Other agencies—including the Department of the Interior's (Interior) U.S. Geological Survey and the National Aeronautics and Space Administration—also manage programs to provide climate information to decision makers.

Federal resource management agencies are also taking steps to adapt to a changing climate. For example, the United States Department of Agriculture's (USDA) Forest Service developed a strategic framework for responding to climate change that recognizes the need to enhance the capacity of forests and grasslands to adapt. In written testimony at a March 3, 2009 hearing before the House Committee on Natural Resources, Subcommittee on National Parks, Forests, and Public Lands, the Chief of the Forest Service stated that dealing with risks and uncertainties introduced or made worse by climate change will need to be a more prominent part of the Forest Service's management decision processes.[3] Similarly, Interior recognized a number of adaptation-related policy options for land managers in reports produced for its Climate Change Task Force.[4] For example, the task force recognized the need to revise management plans to reflect the effects of predicted climate conditions.

Other federal efforts are also attempting to link climate information with the needs of decision makers. The Climate Change Science Program (CCSP)—a multi-agency coordinating group that integrates federal research on climate change—is in the process of developing a series of "building blocks" that outline options for future climate change work, including science to inform adaptation. The adaptation building block includes support and guidance for federal, regional, and local efforts to prepare for and respond to climate change, including characterizing the need for adaptation, and developing, implementing, and evaluating

[3]Also, on January 16, 2009, the Forest Service issued guidance for addressing climate change considerations in land management planning and project implementation.

[4]For more information about the Department of the Interior Climate Change Task Force, see http://www.usgs.gov/global_change/doi_taskforce.asp.

adaptation approaches. In addition, a recent CCSP report described adaptation options for climate-sensitive ecosystems and resources on federally owned and managed lands.[5] Another example of federal efforts to link climate information with the needs of decision makers is the Environmental Protection Agency's (EPA) Climate Ready Estuaries program to develop and implement adaptation strategies in coastal communities.[6]

While adaptation is one of many competing priorities for decision makers, certain state, local, and international governments are nonetheless developing and implementing climate change adaptation plans. For example, we just completed a site visit exploring Maryland's adaptation initiatives. In August 2008, the state issued a comprehensive strategy for reducing its vulnerability to climate change, focusing on sea level rise and coastal storms. The state has completed an extensive mapping effort to identify coastal vulnerability and has begun educating coastal counties about changes that can be made to local ordinances to reduce coastal erosion and increase resilience. Specifically, it provided guidance to three coastal counties recommending changes to planning documents, buildings codes, and local laws to address the risks resulting from sea level rise. Two recent reports by non-government research groups summarize other state and local adaptation planning efforts.[7] As part of our ongoing work for the Select Committee, we plan to further explore the Maryland example and examine additional international, federal, and local adaptation planning and implementation efforts through four more site visits, including the United Kingdom, a federal land management unit, the City of Chicago, and King County, Washington. These site visits will allow us to identify and document how existing adaptation efforts were developed and implemented. Further, site visits will help us identify the

[5]CCSP, 2008: *Preliminary review of adaptation options for climate-sensitive ecosystems and resources.* A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. [Julius, S.H., J.M. West (eds.), J.S. Baron, B. Griffith, L.A. Joyce, P. Kareiva, B.D. Keller, M.A. Palmer, C.H. Peterson, and J.M. Scott (Authors)]. U.S. Environmental Protection Agency, Washington, DC, USA, 873 pp.

[6]Estuaries are places where rivers meet the sea.

[7]See *Adaptation Planning: What U.S. States and Localities are Doing*, Prepared for the Pew Center on Global Climate Change, November 2007 (Updated January 2009), available at http://www.pewclimate.org/working-papers/adaptation, and *A Survey of Climate Change Adaptation Planning*, The H. John Heinz III Center for Science, Economics, and the Environment, Washington DC, 2007, available at http://www.heinzctr.org/publications/meeting_reports.shtml

information and other needs of decision-makers, how the federal government is addressing these needs, and how these efforts can be improved.

Challenges in Adapting to Climate Change

Several of our recent reports on climate change illustrate a number of challenges faced by government officials when adapting to a changing climate. Among them, (1) climate change is one of many competing priorities for government officials, (2) a lack of guidance can constrain the ability of officials to consider climate change in management and planning decisions, (3) insufficient site-specific information can reduce the capability of officials to manage the effects of climate change on the resources they oversee, and (4) officials are struggling to make decisions based on projected future climate scenarios that may not reflect past conditions. Our ongoing work for the Select Committee will continue to explore these and other challenges by obtaining information from a broad range of federal, state, and local officials knowledgeable about climate change adaptation.

Competing priorities. Our August 2007 report on climate change on fed lands shows how climate change impacts compete for the attention of decision makers with many more immediate priorities.[8] The federal government manages nearly 30 percent of the land in the United States. Three federal agencies within Interior—the Bureau of Land Management, U.S. Fish and Wildlife Service, and the National Park Service—and USDA's Forest Service administer over 90 percent of these lands. NOAA administers Marine Protected Areas.[9] These agencies manage their resources for a variety of purposes related to preservation; recreation; and in some cases, resource use, yet each agency has distinct responsibilities for the resources it administers. The agencies are generally authorized to plan and manage for changes in resource conditions, regardless of the cause that brings about the change. As such, federal resource management agencies are generally authorized but not specifically required to address changes in resource conditions resulting from climate change in their actions and planning efforts.

[8] *Climate Change: Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources*, GAO-07-863, (Washington, D.C.: Aug. 7, 2007)

[9] Marine Protected Areas are areas of the marine environment that have been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein.

The same report found that the resource management agencies we reviewed did not at that time make climate change a priority, and that the agencies' strategic plans did not specifically address climate change. Resource managers explained that they had a wide range of responsibilities and that, because none of the agencies designated climate change as a priority, they focused first on near-term activities that they were specifically required to undertake, leaving less time and resources for longer-term issues such as climate change. Resource managers told us that climate change effects were typically not addressed in agency planning activities. Although resource management agencies are now beginning to consider climate change adaptation in planning decisions, this example illustrates how other issues may overshadow climate change adaptation if it is not explicitly designated as a priority.

Lack of guidance. Our August 2007 report also noted that resource managers were constrained by limited guidance about whether or how to address climate change and, therefore, were uncertain about what actions, if any, they should take. In general, resource managers from all of the agencies said that they needed specific guidance to incorporate climate change into their management actions and planning efforts. For example, officials from several federal land and water resource management agencies said that guidance would help resolve differences in their agencies about how to interpret broad resource management authorities with respect to climate change and give them an imperative to take action. While these agencies have started to issue guidance to resource managers, this example shows how a lack of guidance can limit efforts to adapt.

Lack of site-specific information. Our report also demonstrated that resource managers did not have sufficient site-specific information to plan for and manage the effects of climate change on the federal resources they oversee. In particular, the managers lacked computational models for local projections of expected changes. For example, at that time, officials at the Florida Keys National Marine Sanctuary said that they lacked adequate modeling and scientific information to enable managers to predict change on a small scale, such as that occurring within the sanctuary. Without such models, most of the managers' options for dealing with climate change were limited to reacting to already-observed effects on their units, making it difficult to plan for future changes. Furthermore, these resource managers generally lacked detailed inventories and monitoring systems to provide them with an adequate baseline understanding of the plant and animal species that existed on the resources they manage. Without such information, it is difficult to determine whether observed changes are within the normal range of variability.

Uncertainties in making decisions based on projected future conditions. A recent report by the National Research Council (NRC) shows how officials are struggling to make decisions based on future climate scenarios instead of past climate conditions.[10] According to the report, requested by EPA and NOAA, government agencies, private organizations, and individuals whose futures will be affected by climate change are unprepared both conceptually and practically for meeting the challenges and opportunities it presents. Many of their usual practices and decision rules (for building bridges, implementing zoning rules, using private motor vehicles, and so on) assume a stationary climate—a continuation of past climate conditions, including similar patterns of variation and the same probabilities of extreme events. According to the NRC, that assumption, fundamental to the ways people and organizations make their choices, is no longer valid. Climate change will create a novel and dynamic decision environment.

Our own 2007 climate change-related report on the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program, which insures properties against flooding, and USDA's Federal Crop Insurance Corporation, which insures crops against drought or other weather disasters, reached similar conclusions, highlighting how historical information may no longer be a reliable guide for decision making.[11] Among other things, the report contrasted the experience of public and private insurers. Many major private insurers were incorporating some near-term elements of climate change into their risk management practices. In addition, some private insurers were approaching climate change at a strategic level by publishing reports outlining the potential industry-wide impacts and strategies to proactively address the issue. This more proactive view was recently echoed on March 17, 2009, by the National Association of Insurance Commissioners, which adopted a mandatory requirement that insurance companies disclose to regulators the financial risks they face from climate change, as well as actions the companies are taking to respond to those risks.

[10]National Research Council (2009), *Informing Decision in a Changing Climate.* Panel on Strategies and Methods for Climate-Related Decision Support, Committee on the Human Dimensions of Global Change, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

[11]*Climate Change: Financial Risks to Federal and Private Insurers in Coming Decades Are Potentially Significant,* GAO-07-285, (Washington, D.C.: Mar. 16, 2007)

In contrast, our 2007 report noted that the agencies responsible for the nation's key federal insurance programs had done little to develop the kind of information needed to understand their programs' long-term exposure to climate change for a variety of reasons. As a FEMA official explained, the National Flood Insurance Program is designed to assess and insure against current—not future—risks. Unlike the private sector, neither this program nor the Federal Crop Insurance Corporation had conducted an analysis to assess the potential impacts of an increase in the frequency or severity of weather-related events on their operations over the near- or long-term. Both FEMA and USDA have committed to study these issues further and report to the Congress, with USDA estimating completion by December 31, 2009.

Preliminary observations from our interviews with knowledgeable stakeholders and review of existing adaptation reports confirm the challenges discussed above, but also identify additional issues. For example, certain documents we reviewed as part of our ongoing work for the Select Committee identified the lack of public awareness about adaptation as a challenge. Our continuing work will explore this issue further and seek to identify other challenges warranting the attention of policymakers by collecting information from diverse groups of knowledgeable federal, state, and local officials.

Potential Adaptation Actions by the Congress and Federal Agencies

Some of our recent climate change-related reports offer clues on the types of actions federal agencies and the Congress could take to assist states and communities in their efforts to adapt to climate change. Our August 2007 report on federal land management, for example, recommended that the Secretaries of Agriculture, Commerce, and the Interior develop guidance that advises resource managers on how to address climate change effects and gather the information needed to do so. Our March 2007 report assessing the financial risks to federal insurance programs found that their exposure to weather-related losses had grown substantially and recommended that the Secretaries of Agriculture and Homeland Security analyze the potential long-term fiscal implications of climate change for the programs and report their findings to the Congress.

Our May 2008 report on the economics of climate change also identified actions that could assist officials in their efforts to adapt to a changing

climate.[12] Some of the economists surveyed for this report suggested, for example, reforming insurance subsidy programs in areas vulnerable to natural disasters like hurricanes or flooding. Several noted that a clear federal role exists for certain sectors, such as water resource management, which could require additional resources for infrastructure development, research, and managing federal lands.

Our current effort for the Select Committee, focused more directly on climate change adaptation than our prior reports, will provide additional information and insights on the types of actions federal agencies and the Congress could take to assist adaptation efforts. To date, several interviews with knowledgeable stakeholders and evaluation of existing adaptation reports suggested a need for improved coordination among federal agencies and between federal, state, and local governments. Some have also suggested the creation of a centralized government entity to collect and share information about climate change impacts and adaptation. We plan to explore these observations in greater detail by obtaining information and perspectives from a wide range of knowledgeable officials on the front lines of the nation's efforts to adapt to a changing climate. We expect to complete our ongoing work by late 2[illegible]

Mr. Chairman, this concludes my prepared statement. I would be happy to respond to any questions that you or other Members of the Subcommittee may have at this time.

Contact and Staff Acknowledgments

Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this statement. For further information about this testimony, please contact John Stephenson, Director, Natural Resources and Environment at (202) 512-3841 or stephensonj@gao.gov. Key contributors to this statement were Steven Elstein (Assistant Director), Ben Shouse, and Joe Thompson. Chuck Bausell, Kate Cardamone, Cindy Gilbert, Richard P. Johnson, Kirsten Lauber, Jeanette Soares, and Ruth Solomon also made important contributions.

[12] *Climate Change: Expert Opinion on the Economics of Policy Options to Address Climate Change*, GAO-08-605, (Washington, D.C.: May 9, 2008)

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Mr. MARKEY. And we thank you, Mr. Stephenson, very much. Our next witness is Mr. Larry Schweiger, who is the president and CEO of the National Wildlife Federation. Previously Mr. Schweiger served as president and CEO of the Western Pennsylvania Conservancy and as the first vice-president of the Chesapeake Bay Foundation. He currently chairs the Green Group, a coalition of environmental organizations. We welcome you back, and whenever you are ready, please begin.

STATEMENT OF LARRY SCHWEIGER

Mr. SCHWEIGER. Thank you, Mr. Chairman, and members of the subcommittee.

Mr. MARKEY. Pull the microphone in just a little bit closer please.

Mr. SCHWEIGER. Yeah. America has been blessed with an abundance of natural resources. Born and raised as a hunter and angler, I can say that our unique wildlife heritage has helped define the traditions and values of my family and I know of many other American families for generations.

Since the conservation leadership of President Theodore Roosevelt, millions of Americans have devoted themselves to protecting and restoring our country's natural resources. Now, because of unchecked global warming, a century of conservation achievement is in jeopardy.

Today's hearing is essentially about whether Congress will ensure our children and their children are not left in a world that is fundamentally different from the one that we have enjoyed. I ask you, Mr. Chairman and subcommittee members, are you ready to talk about a world that no longer has polar bears, vast sagebrush depth, and free-roaming antelope, ice fishing, and deep snows in the water, cold water rivers teeming with salmon and trout? It is not an exaggeration to call what we are facing a climate crisis. In fact, the problem with the debate so far is that the climate change has consistently been underestimated. The conservative protections that have framed this story for many years are now being surpassed at a rate that has even shocked scientists closely monitoring the changes.

Congress must enact a two-part agenda in its climate and energy legislation to adequately address the climate crisis. First, Congress must cap global warming pollution now and being steadily and rapidly reducing at a rate and pace dictated by the science and by the precautionary principles. Reducing carbon pollution in the atmosphere is the only way to head off the worst impacts of the climate change on people and on wildlife.

Secondly, Congress must use revenues from the carbon cap program to carry out a program that is clean, green, and fair. Clean because we must invest in clean energy technologies to move to a new place in this country. Green because we must provide a large-scale dedicated funding to protect our nation's wildlife and other natural resources from climate change. And fair because we must protect consumers and particularly help those who are most vulnerable around the world.

I want to emphasis if we cap carbon pollution but fail to invest adequately in natural resource protection, we will have accom-

plished only half of the job. Because we have already committed so much global warming pollution to the atmosphere, we will necessarily be grappling with the harmful impacts to wildlife for decades to come.

National Wildlife Federation is working with scientists, resource managers, and a coalition of more than 700 hunting, fishing, and conservation organizations from every state in the nation to urge Congress to design climate legislation that conserves wildlife and other natural resources from the impacts of global warming.

You will see from the attached to my written testimony a set of principles from the National Wildlife Federation and 19 other national conservation and supporting organizations calling for large-scaled dedicated funding for natural resource adaptation and for identifying key legislative provisions to ensure that expenditures of such funding is science based and strategic.

Also attached is a letter from 612 leading scientists, highlighting the urgency of the issue and also calling for large-scale dedicated funding to the purpose of adaptation. We are gratified to see President Obama pledge in his campaign to use dedicated funding from the climate legislation for natural resource adaptation. We are also pleased that our coalition's principles were largely reflected in the Climate Security Act, passed by the Senate Environmental Public Works Committee last year.

Conservation practitioners have already started planning their natural resource adaptation efforts across the country, but planning will be wasted without the resources to put that program on the ground. Some have argued that funds for safeguarding natural resources should come from sources other than a cap program; however, the principle of pollute-or-pay must apply here. Any legislation that allows companies to pay to pollute must dedicate a portion of those payments to repair the current and future damages caused by that pollution.

Mr. Chairman, the fourth report of the IPCC warns that in the lifetime of a child born today, 20 to 30 percent of the world's plant and animal species will be on the brink of extinction if we don't take action now. It makes it clear that unless we both cut carbon emissions and invest in adaptation, we could easily lose over a million species.

To meet our fundamental ethical duty to pass on a healthy planet to future generations, we must reduce carbon pollution, and we must invest now in natural resource adaptation. We must protect the natural world that protects us and our children. Thank you.

[The prepared statement of Mr. Schweiger follows:]

Testimony of
LARRY SCHWEIGER, PRESIDENT and CEO
NATIONAL WILDLIFE FEDERATION

Before the
SUBCOMMITTEE ON ENERGY AND ENVIRONMENT, HOUSE COMMITTEE ON ENERGY AND COMMERCE

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I. INTRODUCTION

Good morning, Chairman Markey and members of the subcommittee, my name is Larry Schweiger and I serve as President and CEO of the National Wildlife Federation. I would like to thank you for the opportunity to testify today on behalf of our more than four million members and supporters. The National Wildlife Federation's mission is to inspire Americans to protect wildlife for our children's future.

America is blessed with an abundance of natural resources that are essential for our food, shelter and economic vitality. They provide for our physical and spiritual well being. The unique habitats and landscapes in America's regions are the characteristics that define us as Americans. Born and raised as a hunter and an angler, I can say that our unique wildlife heritage has helped define traditions and forge family values in millions of American families from generation to generation.

Since the conservation leadership of President Theodore Roosevelt, millions of Americans have devoted themselves to protecting and restoring our country's natural resources. Some of these selfless individuals are in this room. We have all benefited from their work in countless ways. Now, because of unchecked global warming, a century of conservation achievements is in jeopardy.

As you conduct your work on this most compelling challenge of our time - the impacts of global warming on the natural world - let us remember the words of President Roosevelt:

"Of all the questions which can come before this nation, short of the actual preservation of its existence in a great war, there is none which compares in importance with the great central task of leaving this land even a better land for our descendants than it is for us ...,

Conservation is a great moral issue, for it involves the patriotic duty of insuring the safety and continuance of the nation. Let me add that the health and vitality of our people are at least as well worth conserving as their forests, waters, lands, and minerals, and in this great work the national government must bear [a] most important part."

Today's hearing is essentially about whether Congress will step up to its moral duty to ensure our children and grandchildren are not left with a world fundamentally different than the one we have enjoyed. Are we ready to tell our children that much of what we have enjoyed on earth will not be available to them?

I ask you, Mr. Chairman, and Subcommittee members: Are you ready to talk about a world that no longer has polar bears? Vast sagebrush steppe and free-roaming antelope?

Ice fishing and deep snows in the winter? Sufficient river-flows in the summer? Cold-water rivers teeming with salmon and trout?

It is not an exaggeration to call what we are facing a climate crisis. In fact, the problem with the debate so far is that climate change has consistently been underestimated. The conservative projections that have framed this story for many years are now being surpassed at a rate that has even shocked scientists. With the current pace of climate change, it is hard to imagine what life will look like even ten years from now.

The climate crisis is a story that has been left untold to too many people. It is a story we'd rather not hear, or face up to. It is a story, however that we can still alter, if we act swiftly. But the window is rapidly closing. I have written a book that will soon be published entitled, "Last Chance" because I believe we are facing our last chance to protect life on earth as we have known it. The time for action is now.

National Wildlife Federation and our partners in conservation are extremely pleased that you chose the topic of adaptation for today's hearing. We must do all we can now to safeguard natural resources from a warming world. We are working with scientists, resource managers and a coalition of more than 700 hunting, fishing and conservation organizations from every state in the nation to ask Congress to design climate and energy legislation that will conserve and protect fish, wildlife and natural areas -- including parks, marine sanctuaries, refuges and forests – from the impacts of global warming. (*See* Appendices A and B). We must not wait until the full impacts are upon us. We must prepare responsibly by conserving the resources we need right now, and developing new strategies that integrate climate science into conservation management plans.

If I had a magic wand – and believe me I wish I did – to end all carbon pollution tomorrow, the negative impacts on wildlife and natural resources would continue for decades. Congress must recognize that the climate crisis requires bold action on the effects as well as the causes.

We must invest *now* in safeguarding the natural world from the inevitable impacts of global warming. Mr. Chairman, the fourth report from the Nobel Prize-winning Intergovernmental Panel on Climate Change (IPCC) report warns that in the lifetime of a child born today, 20 to 30 percent of the world's plant and animal species will be on the brink of extinction if we don't take action now.[1] This means that we could easily lose about a million species if current carbon emissions continue and if we fail to invest now in adaptation.

Of course, if we fail to cap global warming pollution, nothing we can do on the adaptation front will save our endangered wildlife or conserve the ecosystems that support our economy and protect our quality of life. The urgent need to cap carbon emissions is frequently noted by commentators on the climate crisis. But many observers

[1] IPCC, *Climate Change 2007. Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [M.L. Parry, et al. (eds.)] (IPCC, 2007a).

fail to recognize that if we cap global warming pollution, but fail to make investments in protecting and restoring our natural resources, we likewise will have accomplished only half the job.

To meet our fundamental ethical duty to pass on a healthy planet to our children and future generations, Congress must enact a two-part agenda in its climate and energy legislation. It must cap carbon pollution at levels dictated by science to avoid dangerous climate change, and it must provide large-scale dedicated funding to implement new strategies that address the inevitable impacts of global warming on wildlife and natural resources. Any solution that puts a price on global warming pollution must use some of the resources generated to repair the current and future damage caused by such pollution.

Congress must enact legislation that offers Americans a better way to power our future and a better way to protect the planet. Restoring America's economic health is linked to restoring the health of our natural systems. We must address carbon pollution and the growing threats to our natural world. We cannot do one without the other, or we will fail to meet our moral obligations to the generations that will follow us.

II. CLIMATE CHANGE IS HARMING WILDLIFE AND DISRUPTING THE ECOSYSTEMS ON WHICH BOTH PEOPLE AND WILDLIFE RELY

Across the planet, carbon emissions from human activity are producing dramatic changes in the natural world, changes that have been accelerating at an astounding pace. Scientific findings since the publication of the 2007 IPCC scientific assessment suggest that the need for action is more urgent than ever. Earlier this month, scientists from around the world gathered in Copenhagen to discuss their most recent findings and concluded that the worst-case scenarios found in the 2007 assessment were being realized and even exceeded. New studies show that the melting of Arctic sea ice is vastly outpacing previous predictions, sea level rise projections must be revised dramatically upward, and there is a rapid new release of methane from thawing permafrost and deep sea ice. Simply put, science mandates that we act as swiftly as possible to reduce greenhouse gas emissions as deeply as possible while safeguarding natural resources threatened by global warming.

In the United States, we are seeing a wide array of changes:

- Higher average air and water temperatures (both freshwater and marine);
- Increases in average annual precipitation in wetter regions (e.g., Northeast) and decreases in drier regions (e.g., Southwest), with an increasing proportion of precipitation falling in intense downpours;
- Lengthening of the frost-free season and earlier date of last-spring freeze;
- Declines in average Great Lakes ice cover and Arctic sea ice extent and thickness. Arctic summer sea ice is rapidly disappearing – it now covers less than 1/2 the area covered in the late 20th century and is melting even faster than scientists predicted;

- More extreme heat waves;
- More extensive drought, particularly in the West. Western droughts and increasing temperatures have led to a four-fold increase in major forest fires and six-fold increase in area burned in just two decades;
- Earlier spring snowmelt and a significant decline in average snowpack in the Rocky Mountains, Cascades, and Sierra Nevada ranges;
- Accelerating rate of sea-level rise and increased ocean acidity; and
- Increase in the intensity, duration, and destructiveness of hurricanes.[2]

These physical changes are already causing significant ecosystem disruptions. Increased water temperatures in coral reefs in Southern Florida, the Caribbean, and Pacific Islands have contributed to unprecedented bleaching and disease outbreaks.[3] Increased storm events, sea level rise, and salt-water intrusion have all led to a decline in coastal wetland habitats from the Atlantic Coast to the Gulf of Mexico. Already-beleaguered salmon and steelhead from Northern California to the Pacific Northwest are now challenged by global warming-induced alteration of habitat conditions throughout their complex life cycles.[4] Forest and grassland systems throughout the West have been stressed by drought, catastrophic wildfires, insect outbreaks, and the expansion of invasive species.[5] Across North America, plants are leafing out and blooming earlier; birds, butterflies, amphibians, and other wildlife are breeding or migrating earlier; and species are shifting ranges northward and to higher elevations.[6]

These and other changes are bellwethers for what scientists project will be even more dramatic impacts in the decades to come, even if we achieve significant reductions in our emissions of heat-trapping greenhouse gases. Some studies suggest that parts of North America will experience complete biome shifts, whereby the composition and function of a region's ecological systems change.[7] For example, boreal forest vegetation is projected to continue its spread into Arctic tundra regions at northern latitudes and higher elevations, with its current southern range possibly converting to grassland or temperate forest. The southwestern U.S. is expected to shift permanently to a more arid climate with even a modest amount of additional warming.[8]

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[2] This summary of impacts, as well as the adaptation principles and many of the case studies discussed below, including a full list of references, are drawn from Glick, P., et al., "A New Era of Conservation: Review of Climate Change Adaptation Literature" (National Wildlife Federation, 2009). (http://www.nwf.org/globalwarming/pdfs/NWFClimateChangeAdaptationLiteratureReview.pdf).

[3] Donner, S.D., Knutson, T.R., and Oppenheimer, M., "Model-based Assessment of the Role of Human-induced Climate Change in the 2005 Caribbean Coral Bleaching Event," *Proceedings of the National Academy of Sciences* 104 (2008).

[4] Janetos, A., et al., "Biodiversity," *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States* (U.S. Climate Change Science Program and Subcommittee on Global Change Research, 2008).

[5] Independent Scientific Advisory Board, *Climate Change Impacts on Columbia River Basin Fish and Wildlife* (Northwest Power and Conservation Council, 2007).

[6] Parmesan, C., and Galbraith, H., Observed Impacts of Global Climate Change in the U.S. (Pew Center on Global Climate Change, 2004).

[7] IPCC, 2007a.

[8] Solomon, S., et al., "Irreversible Climate Change Due to Carbon Dioxide Emissions," *Proceedings of the National Academy of Sciences* 106 (2009): 1704-1709.

Of particular concern is the disruption of entire ecosystems. As diverse species respond to global warming in different ways, important inter-specific connections – such as between pollinators and the flowers they fertilize, or breeding birds and the insects on which they feed – will be broken.[9] Decoupling of such relationships among species can have disastrous consequences. For example, research on the Edith's checkerspot butterfly (*Euphydryas editha*) in California revealed a climate-driven mismatch between caterpillar growth and the timing of its host plant drying up at the end of the season.[10] Observations of the species in the southernmost portions of its range have shown that during periods of extreme drought, or in low snowpack years, caterpillar food plants were already half dry by the time the eggs hatched. This reduction in forage quality led to high extinction rates among those populations.

The ecological impacts associated with climate change do not exist in isolation, but combine with and exacerbate other stresses on our natural systems. Leading threats to biodiversity include habitat destruction, alteration of key ecological processes such as fire, the spread of harmful invasive species, and the emergence of new pathogens and diseases.[11] The health and resilience of many of our natural systems are already seriously compromised by these "traditional" stressors and changes in climate will have the effect of increasing their impact, often in unpredictable ways. The loss and fragmentation of natural habitats due to the development of roads, buildings, and farms is especially worrisome because it hinders the ability of species to move across the landscape to track favorable climatic conditions.[12]

As noted above, the IPCC concluded in its most recent assessment of the science that as many as a million species of plants and animals around the world could be threatened with extinction between now and 2050 if we do not implement meaningful steps to address the problem. This unprecedented threat to our natural world recently led 612 leading experts in the biological sciences to write to Congress urging enactment of a large-scale dedicated funding mechanism to enable natural resources managers to safeguard natural resources from climate change impacts. *See* Appendix A.

III. WHEN NATURE THRIVES, AMERICA THRIVES

I would like to talk today about how Congress can face up to this dire situation and not only help wildlife and wildlife habitats survive global warming, but help them thrive.

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[9] Root, T., and Schneider, S., "Climate Change: Overview and Implications for Wildlife," *Wildlife Responses to Climate Change: North American Case Studies* [S. Schneider and T. Root (eds.)] (Island Press, 2002).
[10] Parmesan, "Climate and Species' Range," *Nature* 382 (1996): 765-766.
[11] Wilcove, D.S., et al., "Quantifying Threats to Imperiled Species in the United States," *BioScience* 48 (1998): 607-615
[12] Ibañez, I., et al., "Predicting Biodiversity Change: Outside the Climate Envelope, Beyond the Species-area Curve," *Ecology* 87 (2006): 1896-1906.

As goes America's wildlife, so goes America. The health of wildlife and natural ecosystems is closely linked with the health of the economy, human health and safety and quality of life.

Can we weather the storm on the horizon if we do not pay careful attention to the warnings and alarms that are plain to see from the wildlife around us? Can we have safe communities and healthy families if we fail to protect the natural world we depend on for clean water, abundant food, flood protection and a strong economy? What will it be like for our kids and grandkids to grow up in America if we allow the majesty and vitality of America's great outdoors to be spoiled on our watch?

As naturalist Rachel Carson emphasized in her timeless book *Silent Spring*, wildlife provides the warning signal that enables us to take action on threats to our environment before it is too late. If we pay attention to what is happening to wildlife today from carbon emissions, we see early signs of "system failure" in many regions. For example, as the ocean warms and becomes more acidic and coral species begin to decline and disappear, we see signs of a potential breakdown in the very marine food web that people depend upon for their sustenance. As polar bears lose their hunting grounds and begin to experience reproductive failures, we see signs of a potential breakdown in an entire way of life that has evolved among the tribal people of the Arctic for many centuries. The dramatic changes we see in the tropical seas and the Arctic signal the potential for equally dramatic changes in the temperate zones if we fail to take immediate action.

In addition to serving as an important sentinel of change, wildlife serves as the foundation of rural economies throughout our nation. Fishing, hunting, hiking and other outdoor activities that rely on healthy wildlife and ecosystems contribute $730 billion to the U.S. economy. They also support nearly 6.5 million jobs and generate $88 billion in state and national tax revenue.[13] Continuation of this economic activity at or near current levels depends on a commitment by Congress to invest in safeguarding wildlife and ecosystems from climate change impacts.

These numbers barely scratch the surface of the vast array of ecosystem services that are vital to human existence.

Wetlands provide an important example of how the economy, human health and safety and quality of life depend on conservation. Wetlands provide essential flood control, water purification, ground and surface water supply, and wildlife habitat values. Using a very conservative estimate of $10,000 in value of benefits per acre, the remaining 100 million acres of wetlands in the lower 48 states are worth roughly $1 trillion.[14] Although the extent of overall damage to wetlands that will result from global warming is unknown - this will be determined in significant part by the actions of Congress – global

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[13] *The Active Outdoor Recreation Economy: a $730 Billion Contribution to the U.S. Economy* (Outdoor Foundation, 2006).

[14] King, D., "The Dollar Value of Wetlands: Trap Set, Bait Taken, Don't Swallow," *National Wetlands Newsletter* 20 (1998): 9-11 (http://www.kingeconomics.com/pubs/King%20Value%20of%20Wetlands%20paper.pdf).

warming is projected to dry up or degrade up to 90 percent of the wetlands in the nation's prairie pothole region alone.[15]

The economic benefits of forests provide another reason for urgent action to confront climate change. The U.S.'s 520 million acres of forests[16] are valued at more than $60 billion for the annual benefits they provide, such as water filtration and storage, flood protection, recreation, timber production and recreational opportunities.[17] As the climate has warmed, the area burned by fires in the western U.S. has increased six-fold and fire-fighting burdens have sky-rocketed, costing the federal government $1.5 billion in 2006 alone.[18] The major increase in fires accelerates erosion, lowers water and air quality, and decreases timber yields, among other impacts.

Large-scale investments in forest conservation, both through strategic acquisitions and through enhanced management and restoration measures, would pay enormous dividends. For example, water utilities that rely upon surface water depend heavily on investments in forest conservation to avoid the much higher expenses associated with water treatment facilities. One study showed that for every 10 percent increase in forest cover in the source area, utilities saved *20 percent* of their water treatment and chemical costs.[19]

Similarly, large-scale investments in restoring coastal and floodplain habitats to buffer against sea level rise and intensified storms would have substantial economic and human safety benefits. During the 1980s, there were just three weather-related natural disasters with losses of $1 billion or more. The number rapidly increased to 26 during the 1990s, and another 26 between 2000 and 2006 alone.[20] Investments in buffer zones and continuous vegetative corridors along rivers and streams, on barrier islands and along coastlines not only protect and strengthen critical ecosystems, but also reduce the amount of property at risk from catastrophic damages due to storms and sea-level rise. Such investments also promote land uses, such as recreation and agriculture, which are more compatible with storms and natural hazards. Moreover, they often promote greater groundwater infiltration, which helps moderate the impacts of intensified droughts and low flow periods that accompany climate change.

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[15] Anderson, M.G., and Sorenson, L.G., "Global Climate Change and Waterfowl: Adaptation in the Face of Uncertainty," *Transaction of the 66th North American Wildlife and Natural Resources Conference* (Wildlife Management Institute, 2001): 300-319.

[16] Pimentel, D., et al., "Economic and Environmental Benefits of Biodiversity," *BioScience* 47 (1997): 747-757.

[17] Krieger, D.J., *The Economic Value of Forest Ecosystem Services: A Review* (The Wilderness Society, 2001).

[18] Johnson, D., and Zurlo, M., "Fire Zone" (http:www.infoplease.com/spot/forestfire1.html).

[19] Ernst, C., et al., *Protecting the Source: Conserving Forest to Protect Water* (American Water Works Association, 2004). This statistic applies only to source areas with less than 65 percent forest cover. Incomplete data prevented any conclusions regarding the benefits of adding additional forest cover to areas that already have 65 percent or greater forest cover.

[20] Brown, L., *Plan B 3.0 Mobilizing to Save Civilization* (Earth Policy Institute; W.W. Norton and Company, 2008).

Increases in weather-related disasters associated with global warming carry more than an economic cost. The perils of weather-related disasters are exemplified by Hurricane Katrina, which caused one million evacuees to flee and more than 1,800 deaths.[21] A two-foot rise in sea level is likely this century and projected to subject nearly 2,200 miles of major roads and 900 miles of railroads to regular inundation in Maryland, Virginia, North Carolina and District of Columbia alone.[22] Investing in restoring coastal wetlands and other buffers against sea level rise and intensified storms will be essential to protecting these and other communities.

Safeguarding our natural resources is also essential for achieving our nation's greenhouse gas reduction goals. A key part of these goals will be met through sequestering carbon in forests and grasslands – but only if those natural systems are sufficiently resilient to withstand the intensified floods, droughts, pests, disease and other stresses that accompany climate change.

Clearly, we must act now to safeguard our natural resources not just for aesthetic and moral reasons, but also because they serve as the foundation of our very lives and of much of our economy. What we do today will determine the well-being of our children and grandchildren, and the economic security of our country.

IV. LEGISLATION CAPPING GLOBAL WARMING POLLUTION MUST BE "CLEAN, GREEN, AND FAIR."

As the broad agreement among scientists continues to tell us, to avoid the worst effects of global warming we must limit additional warming to no more than 2 degrees Celsius over pre-industrial levels.[23] According to the IPCC, we have a reasonable chance of meeting this objective if developed countries, such as the United States, as a whole cut their emissions by 25-40 percent below 1990 levels by 2020 and by 80-95 percent below 1990 levels by 2050.[24]

It should come as no surprise, therefore, that NWF's top priority is enactment of legislation that places mandatory caps on global warming pollution from major emitters and invests in transforming America to a new, clean energy economy. This legislation must reduce domestic global warming pollution as swiftly as possible by 2020 and by

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[21] Brown, A., "Hurricane Katrina Pummels Three States," *CNN Transcripts* (http://transcripts.cnn.com/TRANSCRIPTS/0508/29/asb.01.html, aired August 29, 2005) and Grier, P, "The Great Katrina Migration," *Christian Science Monitor* 12 (2005).

[22] U.S. Climate Change Science Program (CCSP), *Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research* [M.J. Savonis, V.R. Burkett, and J.R. Potter (eds.)] (U.S. Department of Transportation, 2008) (http:// www.climatescience.gov/Library/sap/sap4-7/final-report/).

[23] This temperature increase is equivalent to 3.6 degrees Fahrenheit over pre-industrial levels or about 2 degrees Fahrenheit over the amount of warming that has already occurred.

[24] IPCC, *Climate Change 2007. Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Houghton, J., et al. (eds.)] (IPCC, 2007b).

over 80 percent by mid-century in order to protect wildlife and future generations from the most destructive impacts of climate change. If designed and implemented correctly, such legislation can also provide the financial resources needed to invest in new clean energy solutions, create millions of new jobs, protect the public from rising energy prices, *and* safeguard America's natural resources from the impacts of global warming.

The best means to accomplishing these goals is by implementing an economy-wide cap and invest system that is "clean, green, and fair." Through such a system, the nation's biggest polluters should be required to promptly and steadily reduce their pollution levels. Revenue generated from polluters paying for emission allowances can be directed to meet our moral obligation to solve global warming, facilitate a clean energy transition, protect our natural resources from the impacts of a warming climate, and take care of our communities. While the cap sets out a path to reduce global warming pollution, the choices of how we invest the financial resources generated from such a system will also determine whether we solve the climate crisis and create a low-cost, productive, and sustainable transition to a clean energy economy.

A. Investing in a Clean Energy Future

We must remember that the challenge of combating global warming also brings enormous opportunity. The shift to a clean energy economy will put millions of Americans, including those most in need, back to work in the face of our deepest economic crisis since the Great Depression. Resources generated by a cap and invest system can ensure that this opportunity is realized.

To meet the challenge of global warming, we must first transform the ways America and the rest of the world produce and use energy, achieving dramatic improvements in the efficiency with which we use energy in our homes, businesses, and vehicles and moving to clean, renewable energy, like wind and solar power. A significant share of revenue generated by new global warming legislation must be directed toward overcoming technological or market obstacles, and toward creating new and stable jobs in key sectors, including green buildings and other efficiency improvements. These investments also must focus on building an updated smart electric grid, generating wind, solar, and geothermal electricity, designing carbon capture and storage, and transforming the transportation sector (with low carbon fuels, electric automobiles, and reduced vehicle miles traveled). And new incentives must be made available to encourage American farmers and land owners to assist in combating global warming by enhancing the sequestration of carbon on their private lands with healthy forests, sustainable agriculture, and other actions.

B. Investing in our Green Conservation Legacy

Of an equal imperative is the need to protect America's great, green legacy of conservation. As I elaborate further in the next section of this testimony, we need to ensure that our critical natural resources are protected from the growing impacts of global warming. Any solution that puts a price on global warming pollution must also use some

of the resources it generates to repair the current and future damage caused by such pollution. Financial commitments are needed, and will continue to be needed, to protect and restore the land and water that people and wildlife depend on, including freshwater ecosystems, forest lands, and coastal ecosystems, so that they are more resilient. Federal climate legislation must include sufficient funding to empower natural resource managers at the national, state, local and tribal levels to identify, prioritize and protect ecosystems at risk from global warming. The investment must be dedicated, not appropriated, so that resource managers have a guaranteed source of funding for these critically important projects.

C. Investing in Fair Solutions

We know that creating a program to reduce global warming pollution will, over time, drive major, positive changes in our homes, communities and workplaces. During this transition we need not only to protect individuals and communities from potential short-term financial hardship that could result from these changes, but also to promote the technology, training, and other investments needed to ensure that the transition brings new jobs and opportunities to every community. Jobs in industries made vulnerable by our transition to a new clean energy economy must also be protected by supporting the retooling of industry with new and more energy efficient technologies. And long-term investments need to provide communities with new employment and educational opportunities, including urban and rural worker training programs. These will create the work force needed to build the new clean energy infrastructure.

Funding from a cap and invest program also should ensure that Americans are protected from potential increases in energy costs that may occur when the program is implemented. Because low- and moderate-income households spend a larger share of their budgets on energy and other basic costs of living than others, we must make sure that any energy-related price increases are cushioned by direct consumer rebates that effectively and efficiently reach households and workers in need. Investment in energy efficiency also is crucial – it is one of the most effective means of protecting all consumers from rising energy prices because it keeps money circulating in American households and communities rather than allowing it to flow overseas to import more polluting fuels.

Our responsibility to solve global warming in a fair and equitable manner does not stop at our borders. In addition to acting at the domestic level, the U.S. must also become an international leader and forge a new climate treaty by the Copenhagen climate negotiations in late 2009. Successfully resolving the global warming crisis at the international level is dependent, in part, on substantial funding for adaptation in developing countries, which are the most vulnerable to climate change impacts. The United Nations Development Program (UNDP) recently estimated that through 2016 developing countries will require approximately $86 billion per year in new adaptation funding to cope with the impacts of climate change.[25] The U.S. should lead the way

25 UNDP, "Fighting Climate Change: Human Solidarity in a Divided World," *Human Development Report 2007/2008* (UNDP, 2008) (http://hdr.undp.org/en/media/HDR_20072008_EN_Complete.pdf).

toward a global solution to climate change by providing developing countries with measurable, reportable, and verifiable financing for clean energy technologies, forest conservation, and adaptation efforts that address unavoidable climate impacts.

V. SAFEGUARDING NATURAL RESOURCES IN THE FACE OF CLIMATE CHANGE WILL PAY LARGE DIVIDENDS FOR PEOPLE AND WILDLIFE

A. Aggressive Action is Needed to Protect People and Wildlife from Climate Change Impacts

Conservation strategies of the past century have been carried out under the assumption that climate, weather patterns, species and habitat ranges, and other environmental factors will (or should) remain consistent with historical trends. Today, much of the environmental progress that has been achieved using these strategies is at grave risk. Continuing to operate under a "business as usual" approach will likely lead to a wave of extinctions and severe degradation of the ecosystems on which both people and wildlife depend. Given current trends of global warming and human development, a new conservation paradigm must be launched. This paradigm, referred to here as natural resources adaptation, is far more ambitious than the previous approach to conservation. In essence, it calls for anticipating the harmful combined impacts to ecosystems of inevitable global warming and human development and using conservation measures to protect wildlife and people from those impacts.

Although the discipline of natural resources adaptation is a new one, a consensus is rapidly emerging among scientists and natural resource managers on the key steps that must be taken. In selecting conservation objectives and developing management strategies, natural resources adaptation experts recommend adhering to the following five principles:

1. **Reduce other, non-climate stressors.** Addressing other conservation challenges—such as habitat destruction and fragmentation, pollution, and invasive species—will be critical for improving the ability of natural systems to withstand or adapt to climate change. Reducing these stressors will increase the resilience of the systems, enabling them to recover from climate-related disturbances and return to a functional state.

2. **Manage for ecological function and protection of biological diversity.** Healthy, biologically diverse ecosystems are better able to withstand the impacts of climate change than depleted ecosystems. Ecosystem resilience can be enhanced by protecting biodiversity among different functional groups, among species within function groups, and variations within species and populations, in addition to species richness itself.

3. **Establish habitat buffer zones and wildlife corridors.** Improving habitat "connectivity" to facilitate species migration and range shifts in response to changing climate condition is an important adaptation strategy.

4. **Implement "proactive" management and restoration strategies.** Efforts that actively facilitate the ability of species, habitats and ecosystems to accommodate climate change—for example, beach renourishment, enhancing marsh accretion, planting climate-resistant species, and translocating species—may be necessary to protect highly valued species or ecosystems when other options are insufficient.

5. **Increase monitoring and facilitate management under uncertainty.** Because there will always be some uncertainty about future climate change impacts and the effectiveness of proposed management strategies, careful monitoring of ecosystem health coupled with management approaches that accommodate uncertainty will be required.

Conservation practitioners are already putting these principles into action. For example, we know that we must rebuild the coastal wetland complex in Louisiana if we are going to protect the people and wildlife of that region from the combined effects of sea level rise and intensified storms. Coastal Louisiana loses the equivalent of 32 football fields of land every day. If this rapid loss is allowed to continue, nearly 2 million people in Louisiana's coastal zone will be subjected to more frequent and severe flooding. Entire communities may have to be abandoned. Seafood and other natural resources critical to families across the country will be lost.

To address this threat, the National Wildlife Federation is working with the state, federal agencies, and other NGO partners to restore this vast wetland complex. One very promising near-term opportunity is a project to restore the Bayou Bienvenue cypress swamp -- a 31,000 acre area in St. Bernard Parish and eastern New Orleans. This cypress forest once protected the community and its natural resources from storms, and with the support of Congress, it can do so again. Imagine the progress that could be made in protecting communities from storms and floods, and generating economic activity, if Congress were to use dedicated funding generated by cap-and-invest legislation to stimulate these kinds of habitat restoration projects across the country.

There are similar adaptation projects in early stages of planning and implementation in every region of country. These projects, and many others, await a substantial funding commitment from Congress to produce the conservation outcomes that the American people value and expect. For example:

- In New York, the Department of Environmental Conservation (DEC) is working with state Department of Transportation (DOT) on redesigning the standards for culverts under roadways across the state to take into account intensified rainfall events and to improve the connectivity of aquatic and riparian habitats. Both agencies have integrated

climate change forecasts into their planning. The DEC benefits from the expanded culverts because they help reduce soil erosion, allow for sediment buildup and improve aquatic habitat; the DOT benefits because roadways are less likely to be washed away by storms.[26]

- In Massachusetts, the state is integrating principles of climate change adaptation in its ongoing watershed activities. In its Town Brook Restoration Project, agency and non-governmental organization (NGO) partners are restoring habitat and connectivity for both resident and anadromous cold water fish in Plymouth. The project entails a combination of selected dam removal, restoration of areas of natural stream bank, altering a culvert, and rebuilding a fish ladder. Anticipating the more intense rainfall events and warmer stream temperatures that accompany climate change, the state will be providing fish with more natural flow regimes as well as cold-water refugia.[27]

- Also in Massachusetts, the state is undertaking a comprehensive assessment of the climate change vulnerability of its priority wildlife habitats to understand which wildlife species and habitats will be at increased risk, and where future conservation actions will be most important. Building on the state's federally-approved wildlife action plan, this vulnerability assessment is being used by state agencies and private conservation partners to alter priorities for conservation land acquisitions.[28]

- In California's San Francisco Bay, efforts to restore salt marsh habitat on abandoned salt evaporation ponds have been revised to take projected sea level rise into account. The U.S. Fish and Wildlife Service (FWS) is restoring these wetlands with the aim of not only providing habitat for migratory birds and endangered species but also protecting low-lying communities from flooding.[29]

- The Western Governor's Association (WGA) has recognized that healthy ecosystems and abundant wildlife are important economic drivers and that in the face of climate change the survival of many of the West's most cherished wildlife species will depend on protecting crucial habitats and ensuring connectivity among these habitats. To that end, it has carried out a multi-state planning effort to identify important wildlife corridors, and has established a Western Wildlife Habitat Council to coordinate and manage implementation of the wildlife corridors initiative.[30]

- On the southern tip of Florida, bleaching events in the coral reef have been increasing in number and severity due in part to warming of ocean waters. The recovery

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[26] Federal Highway Administration, *Integrating Climate Change into the Transportation Planning Process* (ICF International, 2008).
[27] Massachusetts Department of Fish and Game, "Adapting to Climate Change" (http://www.mass.gov/dfwele/climatechange.htm).
[28] Ibid.
[29] FWS, "Many Partnerships Involved in South Bay Restoration," *Tideline: San Francisco Bay National Wildlife Refuge Complex* 23 (2003).
[30] WGA, Wildlife Corridors Initiative (Western Governors' Association, 2008).

plan outline for the threatened elkhorn and staghorn coral calls for new measures to prevent land-based pollution will make corals far less susceptible to such bleaching.[31]

- In North Carolina, agencies and NGOs such as the Nature Conservancy are responding to and anticipating a significant loss of lowland wetlands due to a combination of land subsidence and sea-level rise in the Albemarle-Pamlico region. They are installing water control structures to manage water levels, to enhance marsh accretion and planting flood- and salt-tolerant plant species such as native bald cypress. In addition, they are constructing native oyster reefs along the shorelines to reduce wave energy and create new shallow-water habitats.

- In Maryland, the state has established a "Living Shorelines" program that uses sand-loving plants to anchor Chesapeake Bay coastal habitats in the face of sea level rise. Maryland changed its laws last year to encourage more communities to build this kind of project instead of hardened bulkheads, and awards $1.5 million a year in no-interest loans for such projects.[32] This is a departure from the costly and ecologically destructive "armoring" approach to sea level rise, which relies on man-made sea walls or rock piles that has made the Chesapeake look like a "high-sided swimming pool" in some places.[33]

- In Washington, university scientists and state agencies are working with Washington State's Watershed Planning Program to help locally-based watershed managers anticipate projected shifts in annual streamflow patterns and thereby reduce flood damage and improve stream health.

- In Oregon, the Forest Service and others modeling future climate conditions and vegetative change to project potential impacts of climate change on natural systems in the Rogue River Basin of Oregon. They project that reduced snowpack, rising temperatures, and the occurrence of drought will dry out soils and make forests more susceptible to wildfires, leading to declining forest product production to decline. As a result, managers are considering adjusting forestry management practices and post-fire logging activities, as well as adopting policies that integrate fuel reduction efforts with small scale biomass energy production.

- In Virginia and at least fourteen other states, state wildlife agencies have brought together stakeholders at workshops to update their State Wildlife Action Plans to ensure that they account for inevitable climate change.

As the above examples make clear, natural resources conservation leaders across the country are helping to launch a new paradigm for conservation, one that helps America safeguard its natural assets from the unprecedented threat of human-caused climate

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[31] Grimsditch, G.D., and Salm, R.V., Coral Reef Resilience and Resistance to Bleaching (The World Conservation Union, 2005).
[32] Maryland Department of Natural Resources, "Living Shorelines" (http://shorelines.dnc.state.md.us/living.asp).
[33] Fahrenthold, D.A., "Eco-bills Come Due at Bay's Beaches," *The Washington Post*, March 19, 2009, p. A01..

change. However, the financial resources available for this work have been quite limited, especially when compared to investments made in the physical sciences and in investigating the causes and mitigation of climate change. To put this new paradigm fully into place, Congress must make large-scale investments in the design and implementation of a national adaptation strategy as well as region-specific natural resources adaptation plans.

B. Natural Resources Adaptation Requires Strong Investments, but the Benefits Greatly Exceed the Costs

In May 2008, the Senate considered S. 3036, the Climate Security Act (CSA), which earlier had been approved by the Environment and Public Works Committee. Among other features benefiting wildlife and natural resources, the CSA provided an average of roughly $7 billion annually over its first two decades for natural resources adaptation in the U.S. NWF and its conservation partners firmly believe that this is an appropriate level of investment of auction proceeds for protection of U.S. natural resources threatened by climate change, given the numerous other pressing demands for those proceeds.

Although no study has yet tabulated the full cost of conserving species and ecosystems in the face of climate change, it is clear that the cost will be far greater than $7 billion annually. For example, a series of studies on the costs of restoring the Everglades, Chesapeake Bay and Great Lakes suggests that the cost over five years ranges from at least $10 billion to $20 billion each.[34] Another study found that $350 billion would be needed over 30 years to make up a viable habitat conservation network across the lower 48 states (using conservation easements to acquire interests in land).[35]

Although most of the conservation actions considered in these studies would build ecosystem resiliency in the face of climate change, it should be emphasized that these studies did not specifically take into account the impacts of climate change in arriving at their cost estimates.[36] Considering that climate change adds a large stressor on top of existing stressors, Congress should assume that these cost estimates significantly understate the overall costs of conserving ecosystems in the face of climate change.

Despite this large price tag, Congress must recognize that, as discussed above, the economic benefits of conservation reach into the hundreds of billions annually and

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[34] CRS Report for Congress: Ecosystem Restoration in the Great Lakes: The Great Lakes Regional Collaboration Strategy (January 30, 2008).

[35] Casey, F., et al., *The Cost of a Comprehensive National Wildlife Habitat Conservation System* (Defenders of Wildlife, 2008). The study drew from a sample of maps prepared by state and fish wildlife agencies in developing State Wildlife Action Plans, which are largely oriented toward terrestrial habitats.

[36] Presumably, most adaptation measures will use existing conservation tools and approaches, but climate change information will necessitate changes in the timing, location and scale in which they are employed. Natural resources adaptation also will inevitably require the development of novel tools and approaches. Unfortunately, little federal research and development funding to date has gone into adaptation planning and implementation. Substantial public investments are needed to spur innovation in this area.

therefore far exceed the costs. In essence, healthy, well-functioning ecosystems provide the foundation for a healthy economy.

Some will argue that Congress should postpone to another day the funding of natural resources adaptation. This would be a foolish approach. As each day passes where conservation action is delayed, the costs of inaction continue to mount. More and more species spiral toward extinction and ecosystems become further degraded. Over time, the options for restoring them will become increasingly reduced.

C. A Dedicated Funding Mechanism in Climate Legislation is Essential to Meeting the Challenge of Safeguarding Wildlife and Natural Resources from the Impacts of Climate Change

Congress may be tempted to rely upon the annual appropriations process to meet its obligation to safeguard wildlife and natural resources from the impacts of global warming. This would be a mistake. First, the amounts that would potentially available through the appropriations process would not come close to meeting the scope of the challenge. Second, natural resource adaptation projects are necessarily multi-year endeavors, requiring long-term planning and predictable investments. Finally, this nation has long adhered to the principle of "polluter pays." Thus, in determining how to address the harmful impacts of global warming, it is entirely appropriate to use funding generated by those who emit global warming pollution into the atmosphere. In allocating proceeds of the sale of global warming pollution allowances, Congress should highlight how these proceeds are addressing both the causes and effects of this pollution.

Congress also should resist any temptation to create a single dedicated fund for all types of adaptation. Admittedly, adaptation strategies will be needed to address the wide array of impacts of climate change. Sectors outside of natural resources conservation, such as infrastructure, human health, and agriculture, deserve the attention of Congress as well as land and water managers. However, natural resources adaptation requires a distinct approach and a distinct funding source.

D. The Broad Array of Groups that Have Mobilized in Support of the Safeguarding Natural Resources Agenda Shows its Urgency and Importance

NWF participates in a diverse coalition of hundreds of conservation and sporting organizations that have joined in an effort to secure dedicated funding for wildlife and natural resources in federal climate change legislation. The legislative principles that NWF and its leading coalition partners are advocating for are attached to this testimony as Appendix B (and where largely reflected in last year's Climate Security Act). As this document makes clear, this coalition recognizes the crucial importance of ensuring that spending of natural resource adaptation funds is done strategically. We recommend that all spending be guided by national and state-level adaptation strategies, and that such strategies be integrated with large-landscape conservation plans such as State Wildlife

Action Plans. In addition, such strategies must be based on sound science and developed with broad public participation and input.

In summary, NWF urges Congress to cap carbon pollution at levels dictated by science to avoid dangerous climate change, and to provide large-scale dedicated funding to safeguard wildlife and natural resources from climate change impacts. Thank you again for the opportunity to testify today.

APPENDIX A

A Letter from Scientists to the United States Congress Urging Action to Address the Threats of Global Warming to Wildlife and Ecosystems

FEBRUARY 2008

"We write to you to convey our sense of urgency. Global warming is already causing serious damage and disruptions to wildlife and ecosystems, and reliable projections call for significant additional damage and disruptions. To fulfill the nation's longstanding commitment to conserving abundant wildlife and healthy ecosystems for future generations, Congress must craft legislation that greatly reduces greenhouse gas pollution and generates substantial dedicated funding to protect and restore wildlife and ecosystems harmed by global warming."

– 612 Scientific Experts Concerned About Global Warming and Its Effect on Wildlife and Natural Resources, including

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The H. John Heinz III Center for Science, Economics and the Environment

Edward O. Wilson, Ph.D.
Harvard University

Stuart L. Pimm, Ph.D.
Duke University

Paul R. Ehrlich, Ph.D.
Stanford University

Dennis D. Murphy, Ph.D.
University of Nevada, Reno

Reed F. Noss, Ph.D.
University of Central Florida

Peter H. Raven, Ph.D.
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University of Texas, Austin

Institutional Affiliation for Identification Purposes Only

February, 2008

A Letter from More Than 600 Scientists to the United States Congress Requesting Adequate Funding to Address the Threats to Wildlife Posed by Global Warming

Dear Members of Congress,

The undersigned signatories are leading researchers and practitioners from the various disciplines of biological science. We understand that Congress is currently considering a number of proposals to reduce U.S. emissions of greenhouse gases (GHGs) and thereby confront global warming. We applaud this effort. Global warming represents, by far, the greatest threat ever posed to the planet's living resources, which provide the foundation for our economy and our quality of life. We write to you to convey our sense of urgency. Global warming is already causing serious damage and disruptions to wildlife and ecosystems, and reliable projections call for significant additional damage and disruptions. To fulfill the nation's longstanding commitment to conserving abundant wildlife and healthy ecosystems for future generations, Congress must craft legislation that greatly reduces GHG pollution and generates substantial dedicated funding to protect and restore wildlife and ecosystems harmed by global warming.

The following examples of damage and disruptions to wildlife and ecosystems caused by GHG pollution and global warming are among the most noteworthy:

- Melting polar ice caps
- Thawing permafrost
- Acidification of the oceans
- Sea level rise
- Intensified storms
- Warming of rivers, streams, lakes and estuaries
- Declining snowpack on mountains and earlier runoff
- Drought
- Catastrophic fires
- Pest infestations
- Spreading pathogens and invasive species
- Changes in phenology (seasonal events) and distributions of wildlife populations, separating predators from prey and otherwise disrupting ecological communities.

Each of these disturbances to ecosystems, by itself, poses a serious threat of extinction to numerous plant and animal species. Yet none happens in isolation from the other forces that also imperil species, such as habitat destruction and fragmentation, the spread of invasive species and unsustainable harvest of resources for human consumption. Global warming combines with each of these non-climatic factors to place enormous stress on the planet's biological wealth.

If provided with sufficient funding, managers of wildlife, land and water have a number of tools at their disposal to ameliorate threats to ecosystems and to avert mass extinctions. Feasible actions include:

- *Maintaining healthy, connected, genetically diverse populations.* Small isolated populations are more prone to local extirpations than larger, more widespread populations. Although managers already encourage healthy populations, global warming increases the importance of this goal and will likely require adjustments in population targets and in the design of habitat corridors.
- *Reducing non-climate stressors on ecosystems.* Reducing other human-induced stressors such as toxic pollution and habitat loss will minimize negative synergistic impacts with global warming and increase the resiliency of habitats and species to the effects of climate change and variability.
- *Preventing and controlling invasive species.* Rapidly changing climates and habitats may increase opportunities for invasive species to spread. Extensive monitoring and control will be necessary to limit the negative impacts of invasive species.
- *Reducing the risk of catastrophic fires.* Global warming could lead to more frequent fires and/or a greater probability of catastrophic fires. Managers can use prescribed fires and other techniques to reduce fuel load and the potential for catastrophic fires.
- *Protecting coastal wetlands and accommodating sea level rise.* Managers can defend against the negative impacts associated with sea level rise through conservation easements and the acquisition of inland buffer zones to provide an opportunity for wildlife to migrate inland.
- *Adjusting yield and harvest models.* As fish and wildlife populations respond both directly and indirectly to climate through changes in habitats, their productivity and sustainability may increase or decrease. Managers may need to adapt yield and harvest regulations both in anticipation and response to these changes.
- *Considering global warming models as well as historical data when making projections.* Managers must be aware that historical climate, habitat and wildlife conditions are not indicative of future conditions. Projections and planning should take into account expected changes in climate.
- *Employing monitoring and adaptive management.* Due to uncertainty concerning global warming, wildlife managers must anticipate the impacts to wildlife and use monitoring data to quickly adjust management techniques and strategies. Traditional, long-practiced methods and strategies will not be as effective as conditions change.
- *Identifying new opportunities.* Managers must be ready to anticipate and take advantage of new opportunities. For example, if climatic conditions leave existing agricultural areas unusable for agriculture, they could become important wildlife conservation areas with the appropriate agency and landowner collaboration.

Each of these essential steps comes with a price tag. Inevitably, managers of the nation's wildlife, land and water resources will need billions of dollars annually to develop and implement science-based strategies for conserving wildlife and ecosystems threatened by global warming. To make this conservation work feasible, Congress should ensure that substantial revenues generated by any climate change legislation be dedicated to conserving the wildlife and ecosystems that would otherwise be lost or badly degraded by global warming.

We thank you for your consideration of this urgent matter.

Signatories to the Letter from Scientists to the U.S. Congress
Requesting Adequate Funding for Wildlife and Ecosystems Threatened by Global Warming

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APPENDIX B

American Rivers * Association of Fish and Wildlife Agencies * Defenders of Wildlife * Earthjustice * Izaak Walton League of America * National Audubon Society * National Parks Conservation Association * National Tribal Environmental Council * National Wildlife Federation * Pheasants Forever * Quail Forever * Restore America's Estuaries * Sierra Club * Theodore Roosevelt Conservation Partnership * The Nature Conservancy * The Wilderness Society * Trout Unlimited * Trust for Public Land * Wildlife Conservation Society * Wildlife Management Institute

Principles for Including a Natural Resources Adaptation Fund
within Cap and Trade Climate Legislation to
Help America's Fish, Wildlife, and Ecosystems Survive Global Warming

March 23, 2009

Scientists now agree that the concentration of heat-trapping gases already in the atmosphere is causing and will cause significant adverse impacts to the United States and the world. Thus legislation must address not only the causes of worsening global warming, but also the effects of the unavoidable global warming we already face. This must include new dedicated resources to protect and restore the natural environment, including fish wildlife, and their habitat, on which all human health and economic vitality depends.

Therefore, any comprehensive climate legislation must include:

1. Dedicated Annual Funding Based on an Auction System. A carbon cap-and-trade emissions limitation bill should include an auction system for the distribution of emissions allowances. Proceeds from this auction system should be devoted to confronting the climate change challenge, including actions to address the harmful impacts of climate change on the natural environment.

2. Auction Proceeds for Protecting Fish, Wildlife, and Ecosystems. A significant share of the allowance value generated from any cap-and-trade program should be dedicated to protecting and restoring the natural environment, including fish, wildlife and their habitat on which human health depends. Protecting the habitats of fish and wildlife, including terrestrial, freshwater aquatic, estuarine, coastal and marine species, serves all Americans by protecting the clean water, clean air, biodiversity, open space and working natural landscapes that define our quality of life and are the foundation for a strong economy.

3. Broad Authority for Fish, Wildlife, and Ecosystem Protection. Auction proceeds under this bill should provide dedicated funding, not subject to annual appropriations, for climate-related ecosystem protection to ensure that federal, state, and tribal resource agencies and their partners can meet the new challenge of conserving land, water and

habitat in the face of an altered and rapidly changing climate. Eligible activities may include conservation, restoration, land acquisition, fish and wildlife protection, habitat enhancement, planning, research, monitoring, and education activities that are carried out pursuant to comprehensive ecosystem climate adaptation strategies.

4. Eligible Resource Agencies. Agencies eligible for auction proceeds are those federal, state, and tribal agencies with authority and responsibility for programs and resources important to helping fish, wildlife and ecosystems survive climate change. These agencies are referred to in this document as resource agencies.

5. Federal Multi-Agency Comprehensive National Strategy. The activities of the federal resource agencies needed to restore and protect fish, wildlife and ecosystems against the impacts of climate change should be directed and coordinated through a comprehensive national strategy, developed in close consultation with the states, tribes, and other stakeholders, and with advice from the National Academy of Sciences and a science advisory board.

6. State Comprehensive Strategies. The activities of the state resource agencies should be directed and coordinated through individual state comprehensive strategies for fish and wildlife adaptation to climate change that are approved by the Secretary of the Interior and integrated into state wildlife action plans, state coastal zone management plans, and other state wildlife species or habitat plans. Opportunities should be provided for scientific and public input during the development and implementation of these strategies.

7. Cost-Share Requirements. In order to ensure full and effective utilization of funds under this program, required cost-share contributions by states and other nonfederal entities receiving auction proceeds, should be capped at relatively modest levels for climate-related conservation actions. This cost-share requirement should supersede existing cost-share requirements in the programs through which the adaptation strategy is delivered.

8. Enhanced Scientific Capacity. The scientific capacity of the federal resource agencies to evaluate and address the impacts of climate change on fish, wildlife, and ecosystems should be enhanced through, among other things, the establishment of national climate change and fish and wildlife science centers, housed within agencies such as the U.S. Geological Survey and the National Oceanic and Atmospheric Administration.

Mr. MARKEY. Thank you, Mr. Schweiger, very much. Our next witness is Dr. Calvin Beisner, founder and national spokesman of the Cornwall Alliance for the Stewardship of Creation. Dr. Beisner also serves on the pastoral staff of Holy Trinity Presbyterian Church in Broward County, Florida. Thank you for being with us, Dr. Beisner.

STATEMENT OF E. CALVIN BEISNER

Mr. BEISNER. Thank you, Mr. Chairman, Mr. Upton, and members of the committee.

Mr. MARKEY. Pull that microphone in just a little bit closer.

Mr. BEISNER. I have prepared a more extensive documented written testimony and submit it for the record. When the Apostle Paul wrote to the Galatians about meeting with the other apostles early in his ministry, he said, "They only asked us to remember the poor, the very thing I also was eager to do." That has been my motivation for over 25 years of study and writing on developmental and environmental economics.

Both the Old and the New Testaments insist that rulers protect the poor from harm, following the example of Yahweh, who Psalm 140:12 tells us "will maintain the cause of the afflicted and justice for the poor." Yet often the very people who are responsible to protect the poor make laws that, whether intentionally or not, harm them.

Climate change legislation may, I fear, be one such case. The naturalist atheistic worldview sees earth and all its ecosystems as the result of chance processes and therefore inherently unstable and fragile, vulnerable to enormous harm from tiny causes. The biblical worldview sees earth and its ecosystems as the effect of a wise God's creation and providential preservation and therefore robust, resilient, and self-regulating, thus preventing small perturbations from setting off a catastrophic cascade of reactions.

Both this biblical worldview and high quality scientific empirical findings convince me that the fear of catastrophic manmade global warming is mistaken. And if so, fighting it is a waste. But even if not, fighting it may still be a mistake. The most thorough comparisons between the costs and benefits of temperature mitigation on the one hand and adaptation through economic growth on the other have concluded resoundingly that adaptation wins hands down.

I am aware that the Stern Review argues that the costs of doing nothing will exceed those of fighting warming, but it reaches that conclusion by assuming, among other mistakes, a zero time discount rate to compare the values of present and future costs. If you doubt the buffoonery of that, see me afterward. I would like to borrow $1 million for 90 years at zero interest.

What concerns me most is the impact of climate policy on the poor. If we tax CO_2 emissions, which, after all, enhance plant growth and so benefit all of life, if we tax them, whether directly or via cap-and-trade, we raise the price of energy and so the prices of all things made and transported by energy, which is essentially everything. This is particularly devastating to the poor, for whom energy constitutes a higher proportion of spending than for others.

Forcing the poor in the developing world, as must be done if we seriously mean to stabilize CO_2, to forego the use of carbon-based

fuels, coal, oil, and natural gas, the cheapest fuels per kilowatt hour of energy delivered, means delaying by decades or generations the time when they can afford electricity for their homes and industries and thus delays for similar periods the time when they can refrigerate their food and so protect it from spoilage and themselves from under-nutrition for lack of food and diseases from spoiled food.

When they can heat their homes with clean electricity rather than by open fires of wood and dry dung, the smoke from which causes respiratory diseases that reduce the amount of work they can do and so reduce their incomes and kill two to four million per year.

When they can air condition their homes and so close windows and doors, keeping out insects that spread malaria, dengue fever, and other diseases that kill millions every year and disable scores to hundreds of millions.

As Lomborg puts it, in the Third World, access to fossil fuels is crucial. About 1.6 billion people don't have access to electricity, which seriously impedes development. 2.5 billion people use biomass, such as wood, waste, and dung, to cook and keep warm. About 1.3 million people, mostly women and children, die each year due to heavy indoor air pollution. A switch from biomass to fossil fuels would dramatically improve 2.5 billion lives.

Inexpensive fossil fuels contributed enormously to the economic development of the wealthy countries of the world. To demand that poor countries forego their use is to deprive them of that benefit and is, I insist, a grave injustice. It is the demand of wealthy powerful elites at the expense of the vulnerable poor.

No alternative fuels can compete at present with fossil fuels for price. To compel their use in order to reduce CO_2 emissions is therefore to raise the price of energy and to harm the poor. Until someone can justify just a regressive tax with its fatal consequences, I can only conclude that it is unethical and that we are morally obligated not to impede access by the poor to abundant, inexpensive fossil fuels. Thank you.

[The prepared statement of Mr. Beisner follows:]

Testimony of
Dr. E. Calvin Beisner
to the Subcommittee on Energy and Environment
of the Committee on Energy and Commerce
of the United States House of Representatives
Wednesday, March 25, 2009

Mr. Chairman, members of the Committee, thank you for inviting me to testify today about the ethics of climate change policy, particularly as it affects energy costs and their impact on the poor. I speak to you as a theologian and pastor, a former professor of social ethics, and the national spokesman of the Cornwall Alliance for the Stewardship of Creation, a network of religious leaders, scientists, and economists dedicated to bringing Biblical world view, theology, and ethics together with excellent science and excellent economics to address simultaneously the challenges of economic development for the very poor and effective stewardship of creation. Sadly, we often find that our dual aims require us to warn of unintended negative consequences for the poor of policies touted to protect the environment.

In Job 24, Job mourned the fact that often in his day the powerful pushed the poor aside, making them hide themselves because of their nakedness. Psalm 72 describes a just king, one like the coming Messiah, as having compassion on the poor and needy and saving them. When the Apostle Paul wrote to the Galatians about meeting with the other apostles early in his ministry, he said, "They only asked us to remember the poor–the very thing I also was eager to do" (Galatians 2:10). That has been my motivation for over twenty-five years of study and writing on developmental and environmental economics, demonstrated in four published books, many articles and conference presentations, and fifteen years of teaching at the collegiate and graduate levels. Both the Old and the New Testaments insist that rulers protect the poor from harm, following the example of Jahweh, who, Psalm 140:12 tells us, "will maintain the cause of the afflicted and justice for the poor."

Yet often the very people who are responsible to protect the poor make laws that, whether intentionally or not, harm them. "Woe to those who enact evil statutes and to those who constantly record unjust decisions," God said through the Prophet Isaiah, "so as to deprive the needy of justice and rob the poor of My people of their rights . . ." (Isaiah 10:1–2). The God of Scripture is not surprised by a "throne of destruction" that "devises mischief by decree" (Psalm 94:20).

I am convinced that policies meant to reduce alleged carbon dioxide-induced global warming will be destructive, devising mischief by decree. As Lord Monckton points out in his own testimony today, the best, most recent empirical scientific discoveries have shown that even the mid-range scenarios of the IPCC exaggerate the warming effect of increased CO2 by at least seven times; atmospheric CO2 concentration is rising at a fraction of the rate forecast by the IPCC; and Earth has been cooling for the last seven years at a rate of 3.5°F per century.

These findings, opposite the expectations of the IPCC, are consistent with the Biblical world view. The naturalist, atheistic world view sees Earth and all its ecosystems as the result of chance processes and therefore inherently unstable and fragile, vulnerable to enormous harm from tiny causes. The Biblical world view sees Earth and its ecosystems as the effect of a wise God's creation and providential preservation and therefore robust, resilient, and self-regulating–like the product of any good engineer who ensures that the systems he designs have positive and negative feedback mechanisms to balance each other and prevent small perturbations from setting off a catastrophic cascade of reactions.

The IPCC's work rests on the naturalist, atheistic world view. Every one of its computer climate models, without exception, assumes that positive feedback mechanisms vastly outnumber and outweigh negative feedbacks, which is the root of fears of a runaway greenhouse effect and a

"tipping point" beyond which there is no return.

But empirical observation–the very soul of scientific method–has shown otherwise. The IPCC exaggerates the rate of carbon buildup because it doesn't recognize the capacity of Earth's plants and oceans to absorb vast amounts of carbon from the atmosphere and turn it into the building blocks of life. But that is precisely what has been happening, with wild and cultivated plants growing larger and more numerous because of increased CO2, and raising crop yields (and so lowering food prices. And the IPCC exaggerates the warming effect of CO2 in the atmosphere largely because its computer models all assume that clouds are a positive feedback–that they respond to rising surface temperature by trapping still more heat. But University of Alabama climatologist Roy Spencer, using data from NASA satellites, has shown the opposite: warming clouds diminish as surface temperature rises, allowing more heat to radiate out to space. The system works like a thermostat, keeping surface temperature within a narrow range well suited to human and other life on Earth.

The Biblical world view prepares us for just such findings. When God finished His creation, "God saw all that He had made, and behold, it was very good" (Genesis 1:31). Do you think he would have judged a fragile system biased by unidirectional feedbacks toward destruction that way? No, He would not. Indeed, the global destruction of the Flood required His supernatural intervention (Genesis 6–8), after which He promised Himself, "I will never again curse the ground on account of man . . .; and I will never again destroy every living thing, as I have done. While the earth remains, seedtime and harvest, and cold and heat, and summer and winter, and day and night shall not cease" (Genesis 8:21–22)–the repeated pairs of opposites being the poetic device called merism, implying that God had committed Himself to ensuring that all the cycles needed for human (and other) thriving would continue.

Both this Biblical world view and high-quality empirical scientific findings[1] convince me that the fear of catastrophic manmade global warming is mistaken. And it is *tragically mistaken* because it has become the basis of policy proposals that threaten enormous harm to the world's economies

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[1]I have discussed such findings in several papers and articles over the past three years, sometimes with co-authors. These include "An Examination of the Scientific, Ethical, and Theological Implications of Global Warming," written with climatologist Roy Spencer and energy policy analyst Paul Driessen (November, 2005); "A Call to Truth, Prudence, and Protection of the Poor: An Evangelical Response to Global Warming," written with Spencer, Driessen, and environmental economist Ross McKitrick (July 2006); "Scientific Orthodoxies, Politicized Science, and Catastrophic Global Warming: Challenges to Evangelicals Navigating Rough Waters in Science and Policy" (November 2006); "Important Developments on Global Warming in 2006" (December 2006); "Global Warming: Why Evangelicals Should Not Be Alarmed" (October 2007); "Some Theological Perspectives on the Climate Change Debate" (November 2007); "Deep Ecology, Neo-Paganism, and the Irrationalism of Global Warming Hysteria" (February 2008); the "Cornwall Stewardship Agenda," written with McKitrick, Spencer, Vice President of the Ethics and Religious Liberty Commission of the Southern Baptist Convention, Bryan College President Stephen Livesay, Grove City College Associate Professors of Economics Tracy Miller and Shawn Ritenour and Professor of Religion David Gordon, Calvin College Associate Professor of Economics Abel Abadeer, Eastern College Professor of Economics John Stapleford, University of Delaware Center for Climatic Research Director and climatologist David Legates, Westminster Seminary Emeritus Professor of New Testament Peter Jones, and Southern Baptist Theological Seminary Dean of the School of Theology Russell Moore (April 2008). Some of the more important books presenting scientific evidence against the hypothesis of catastrophic, CO2-induced global warming are Christopher Essex and Ross McKitrick's *Taken By Storm: The Troubled Science, Policy, and Politics of Global Warming*, rev. ed. (2008); Howard C. Hayden, *A Primer on CO2 and Climate* (2007); *The Global Warming Debate: Science, Economics, and Policy: Proceedings of a Conference Sponsored by the American Institute for Economic Research* (2007); Nigel Lawson, *An Appeal to Reason: A Cool Look at Global Warming* (2008); Patrick J. Michaels, *Meltdown: The Predictable Distortion of Global Warming by Scientists, Politicians, and the Media* (2004); Patrick J. Michaels and Robert C. Balling, Jr., eds., *The Satanic Gases: Clearing the Air about Global Warming* (2000); Patrick J. Michaels, ed., *Shattered Consensus: The True State of Global Warming* (2005); S. Fred Singer and Dennis T. Avery, *Unstoppable Global Warming Every 1,500 Years*, rev. ed. (2008); Willie Wei-Hock Soon and Steven H. Haskell, *The Maunder Minimum and the Variable Sun-Earth Connection* (2003, 2007); Henrik Svensmark, *The Chilling Stars:A New Theory of Climate Change* (2007). And some of the more important recent articles in the field are S. E. Schwartz, (2007), "Heat capacity, time constant, and sensitivity of the Earth's climate system," *J. Geophys. Res.*, 112, doi:10.1029/2007JD008746 (online at http://www.ecd.bnl.gov/steve/pubs/HeatCapacity.pdf; R. W. Spencer, W. D. Braswell, J. R. Christy, and J. Hnilo (2007), "Cloud and radiation budget changes associated with tropical intraseasonal oscillations," *Geophys. Res. Lett.*, 34, L15707, doi:10.1029/2007GL029698; R. W. Spencer and W.D. Braswell (2008a), "Satellite measurements reveal a climate system less sensitive than in models," *Geophys. Res. Lett.*, submitted (This paper was rejected by GRL in late 2008. Some of the material contained therein was to be submitted to *Journal of Climate* in January 2009 as part of a much more comprehensive paper.); R. W. Spencer and W.D. Braswell (2008b), "Potential biases in cloud feedback diagnosis: A simple model demonstration," *J. Climate*, November 1; Roy W. Spencer, "Global Warming as a Natural Response to Cloud Changes Associated with the Pacific Decadal Oscillation," 2008 (online at http://www.drroyspencer.com/research-articles/global-warming-as-a-natural-response/); Roy W. Spencer, "Satellite and Climate Model Evidence Against Substantial Manmade Climate Change," 2008 (online at http://www.drroyspencer.com/research-articles/satellite-and-climate-model-evidence/); Roy. W. Spencer, *Climate Confusion: How Global Warming Hysteria Leads to Bad Science, Pandering Politicians and Misguided Policies that Hurt the Poor* (New York: Encounter Books, 2008); Henrik Svensmark and Nigel Calder, *The Chilling Stars: A New Theory of Climate Change* (Cambridge, UK: Icon Books, 2007); S. Fred Singer and Dennis T. Avery, *Unstoppable Global Warming–Every 1,500 Years*, 2d ed. (Lanham, MD: Rowman & Littlefield, 2008); Roy W. Spencer, *The Great Global Warming Bungle* (forthcoming, 2009).

in general and especially to the world's poor. For that reason, I happily join with Lord Monckton in saying, "The right response to the non-problem of 'global warming' is to have the courage to do nothing."

I am aware that the Stern Review, produced for the British government, argues that the costs of doing nothing will exceed those of fighting warming. But it reaches those conclusions by assuming the most extreme temperature and impact scenarios of the IPCC, ignoring contrary scientific evidence, minimizing the costs of mitigation, and, as Yale's Sterling Professor of Economics William Nordhaus[2] and other economists the world over have noted in derision, assuming a zero time discount rate to compare the values of present and future costs. If you doubt the buffoonery of a zero time discount rate, see me afterward; I'd like to borrow a million dollars for a hundred years at zero interest.

The most thorough comparisons between the costs and benefits of temperature mitigation, on the one hand, and adaptation through economic growth, on the other, have concluded resoundingly that adaptation wins, hands down.[3] The Copenhagen Consensus, with contributions by many scientists and economists, led by five Nobel laureates, has found that micronutrient supplements, freer trade, immunization, lowering the price of schooling, malaria prevention and treatment, and eight other measures would all yield far better benefit/cost ratios than research and development of low-carbon energy technologies, and thirteen other policies would outperform either R&D and mitigation of global warming combined or mitigation by itself.[4] Granted opportunity cost, money spent to mitigate temperature increase cannot be spent on the other, more effective policies, and its result is a net loss

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[2]William Nordhaus, *A Question of Balance: Weighing the Options on Global Warming Policies* (2008).

[3]Nordhaus, *A Question of Balance*; Bjørn Lomborg, *Cool It: The Skeptical Environmentalist's Guide to Global Warming* (2007); Lomborg, ed., *Global Crises, Global Solutions* (2004).

[4]http://www.copenhagenconsensus.com/Default.aspx?ID=953

to human and ecosystem well being.

This shouldn't be surprising. Economic development allows human beings to thrive not just in temperate zones but in climates running the gamut from extreme cold (the Arctic) to extreme heat (the tropics). The notion that for some reason we must keep global average temperature–which absolutely no one ever experiences–within a particular range lest devastation ensue is blind to this fact.

What concerns me most at present, however, is not the impact of climate policy on the economy generally, but its impact on America's and the world's poor. Any policy that forces us to switch from lower-cost fuels to higher-cost fuels–no matter which ones they are, and no matter what their real or alleged effect on global temperature might be–is a policy to harm the poor. If we subsidize production of grain ethanol (which full life-cycle analysis shows releases about as much CO2 into the atmosphere per unit of energy delivered as do oil and coal), we not only must support the subsidy by taxation but also diminish the supply of grain for food, contributing, as we did in late 2007 through 2008, to higher food prices and resulting hunger and starvation. If we tax CO2 emissions, whether directly or via cap-and-trade, we raise the price of energy and so the prices of all things made and transported by energy–which is essentially everything.

But this is particularly devastating to the poor, for whom energy constitutes a higher proportion of spending than for the middle class and the rich. In the United States, estimates of the proportion of household budgets spent on energy by the poor range around 25 percent; for the middle class and wealthy, down around 10 percent. Every increase in energy prices therefore raises the poor's cost of living more, proportionately, than the wealthy's. It is, in fact, a highly regressive tax.

The impact on the poor outside America is much worse. Forcing the poor in the developing

world to forgo the use of carbon-based fuels–coal, oil, and natural gas, the cheapest fuels per kilowatt-hour of energy delivered–means delaying by decades or generations the time when they can afford electricity for their homes and industries, and thus delays for similar periods the time

- when they can refrigerate their food and so protect it from spoilage and themselves from undernutrition for lack of food, and diseases from spoiled food;
- when they can heat their homes with clean electricity rather than by open fires of wood and dried dung, the smoke from which causes respiratory diseases that reduce the amount of work they can do and so reduce their incomes, and kill 2 to 4 million every year;
- when they can air condition their homes and so close windows and doors, keeping out insects that spread malaria, dengue fever, and other diseases that kill millions every year and disable scores to hundreds of millions;
- when they can power their tools and factories by electricity, multiplying their productivity and hence increasing their earnings and consequently their ability to afford food, clothing, shelter, health care, transportation, and many other basic needs, not to mention the pleasures of the middle class and wealthy;
- when they can air condition their workplaces, lengthening their effective working hours and hence their earning potential during hot months.
- Perhaps most ironically of all, delaying economic development because of concerns to protect the environment also means delaying the time when developing countries can afford to spend more of their incomes protecting and restoring creation. A clean, healthful, beautiful environment is a costly good, and the wealthier people become, the more of it they can afford, which is why–contrary to the standard view of the environmentalist movement–economic

development is the friend, not the foe, of environmental improvement.[5]

Inexpensive fossil fuels contributed enormously to the economic development of the wealthy countries of the world. To demand that poor countries forgo their use is to deprive them of that benefit. It is, I insist, a grave injustice. It is the demand of wealthy, powerful elites at the expense of the vulnerable poor. It is every bit as much a case of imperialism as was the colonialism of the seventeenth- through mid-twentieth centuries and will slow development. As the Cornwall Alliance put it in our *Call to Truth, Prudence, and Protection of the Poor: An Evangelical Response to Global Warming* (see Appendix):[6]

> by condemning the world's poor to slower economic development by raising energy prices, the ECI asks the poor to give up or at least postpone their claims to modern technology that is essential for a better future for themselves and their children. It tells them they must not expect to have fossil fuels, electricity, or even eco-tourism (because jets emit greenhouse gases and cause climate change). Other environmental activists tell them they must not use hydroelectric or nuclear power to generate electricity, because of fears of damming rivers and risks from handling nuclear wastes. So the world's poor must remain indigenous, traditional, and poor–or as Leon Louw has put it, must continue living in "human game preserves," so that affluent Westerners can visit them in their quaint villages.[7]

And as Bjørn Lomborg put it in *Cool It: The Skeptical Environmentalist's Guide to Global Warming*:

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[5]Indur M. Goklany, *The Improving State of the World: Why We're Living Longer, Healthier, More Comfortable Lives on a Cleaner Planet* (Washington: Cato Institute, 2007), Part B: "The Effects of Economic Development and Technological Change on the Environment," pp. 103–234.

[6]Available online at www.CornwallAlliance.org.

[7]For thorough discussion of the destructive impact of much environmental policy originating in the West on the poor in the developing world, see Paul Driessen, *Eco-Imperialism: Green Power Black Death* (Bellevue, WA: Free Enterprise Press, 2003).

In the third world, access to fossil fuels is crucial. About 1.6 billion people don't have access to electricity, which seriously impedes development. Two and a half billion people use biomass such as wood, waste, and dung to cook and keep warm. For many Indian women, searching for wood costs three hours each day, as they sometimes walk more than six miles per day. It also causes excess deforestation. About 1.3 million people–mostly women and children–die each year due to heavy indoor-air pollution. A switch from biomass to fossil fuels would dramatically improve 2.5 billion lives; the cost of $1.5 billion annually would be greatly superseded by benefits of about $90 billion. For both the developed and the developing world, a world without fossil fuels in the short or medium term is a lot like a world gone medieval.[8]

Despite such findings, many environmentalists naively press for the substitution of alternative fuels for fossil fuels in developing countries. Let me address just one example: the common suggestion that the poor in sub-Saharan Africa and other badly underdeveloped places should opt for solar energy for their huts. One easy way to confront the folly of this thinking is simply to ask ourselves this question: If solar energy is such a cost-effective alternative to fossil fuels that the poor of, say, Kenya should use it for their homes, why don't more Americans, who are hundreds of times wealthier than Kenyans, use it to power our homes? The answer is simple: it *isn't* cost-effective by comparison with fossil fuel-generated electricity.

The average price per kilowatt hour charged in the United States to residential electric customers (most of which comes from fossil fuels) in November, 2008, was 11.5 cents.[9] What does it cost to

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[8]Bjørn Lomborg, *Cool It: The Skeptical Environmentalist's Guide to Global Warming* (New York: Alfred A. Knopf, 2007), 156.

[9]Energy Information Administration, "Average Retail Price of Electricity by End-Use Sector, by State," February 13, 2009 (online at http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_a.html).

supply solar photovoltaic energy to a single home? The website Green Economics, at www.greenecon.net, estimates about 38 cents per kWh assuming a $45,000 system with a 5 KW daily capacity and a twenty-year service life.[10] That's more than 10 times the cost per kWh of generating electricity using coal. No wonder so few Americans use solar! It is essentially the luxury hobby of wealthy people with a penchant for ecological trendsetting.

The truth is that no alternative fuels can compete at present with fossil fuels for price. To compel their use in order to reduce carbon dioxide emissions is therefore to raise the price of energy, and of all products made and transported with it, and so to raise the cost of living for everyone. It is particularly to harm the poor. Until someone can come up with a sound ethical justification for such a regressive tax with such fatal consequences, I can only conclude that it is unethical, and that we are morally obligated not to impede access by the poor to abundant, inexpensive fossil fuels. Ladies and gentlemen of the committee, you face a choice: will you be like those Job condemns, who "cause the poor to go about naked without clothing, and [who] take away the sheaves from the hungry" (Job 24:10)? Or will you join Paul and the rest of the Apostles, and "remember the poor" (Galatians 2:10)? I pray you will do the latter.

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[10]"Understanding the Cost of Solar Energy," *Green Econometrics*, August 13, 2007 (online at http://greenecon.net/understanding-the-cost-of-solar-energy/energy_economics.html).

Appendix

Open Letter

Call to Truth, Prudence, and Protection of the Poor

Mr. MARKEY. We thank you very much for being here. Our next witness is Lord Christopher Monckton. He is the Viscount of Brenchley. Lord Monckton is the chief policy advisor to the Science and Public Policy Institute. From 1982 to 1986, Lord Monckton served as a special advisor to Prime Minister Margaret Thatcher. Please proceed, Lord Monckton.

STATEMENT OF LORD CHRISTOPHER MONCKTON

Mr. MONCKTON. Sir, I bring fraternal greetings from the mother of Parliament to the great Congress of your athletic democracy, and I pray that God's blessing may rest upon your counsels.

[Slide.]

The right response to the non-problem of global warming is to have the courage to do nothing.

[Slide.]

Slide please. Thank you. There has been global cooling, as you see on that slide, for 7 years. The UN's climate panel has exaggerated carbon dioxide's effect on temperature sevenfold, verified by satellite observation—next slide please—that the diminution over time in outgoing long-wave radiation is one-seventh of that which the UN's computer models were told to predict.

[Slide.]

Next slide please. Carbon dioxide is accumulating in the air at less than half the rate that the United Nations had imagined. This century we may warm the world by just half a Fahrenheit degree, if that.

[Slide.]

Next slide please. If doing nothing is inexpedient, adaptation to warmer or cooler weather, when and if necessary, is many times more cost effective than attempted mitigation.

Adaptation to warmer weather is, of course, unnecessary unless the weather actually gets warmer. For 14 years, there has been no statistically significant global warming. Do not do or spend anything to mitigate or adapt to global warming until global temperature is two Fahrenheit degrees warmer than in 2000. That may not happen for at least a century.

We have been adapting to natural variations in climate throughout the history of humankind. Adaptation is a practical, affordable natural response to natural climate change. In the Middle Ages, it was warmer worldwide than today. Then global cooling set in. Our ancestors adapted. The Vikings abandoned their settlements in Greenland. Their graveyard in Hvalsey is under permafrost. It was frost free when they were buried.

In Europe we adapted too. We moved to the valleys as the glaciers advanced, burying mountain roads, silver mines, and forests. Only now are all of these emerging once again. Adaptation therefore is at present unnecessary. Mitigation is always unnecessary. It is also disproportionately expensive as Dr. Beisner has rightly pointed out.

In particular, the impoverishing regressive poll tax that is cap-and-trade has an ignominious past and no future. It has collapsed twice in Europe and once in New Zealand. If the United States adopts cap-and-trade, she may find herself doing so alone. Cap-and-trade will create green jobs by the thousands while destroying

real jobs by the million at a cost of trillions. It is senseless. Green jobs are the new euphemism for mass unemployment.

Cap-and-trade will perversely increase the global emissions it is intended to diminish. You will transfer your jobs, industries, and wealth to India and China. Their emissions per unit of production are far greater than your own. Protectionist tariffs, to try to prevent that, are the last resort of the economically illiterate and the politically desperate. Tariffs always damage those nations who impose them and they also flout your nation's obligations to the World Trade Organization. They are ultra vires.

For proof of the economic damage caused by unilateral but futile attempts at influencing climate, see the galloping exodus from California. Everyone with any get-up-and-go is getting up and going. And unlike their robotic governor, they won't be back.

Or see the food riots in a dozen of the world's poorest regions after the biofuels scam that arose directly from the global warming scare doubled food prices in 18 months. A third of your farmland no longer grows food for people who need it. It grows fuel for automobiles that don't.

For us, dearer food is inconvenient. For starving millions worldwide, as Dr. Beisner has pointed out, it is death. Next slide please.

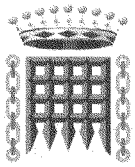
[Slide.]

In Haiti, the biofuel driven doubling of world food prices has forced the poorest to eat mud pies made with real mud. There is serious starvation going on around the world now, and this is directly—not as a result of global warming. There hasn't been any for 14 years—but as a result of policies intended to mitigate what does not need to be mitigated. You must apply the precautionary principle also to the precautions.

[Slide.]

And finally—next slide please—King Canute reminds his courtiers of the limitations of earthly power when the waves disobeyed his command not to wet the royal feet. You can no more command the forces of nature than could King Canute. For the sake of your taxpayers and the poor, whom their taxes support and defend, please don't try.

[The prepared statement of Lord Monckton follows:]



The Right Honorable Christopher Walter Monckton,
Third Viscount Monckton of Brenchley

before

The Energy & Commerce Committee of the House of Representatives

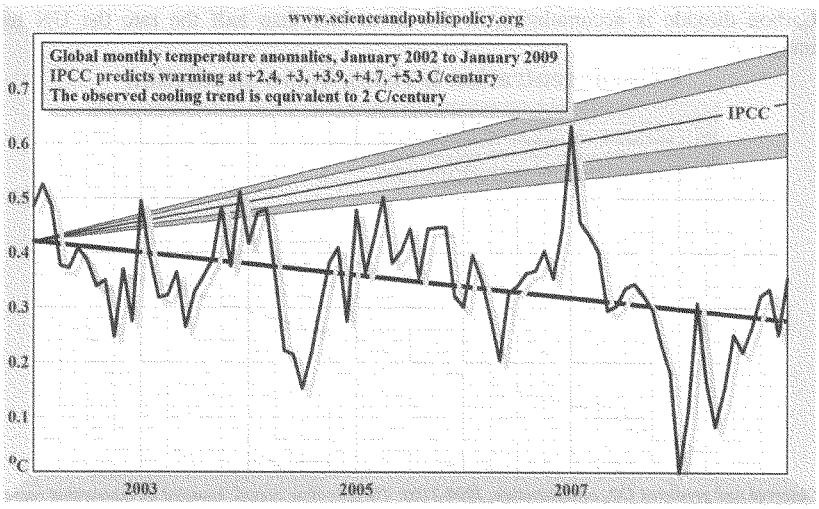
Washington, DC, Wednesday, 25 March, 2009

I BRING fraternal greetings from the Mother of Parliaments to the Congress of your "athletic democracy". I pray that God's blessing may rest upon your counsels.

As a Prime Ministerial policy advisor to Margaret Thatcher, *inter alia* I modeled the economic interactions of taxes and benefits on low-income households, and investigated scientific frauds. I have written and lectured on climate sensitivity. I advise institutions on climate change.

The right response to the non-problem of "global warming" is to have the courage to do nothing. There has been global cooling for seven years –

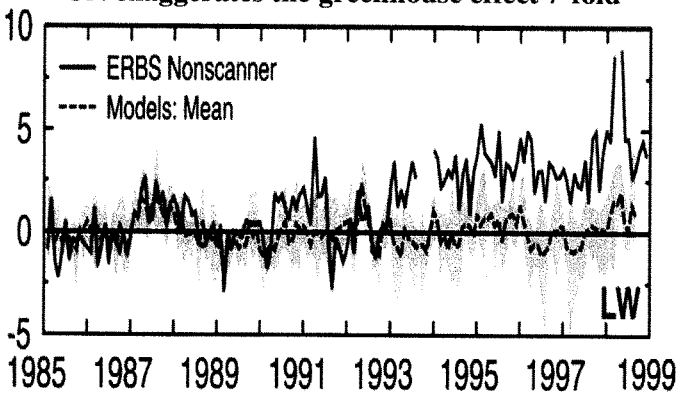
7 years' global *cooling* at 3.5 F°/century



What "global warming"? *The mean of the Hadley and NCDC monthly terrestrial global-temperature datasets and the RSS and UAH satellite lower-troposphere datasets shows a (largely-unreported) cooling for seven years at a rate equivalent to 3.5 F°/century. The pink region shows the UN's projected range of warming rates: the pale pink region is 1 standard deviation either side of the UN's central estimate of 7 F° warming to 2100.*

The UN's climate panel has exaggerated carbon dioxide's effect on temperature sevenfold, verified by satellite observation that the diminution over time in outgoing long-wave radiation is one-seventh of that which the UN's computer games were told to predict –

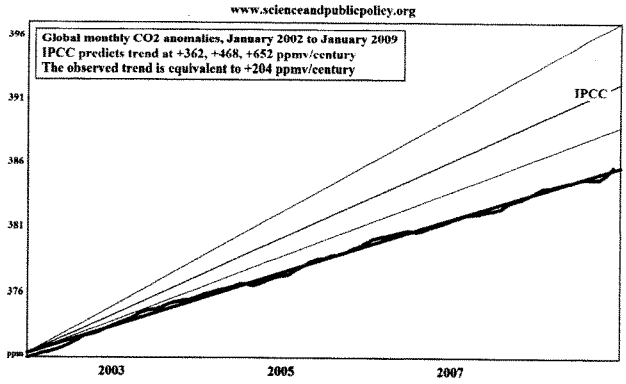
UN exaggerates the greenhouse effect 7-fold



Smoking gun: *14 years' **model-predicted (black)** and **ERBE satellite-observed (red)** change in outgoing long-wave radiation from the Earth's surface. Seven times as much long-wave radiation as the models predict continues to escape to space, demonstrating conclusively that the greenhouse effect has only one-seventh the effect on global temperature that the UN's models predict.* ***Source:*** *Professor Richard Lindzen.*

Carbon dioxide is accumulating in the air at less than half the rate the UN had imagined –

CO_2 concentration is rising below prediction

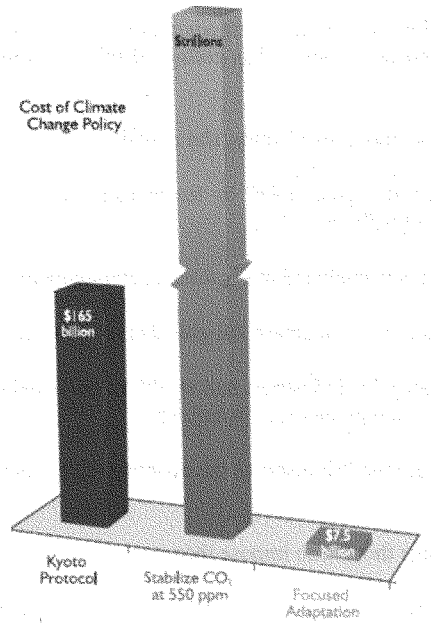


Observed and predicted CO_2 concentration, 2000-2100: *The pale-blue region, bounded by exponential curves, is the UN's predicted path for CO_2 concentration over the present century. The observed, deseasonalized CO_2 concentration change calculated by NOAA from January 2000 to November 2008 (**dark blue**) is near-coincident with the least-squares linear-regression trend (solid, pale-blue line) on the data. CO_2 concentration is no longer rising ever more rapidly, but only in a straight line, even though CO_2 emissions are rising ever more rapidly.*

This century we may warm the world by half a Fahrenheit degree, if that.

If doing nothing is inexpedient, adaptation to warmer *or cooler* weather – when *and if* necessary – is many times more cost-effective than attempted mitigation –

Don't mitigate: adapt (if needed)



Adaptation to warmer weather is unnecessary unless the weather gets warmer.

For 14 years there has been no statistically-significant global warming.

Do not do or spend anything to mitigate or adapt to "global warming" until global temperature is 2 Fahrenheit warmer than in 2000.

We have been adapting to natural variations in climate throughout the history of humankind.

Adaptation is a practical, affordable natural response to natural climate change.

In the Middle Ages it was warmer worldwide than today. Then global cooling set in. Our ancestors adapted. The Vikings abandoned their settlements in Greenland. Their graveyard at Hvalsey is under permafrost. It was frost-free when they were buried.

In Europe we adapted too. We moved to the valleys as the glaciers advanced, burying mountain roads, silver-mines, and forests. Only now are they emerging again.

Adaptation is at present unnecessary.

Mitigation is always unnecessary. It is also disproportionately expensive.

In particular, the impoverishing, regressive poll-tax that is cap-'n'-trade has an ignominious past and no future. It has collapsed twice in Europe and once in New Zealand.

If the United States adopts cap-'n'-trade, she may do so alone.

Cap-'n'-trade will create "green jobs" by the thousand while destroying real jobs by the million at a cost of trillions.

"Green jobs" are the new euphemism for mass unemployment.

Cap-'n'-trade will perversely increase the global emissions it is intended to diminish.

You will transfer your jobs, industries, and wealth to India and China. Their emissions per unit of production are greater than your own.

Protectionist tariffs are the last resort of the economically-illiterate and the politically-desperate.

Tariffs always damage those who impose them.

Tariffs flout your nation's obligations to the World Trade Organization. They are *ultra vires.*

For proof of the economic damage caused by unilateral but futile attempts at influencing climate, see the galloping exodus from California.

Everyone with any get-up-and-go is getting up and going.

Unlike their robotic Governor, they won't be back.

Or see the food riots in a dozen of the world's poorest regions after the biofuel scam doubled world food prices in 18 months.

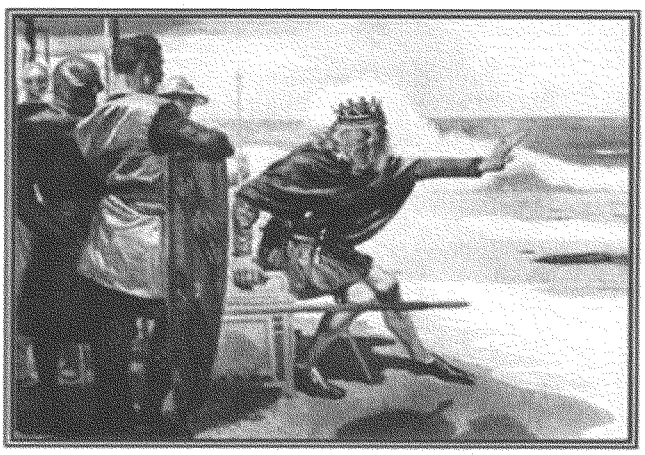
A third of your farmland no longer grows food for people who need it. It grows fuel for automobiles that don't.

For us, dearer food is inconvenient. For starving millions, it is death.

Biofuel-induced starvation: Haitians eat mud pies or die

In Haiti, the biofuel-driven doubling of world food prices has forced the poorest to eat mud pies made with real mud.

Canute could not command nature. Nor can you.



King Canute reminded his courtiers of the limitations of earthly power when the waves disobeyed his command not to wet the royal tootsies. You can no more command the forces of nature than Canute. For the sake of your taxpayers, and of the poor whom their taxes support and defend, don't try.

CARIE ● RANNOCH ❀ PH17 2QJ
01882 632341 ❀ FAX 632776 ● MOBILE 07980 634784
monckton@mail.com
From: The Viscount Monckton of Brenchley

30 March 2009

The Hon. Representative Ed Markey, and The Hon. Representative Joe Barton,
Committee on Energy and Commerce, US House of Representatives, Washington, DC.

Gentlemen,

Questions raised by the Subcommittee on Energy & Environment

I am most grateful for the fairness and good humor with which Chairman Markey conducted the hearing of 26 March 2009 on the question of adaptation to "global warming". The calibre, commitment, and concern of Hon. Gentleladies and Gentlemen on both sides of the House were self-evident.

However, my notes of the hearing indicate that certain national and international executive agencies may have materially, serially, seriously, and successfully misled your Congress for several years about the imagined extent, anthropogenic component, and effects of "global warming".

President Dwight D. Eisenhower, in his farewell address to the nation in 1961, gave a warning "that public policy could itself become the captive of a scientific-technological elite." He said –

> "Partly because of the huge costs involved, a government contract becomes virtually a substitute for intellectual curiosity. ... The prospect of domination of the nation's scholars by Federal employment, project allocations, and the power of money is ever present – and is gravely to be regarded."

Nearly all of your nation's scholars and scientists owe their primary livelihood to the involuntary generosity of the taxpayer. Some of your rent-seeking, scientific-technological elite, taking wilful and shameless advantage of the taxpayer's largesse and of the scientific illiteracy that is now widespread, are mightily enriching themselves by misleading your Congress into appropriating disproportionately large sums to permit them to address the non-problem of anthropogenic "global warming".

The right policy to address a non-problem is to have the courage to do nothing. Therefore I am copying this letter to the President of the United States and to Madame Speaker Pelosi, with a recommendation that they should heed President Eisenhower's warning, and should abandon all measures and expenditures in attempted mitigation of anthropogenic "global warming" until global mean surface temperature shall have increased by at least 2 Fahrenheit degrees compared with the temperature in the year 2000. That small, harmless, and beneficial increase is not likely to occur for at least a century, if then.

At the hearing on March 26, 2009, Congressman Joe Barton required me to supply to the Committee further and better particulars in justification and verification of the three graphs that were included in my written testimony and were displayed during my oral testimony.

Also, I was later asked to provide to the Committee some justification and verification of my assertion that the cumulative frequency, intensity, and duration of all hurricanes, typhoons, and tropical cyclones is currently less than at any time in the 30-year satellite record.

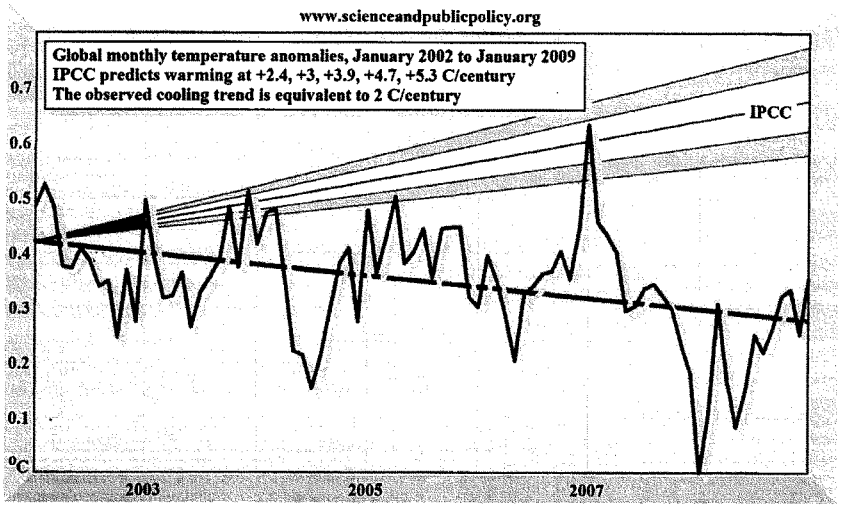
In addition, I made notes of concerns raised by Hon. Members of the Committee during their interventions and am taking the opportunity to respond to them in this letter.

I apologize to the Committee that traveling commitments have prevented me from supplying the necessary responses on the day of the hearing itself. No discourtesy was intended. Without objection, I hope that this letter and its attachment will be entered into the official record of the hearing.

Has our planet cooled for seven years?

Representative Barton bluntly asked Tom Karl, the Director of the National Climatic Data Center, whether he thought I had misled Congress by presenting in my testimony a graph establishing that there has been global cooling for seven years, at a rate equivalent to 3.5 Fahrenheit degrees per century –

7 years' global *cooling* at 3.5 F°/century



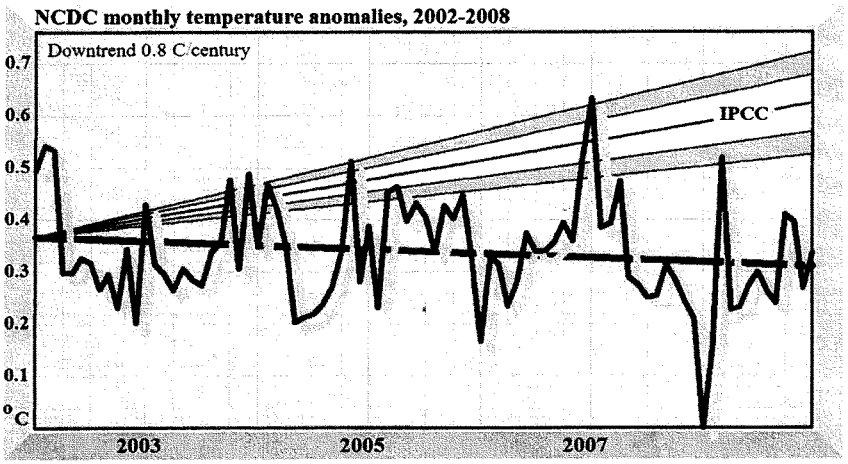
What "global warming"? *The spline-curve plots the monthly mean of the global surface temperature anomalies published by the Hadley Center/Climate Research Unit and by the US National Climatic Data Center, and of the satellite lower-troposphere anomalies published by Remote Sensing Systems Inc. and by the University of Alabama at Huntsville. Beneath the spline-curve, the bright red straight line, the least-squares linear regression trend on the data, shows a (largely-unreported) global cooling for seven years at a rate equivalent to 3.5 F°/century. The pink zone shows the UN's projected range of equilibrium warming rates over the period on the "business-as-usual" scenario A2. Within this zone, the pale pink region represents one standard deviation either side of the UN's central estimate of 7 F° warming to 2100. The basis of calculation for this and similar global-temperature graphs is fully set forth in the technical paper annexed at Flag 1.*

It was evident from the surprise of Representative Barton on seeing this graph that witnesses in support of what I shall call the "official" viewpoint at previous hearings on the question of "global warming" have somehow succeeded in withholding from the Committee the fact that global temperatures have been falling rapidly for seven years, contrary to the predictions of all of the computer models on which the UN relies. The Committee may well wonder what else the "official" witnesses have been withholding.

In this response to the Committee's request for further and better particulars, I shall **red-flag** each point at which, were this an investigation into scientific fraud, my report to the prosecuting authorities would identify information or conduct that might merit further inquiry. A red flag should not be taken as indicating that fraud has occurred: that is a matter for a criminal jury. It is, however, an indication of an apparent irregularity giving grounds for concern and further inquiry, in the investigator's opinion.

Red flag 1: Mr. Karl, in response to a very clearly-phrased and repeated question from Representative Barton, did not forthwith admit that global temperatures have indeed been falling rapidly for seven years. I do not know why he failed to admit this fact: for the global-temperature dataset compiled by the National Climatic Data Center, of which he is the Director, unequivocally confirms seven years' rapid global cooling –

7 years' global *cooling* unequivocally confirmed by NCDC



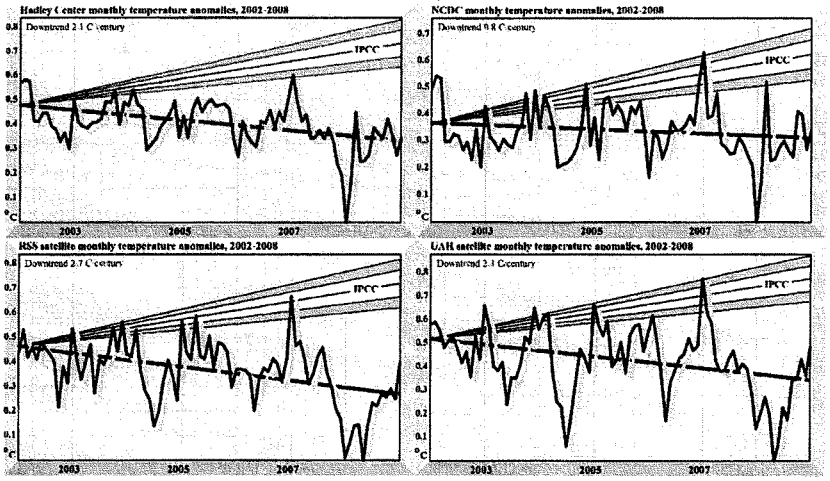
NCDC's own dataset shows seven years' global cooling: *The temperature dataset published by the National Climatic Data Center shows global cooling at a rate equivalent to 1.4 F°/century. During the 20th century, global temperature rose by 1.3 F°.*

Red flag 2: Mr. Karl said that combining surface and tropospheric datasets, as I had combined them in this graph, was not an approach that his agency used, implying that the results might be misleading and might not truly demonstrate global cooling.

The advantage of a composite global-temperature index, however, is that the satellite datasets for the ***lower*** troposphere (not, as Mr. Karl implied, for the troposphere as a whole) are to some extent less prone to heat-island distortions arising from progressive urbanization than the terrestrial datasets on their own. The composite index is accordingly more reliable than any individual dataset, particularly since there is evidence that at least one of the terrestrial datasets has been tampered with by its administrators to create a false impression that global temperature in the late 20th century rose more sharply than it did in reality – a point to which I shall return *infra.*

Indeed, all four of the datasets which were used in the compilation of the composite graph in my testimony, specifically including Mr. Karl's NCDC dataset, are unanimous in demonstrating that global temperature has been falling throughout the seven years 2002-2008 inclusive –

7 years' global *cooling* confirmed by Hadley, NCDC, RSS, and UAH

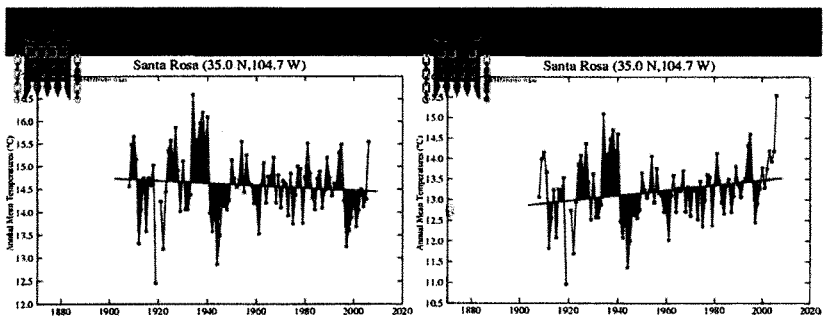


Unanimity: *Each of the four separate datasets used in the compilation of the composite global-temperature index shows seven years' rapid global cooling. Each of the four individual graphs is generally similar to the graph of the combined datasets. Therefore use of the composite index was reasonable, fairly reflecting the underlying datasets.*

Red flag 3: The NCDC global-temperature dataset shows a downtrend in global temperature over the past seven years that is conspicuously out of line with the other three datasets. The NCDC's downtrend, equivalent to 1.4 F°/century, is little more than one-third of the other three datasets' downtrends.

I have not yet had the opportunity to investigate why the NCDC's dataset appears to understate by a substantial margin the global cooling of the past seven years. However, the NCDC's dataset appears to produce outputs very close to those of the NASA Goddard Institute of Space Studies, which has had to be excluded from the composite index because of persistent problems of objectivity and of reliability.

Red flag 4: I shall illustrate these problems with 100 years' temperature data from the temperature station at Santa Rosa, headquarters of NOAA, the parent organization of the NCDC –

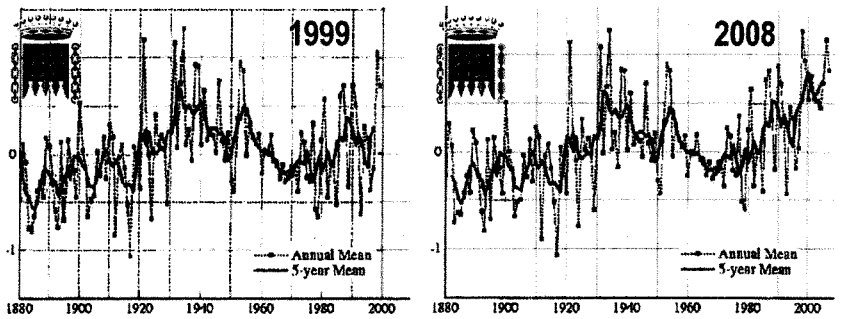


Prestidigitation: *The raw temperature data (left) show cooling. The data after adjustment by GISS show warming, because data from the 1930s have been altered. The reason for this alteration of historical data is unclear and requires investigation.*

Two questions arise. First, does the adjustment of the temperature data by GISS apply only to a few stations, making little difference to the global trend? Secondly, has the adjustment of the data become greater over time, indicating *prima facie* that a systematic and unjustifiable bias has been introduced?

Red flag 5: These questions may be simply answered by making a second comparison: this time between the GISS global dataset *after* data adjustment as it stood in 1999 and the same dataset *after* adjustment as it stood in 2008. Any difference between the earlier and later versions of the *adjusted* dataset would be *prima facie* evidence of a bias that would require further explanation before any reliance could be placed upon the dataset –

Why the NASA GISS global-temperature dataset is not considered reliable



Bias over time: *The GISS global-temperature dataset, after adjustment, as it stood in 1999 (left) and in 2008 (right). The data peak in the 1930s has been reduced in the later version of the dataset, and the 1998 peak has been markedly increased, artificially increasing the warming rate over the period. I am grateful to Dr. Anthony Watts for making these graphs public.*

The data adjustments by GISS, therefore, are sufficient to affect the entire global database, and the comparison between the earlier and later versions of the *adjusted* global database over time shows that the adjustment that produces a warming bias has been increased over the years.

It is considerations such as these that cast doubt upon the reliability of the NASA GISS global-temperature dataset, and hence upon that of the very similar NOAA NCDC dataset. The Committee may wish to investigate this and other apparent defects and irregularities in the compilation of the official global-temperature datasets.

Red flag 6: Mr. Karl said that the temperature downtrend, if it had occurred, had been caused partly by a la Nina phase of the El Nino Southern Oscillation, a cooling event that he said had endured for three years. In fact, the 2007/8 la Nina commenced in late 2007, troughed at the end of that year, and persisted for little more than one year, not three, and the dataset of the NCDC, of which Mr. Karl is the Director, suggests the la Nina persisted for no longer than six months. Therefore, la Nina has had less effect on the cooling trend than Mr. Karl suggests.

Mr. Karl predicted that the next El Nino Southern Oscillation (during which the oceans release heat to the atmosphere, causing a short but sudden warming of the atmosphere) would set a temperature record higher than that which had been observed during the Great El Nino of 1998.

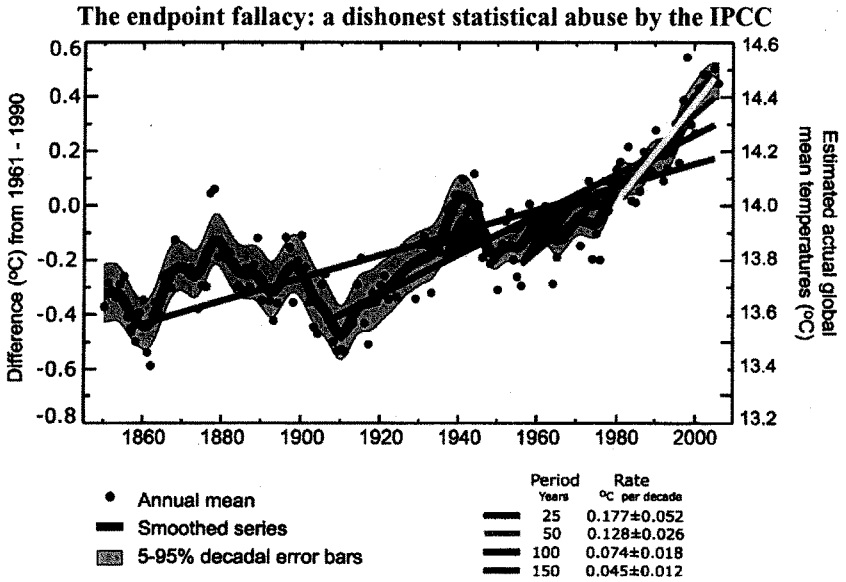
However, the pronounced El Nino warming event that caused the spike in global mean surface temperatures in January 2007 did not set a new temperature record. A very substantial El Nino would now be required to set a new temperature record: there have been only three Great El Ninos in the past 350 years, of which the 1998 El Nino was one.

Red flag 7: Mr. Karl suggested that the global temperature downtrend of the past seven years, if it existed, was a consequence of natural variability in the climate. However, since the recent downtrend was indeed caused by natural variability, then by the same token the global warming of the past 300 years, during the first 270 of which humankind could not – on any view – have had any appreciable influence on temperature, might also have been caused by natural variability.

Red flag 8: Mr. Karl said that 13 of the past 14 years had been the warmest on record: however, even if that were true (his own NCDC dataset shows 12 of the past 14 years as being the warmest on the record, which dates back only to 1880), it is not evidence that the "global warming" of the past 300 years is anthropogenic. The mere *fact* that warming has occurred tells us nothing about the *cause* of the warming. It is scarcely alarming that many of the warmest years on record are at the end of 300 years' warming.

Mr. Karl concurred with a suggestion from the Chair that I had taken the 21st-century downtrend out of context. Since the context is plainly of importance to the Committee, I am happy to provide verification of the points I made in response to the suggestions that the 21st-century downtrend should be placed in context.

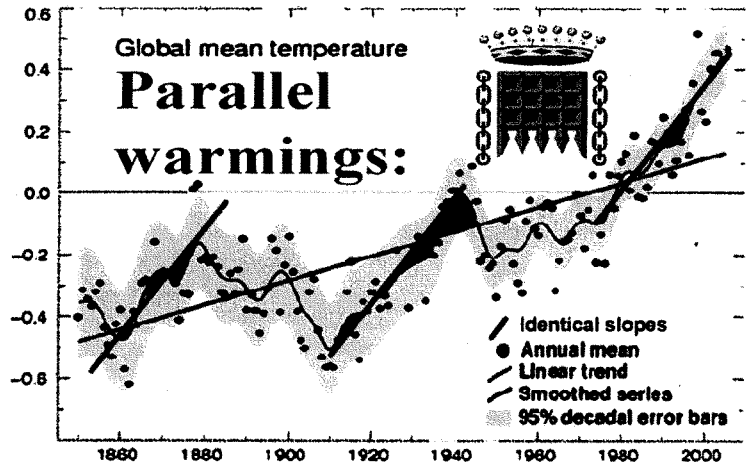
Red flag 9: Let us begin with a temperature graph taken from the 2007 climate assessment report of the UN's climate panel, the IPCC. The graph falsely purports to show that the warming rate has been inexorably increasing throughout the past 150 years –



Lies, damned lies, and statistics: *The IPCC's 2007 report, cited with approval in a science lecture by Dr. Rajendra Pachauri, chairman of the IPCC's science working group, and also about to be cited with approval in a "Technical Support Document" in justification of the EPA's imminent finding that CO_2 and five other gases are jointly or severally "dangerous" in terms of the Clean Air Act, contains the above graph purporting to show that the rate at which the world is warming is inexorably increasing. The graph is an egregious instance of the endpoint fallacy, a dishonest abuse of statistics by which false trends are demonstrated by careful selection of endpoints or (in the present instance) startpoints when evaluating data trends.*

Removal of the IPCC's false trend-lines from the data reveals the true position –

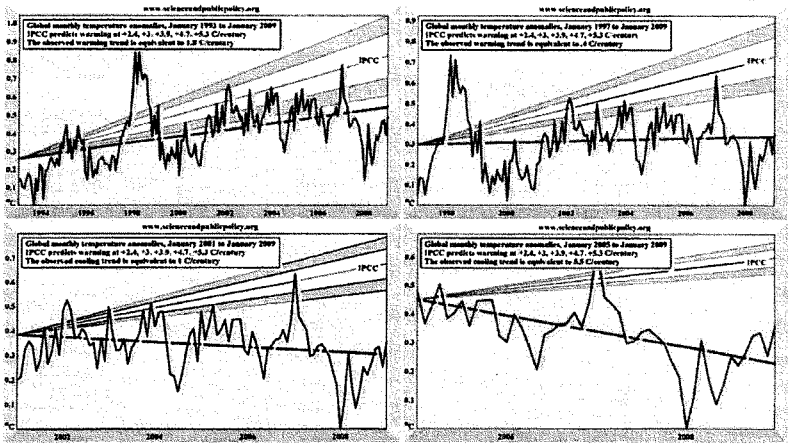
The truth: 1860-1880 and 1910-1940 warmed just as fast as 1975-1998



No anthropogenic signal: *The world warmed at the same rate from 1860-1880 and from 1910-1940 as it did from 1975-1998 (see the three parallel magenta trend-lines). The former two periods occurred before humankind can possibly have had any significant influence on temperature. Therefore there is no anthropogenic signal in the global temperature record, and no basis for the IPCC's assertion that the warming rate is accelerating.*

To demonstrate why the endpoint fallacy is a shoddy statistical abuse, we can use the IPCC's own global temperature data to deliver a result precisely the opposite of that which the IPCC tries to draw –

Heading for a new Ice Age? "Global warming" becomes cooling

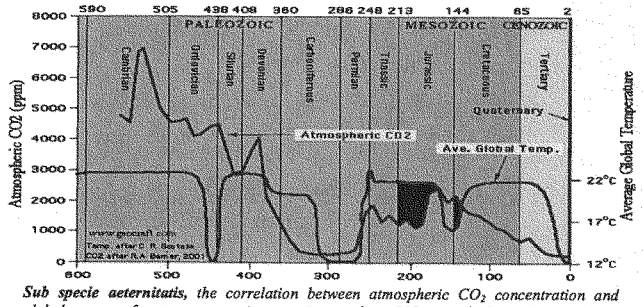


Any result you want: *Beginning in 1993 (top left) and advancing the start-date successively by 4 years at a time, the IPCC's own data show the world heading for an Ice Age. Using the same data as the IPCC, we reach a diametrically opposite (and equally unjustifiable) conclusion, proving the IPCC's abuse of statistical method.*

No reliance can be placed upon purported temperature trends that depend arbitrarily upon a careful selection of start-dates and end-dates. The IPCC and Dr. Pachauri were wrong, and the EPA will be wrong, to rely upon the endpoint fallacy as the basis for their erroneous conclusion that warming rates that are far from unprecedented are accelerating when they are doing nothing of the kind.

Plainly, a longer perspective is desirable. Let us go back 600 million years –

Lack of correlation implies lack of causation

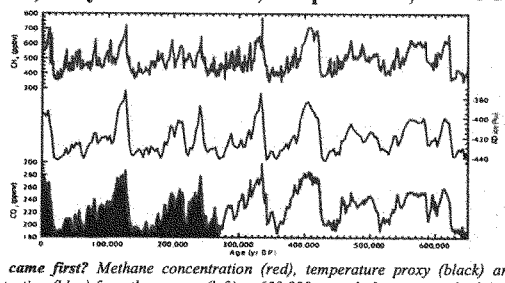


Sub specie aeternitatis, *the correlation between atmospheric CO_2 concentration and global mean surface temperature is non-existent: above 915 ppmv the logarithmic relation between CO_2 and temperature fails (Myrhe et al., 1998), and the addition of further CO_2 has little further influence over global atmospheric temperatures.*

Throughout the past 600 million years, the mode of temperature has been 12.5 Fahrenheit degrees warmer than the present, but atmospheric CO_2 concentration peaked at 7000 parts per million by volume in the Cambrian era. It was at this time that the calcite corals originated. There was also a very high CO_2 concentration compared with today's during the Triassic era, when the delicate aragonite corals were first created by algal symbiosis. Congressman Inslee suggested that corals were no longer adapted to high CO_2 concentrations: he felt that acidification of the oceans would harm them. However, measurements of ocean pH over time are few, and are not adequate to demonstrate any acidification of the oceans: the generally-quoted reduction of 0.1 pH units is derived chiefly from modeling. Today's CO_2 concentration is almost the lowest in the geological record, endorsing Will Happer's testimony before the Senate earlier this month that the planet is currently starved of CO_2, and has been so starved for several million years.

The Vostok ice cores provide a detailed record for the past 650,000 years –

650,000 years' methane, temperature, and CO_2

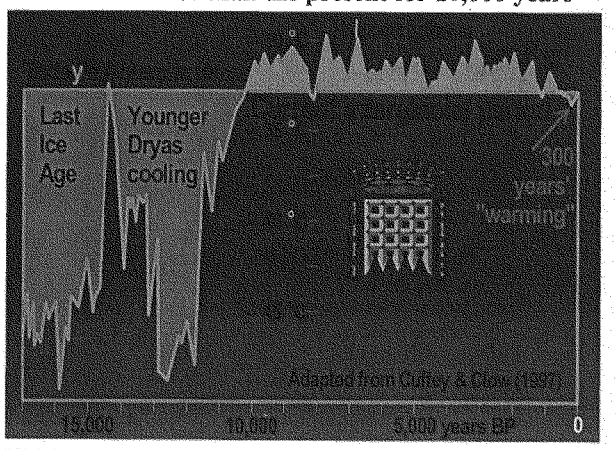


Which came first? *Methane concentration (red), temperature proxy (black) and CO_2 concentration (blue) from the present (left) to 650,000 years before present (right).*

Red flag 10: The Vostok ice cores show that in the past 650,000 years the correlation between greenhouse gases and temperature was close. Al Gore said in his movie that whenever CO_2 changed, temperature changed. However, it was temperature that changed first, and CO_2 that followed 800-2800 years later. The latter change cannot have caused the former.

It is also worth considering the temperature record during the Holocene – the 10,000-year period following the last Ice Age –

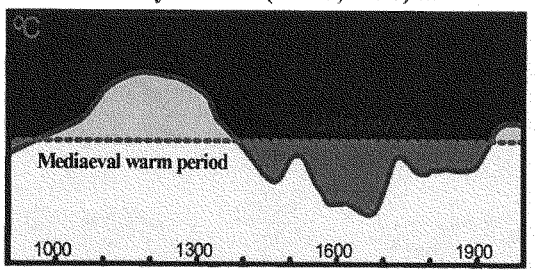
It was warmer than the present for 10,000 years



"Global warming" in perspective: *The recent 300-year period of "global warming", nearly all of which cannot have been anthropogenic, is insignificant in comparison with the Holocene climate record. Throughout much of the past 10,000 years, including the Minoan, Roman (R), and Medieval (M) warm periods, global temperatures were up to 5 Fahrenheit degrees warmer than the present. Today's temperatures are not unprecedented.*

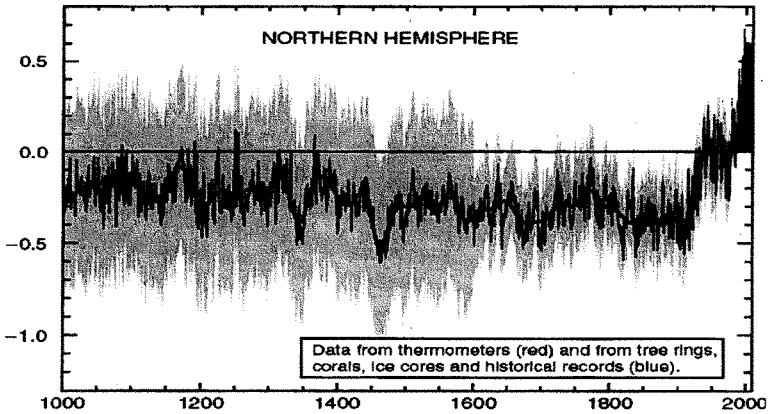
Red flag 11: Unfortunately, the IPCC has made a determined effort artificially to abolish the medieval warm period, apparently with the intention of making it appear, falsely, that today's global mean surface temperatures are unprecedented in recent history.

Now you see it (IPCC, 1990) ...



Medieval warm period? *Yes. This drawing of a graph in the IPCC's 1990 report shows it clearly.*

... now you don't (IPCC, 2001)



Medieval warm period? *Not any more: the UN purported to abolish it in its 2001 assessment report. The above graph appeared six times, in full color, and at large scale, in the 2001 report, the only graph to be so favored.*

The IPCC notoriously abolished the medieval warm period in its 2001 report, having explicitly acknowledged its existence in its 1990 report. Its justification for the purported abolition was highly questionable. The prominence that it accorded to the 2001 graph – the only one in the entire report to be reproduced six times, in full color, and at large scale – suggests a political rather than a scientific motive.

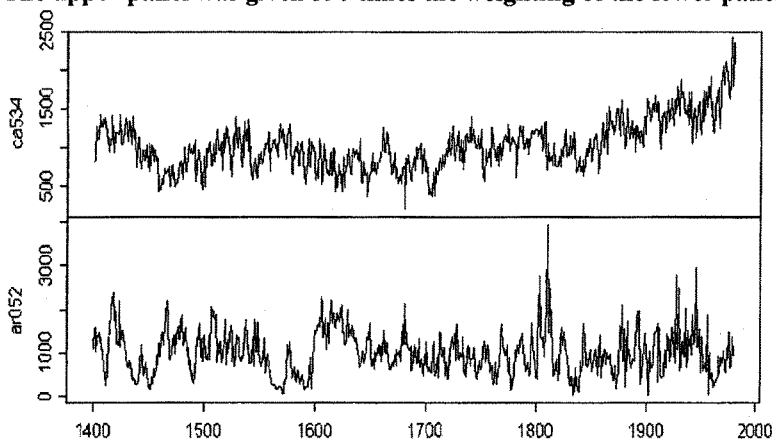
Red flag 12: The UN's report relied upon a paper in *Nature* that contained a number of abuses of sound statistical practice. The paper, (Mann *et al.*, 1998-1999), relied heavily upon bristlecone-pine proxies for pre-instrumental temperature change, even though a previous UN report had explicitly recommended against the use of such proxies on the ground that the width of the tree-rings is influenced not only by temperature change but also by changes in precipitation, and most notably by changes in atmospheric CO_2 concentration. Recent attempts by Mann *et al.* to revive the unsound graph regrettably suffer from the same central defect as the original: removing the bristlecone proxies and a further defective outlier (the Tiljander proxy) from among the proxy datasets clearly shows that the medieval warm period was real, and appreciably warmer than the present day.

The unsatisfactory statistical methods in Mann *et al.* were thoroughly exposed by McIntyre & McKitrick (2003, 2005). In all material respects, the findings of McIntyre & McKitrick were powerfully endorsed by a detailed investigative study by three statisticians at the instigation of the House (Wegman, 2005).

Red flag 13: It is of particular concern that the compilers of the now-discredited graph upon which the UN unwisely placed such undue weight in its 2001 report were extremely reluctant to release their computer programs and data. *Nature* failed to require them to produce the data; and it was only after numerous requests by McIntyre and McKitrick that Mann *et al.* eventually parted with the information necessary to allow a proper, independent, academic review of the graph that the UN had been so willing to accept without any real peer review.

Red flag 14: It is worth demonstrating one or two of the statistical abuses that led to the false abolition of the medieval warm period. One startling abuse was the disproportionate weight given to temperature proxies that provided Mann *et al.* with the "hockey-stick" profile they desired, in comparison with the lesser weight given to proxies that demonstrated the presence of the medieval warm period. An instance –

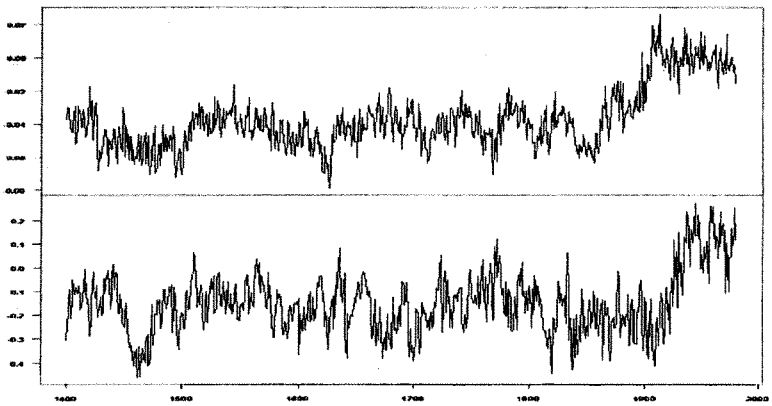
The upper panel was given 390 times the weighting of the lower panel



A false balance is abomination to the Lord: *In the compilation of the UN graph purporting to abolish the medieval warm period, the upper data, showing the present day to be warmer than the previous 600 years, was given 390 times the weight of the lower data, showing the Middle Ages as warmer than the present.*

Red flag 15: The computer model which was used to generate the defective UN graph was tuned t generate data curves showing the present day to be warmer than at any time over the past 600 years regardless of whether the graph were based on genuine temperature proxies or on random red noise –

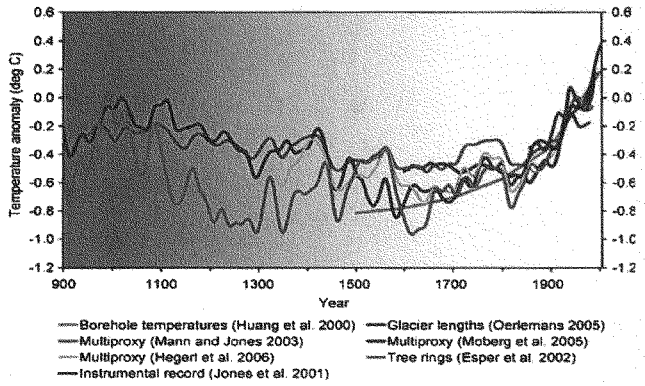
Genuine proxy data (top) and random red noise (bottom)



Whatever answer you want: *The computer model that generated the UN's graph that "abolished" the medieval warm period generates "hockey-sticks" that show today's temperatures as warmer than for 600 years, with the post-1900 temperature increase serving as the blade of the hockey-stick. Remarkably, the model generates "hockey-sticks" even if, instead of the genuine temperature-proxy data (upper panel), random red noise (lower panel) is used.*

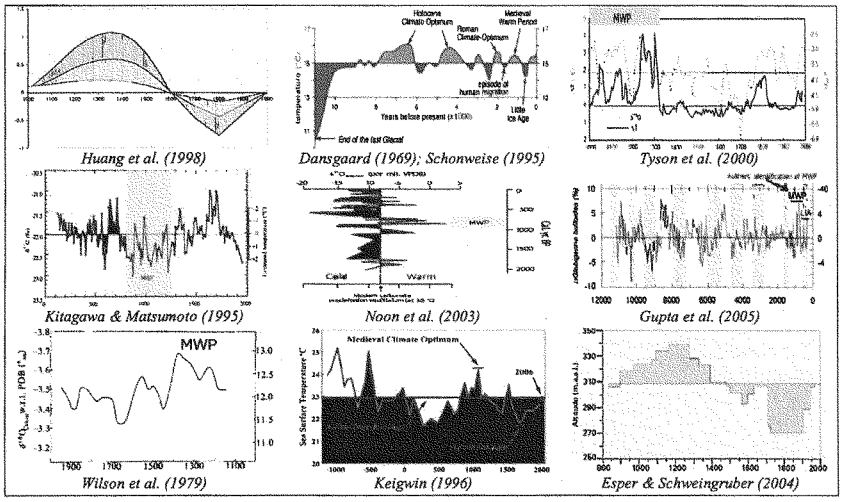
Red flag 16: The EPA, in the Technical Support Document that it will pray in aid as justification for its endangerment finding in respect of CO_2, will disregard the overwhelming majority of the papers in the scientific literature, and will also deny history by finding that there was no medieval warm period –

'No medieval warm period' (EPA, 2009, after NRC, 2006)



Notwithstanding official attempts either to eradicate the medieval warm period altogether or to show that it was not as warm as the present, in the past 25 years at least 670 scientists from 391 institutions in 40 countries have contributed to peer-reviewed papers in the learned literature establishing that the medieval warm period was real, global, and warmer than the present. Here are graphs from a few of these papers –

The medieval warm period graphically illustrated in the learned literature



***Medieval warm period?** Yes, nine times: it is as well established in the scientific literature as it is in the historical record.*

Red flag 17: It was only after the UN's use of the defective graph had been challenged that a suspicious spate of papers supporting Mann *et al.* in their attempted abolition of the medieval warm period appeared in the scientific literature. However, the Wegman report showed that most of the authors of these papers had previously been co-authors with Mann himself. This incident illustrates a central difficulty. Many of the scientific journals have declared prejudices in favour of the "official" position on climate change: therefore, they are far more indulgent of authors who support the "official" position than of skeptics.

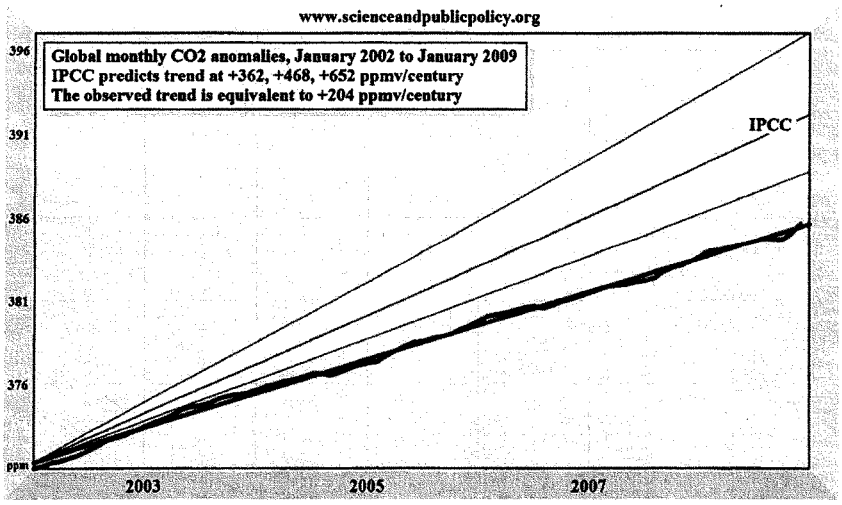
This declared bias among the journal editors allows supporters of the "official" position to knock down any skeptical paper by dashing off a quick rebuttal, which is eagerly printed after a minimum of scrutiny. Then the IPCC, which claims to operate by reviewing the literature, can concentrate on the rebuttals rather than the skeptical papers that question its position. At any rate, the IPCC, in its anxiety not to admit its mistake in attempting so prominently to abolish the medieval warm period in 2001, failed – and continues to fail – to take any account of the overwhelming majority of papers in the literature that demonstrate that the medieval warm period was real, global, and appreciably warmer than the present.

We conclude that today's temperature is not exceptional. It was warmer than today in the medieval, Roman, and Minoan warm periods and throughout most of the Holocene; it was up to 7 F° warmer than the present in each of the four previous interglacial warm periods; and 12.5 F° warmer than the present throughout most of the past 600 million years. Yet Earth did not fry and the oceans did not acidify.

Is "global warming" happening faster than even the IPCC had thought?

In my testimony, I presented a graph indicating that the global atmospheric concentration of carbon dioxide was rising in a straight line at a rate well below the least of the IPCC's exponential projections –

CO_2 concentration, though rising, is well below the IPCC's predictions

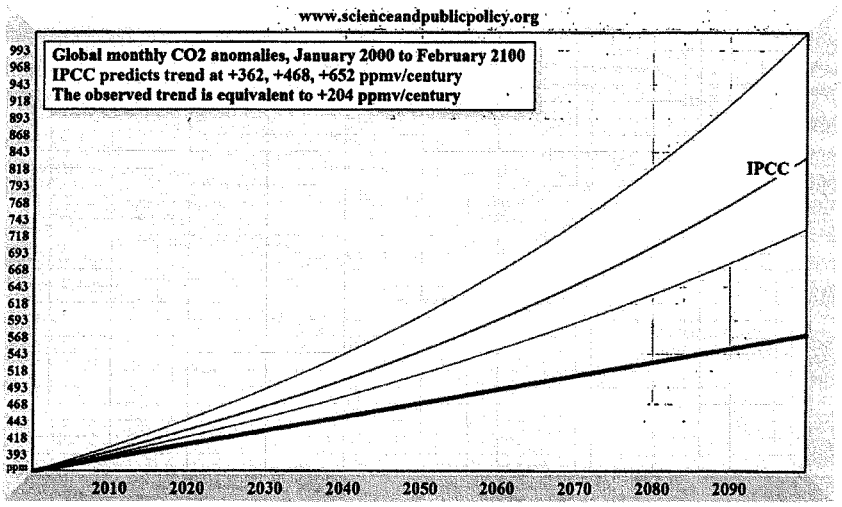


Observed and predicted CO_2 concentration, 2000-2100: *The pale-blue region, bounded by exponential curves, is the UN's predicted path for CO_2 concentration over the present century. The observed, deseasonalized CO_2 concentration change calculated by NOAA from January 2000 to November 2008 (dark blue) is near-coincident with the least-squares linear-regression trend (solid, pale-blue line) on the data. CO_2 concentration is no longer rising ever more rapidly, but only in a straight line, even though CO_2 emissions are rising ever more rapidly.*

Red flag 18: The derivation of the carbon dioxide graph is more fully explained in the technical paper annexed at Flag 1. Briefly, the data (the thick, dark-blue spline-curve) are taken from the NOAA's deseasonalized global CO_2 concentration anomaly dataset. The NOAA is the parent organization of the NCDC, of which Mr. Karl is the Director. The thick pale-blue line beneath the spline-curve is the least-squares linear-regression trend on the data. It is visible that the trend-line is almost coincident with the data, showing CO_2 increasing not exponentially but merely linearly, well below the IPCC's prediction.

The pale blue region, bounded by exponential curves that appear at the above resolution to be close to linear, is the IPCC's projected range for CO_2 concentration increase over the seven-year period, based on its "business-as-usual" scenario A2. Extrapolating the present trend to 2100 yields the following graph –

The fast, exponential CO_2 growth predicted by the IPCC is not occurring



Observed CO_2 growth between 2000 and 2100 is linear, and is also well below the now-visibly-exponential growth curves (bounding the pale blue region) predicted by the IPCC in its 2007 report. If CO_2 continues on its present path throughout the 21st century, the IPCC's projections for anthropogenic temperature increase to the year 2100 must be halved.

Red flag 19: Mr. Karl, on being asked by the Committee to comment on the graph showing that CO_2 concentration had increased at a rate well below the least of the IPCC's predictions, responded to the effect that CO_2 emissions had been rising at a rate well above the greatest of the IPCC's predictions.

Yet it is settled science that it is not the *emissions* but the *concentration* in the atmosphere that determine the influence of CO_2 over temperature. The IPCC admits, in its 2001 report, that it cannot add up what is known as the "carbon budget" to within a factor of two of the right answer. According to the IPCC's estimates, atmospheric CO_2 concentration should be increasing by 4.1 parts per million by volume per year, but in the real world the rate of increase is less than half of that value, at just over 2 ppmv/year.

This very large and admitted discrepancy between prediction and reality is of great significance. On its own, it requires that all of the IPCC's predictions of the anthropogenic increase in temperature between 2000 and 2100 must be almost halved.

The IPCC's central estimate, on the "business-as-usual" scenario A2, is that the CO_2 concentration in 2100 will be 836 ppmv, implying a warming of 6 F° over the century, or 7 F° to equilibrium. On the current, near-linear trend, however, CO_2 concentration will be 575 ppmv, implying a warming of little more than 3 F°/century, or 3.5 F° to equilibrium. A warming of 3.5 F° would be harmless and beneficial.

The IPCC ought not to have had any difficulty in predicting the future path of CO_2 *emissions:* the Chinese Statistical Office, for instance, has made no secret of the very rapid rate at which the regime plans to open new coal-fired power-plants in the coming decade.

China is now the world's largest emitter of CO_2. She has sternly, absolutely, and rightly, refused to make any reduction in emissions below the *per-capita* emissions of the West. Paradoxically, to stabilize CO_2 emissions (even if stabilization were necessary), fossil-fueled growth is essential: for it is well established among demographers that the only reliable way of stabilizing population growth is to raise the general standard of living above the poverty-line. The fastest way to raise living standards is to burn fossil fuels.

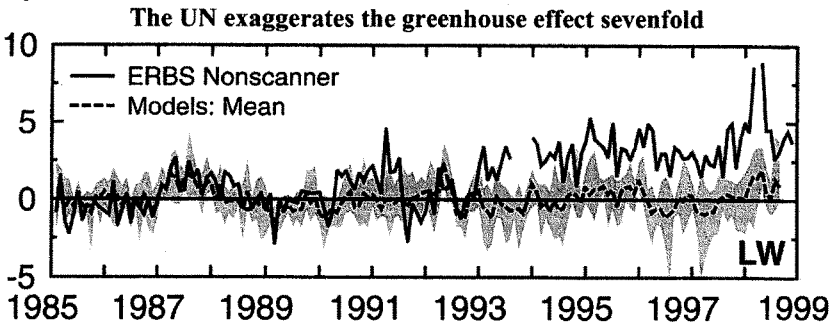
While population continues to grow, as it does in the poorest nations, CO_2 emissions will perforce grow with it. Stabilization of emissions cannot realistically begin until poverty has been eradicated by as much CO_2 emission as may be necessary, thereby making stabilization of the world population possible.

Whatever may be the opinions of Western politicians about the brutality and lack of democracy in China, it is imperative that we should do nothing to impede the economic growth of China: for without economic growth, her population will not stabilize. Even the often savage enforcement of the "one-child" policy has been insufficient to prevent a rapid and continuing growth in China's population.

It is only prosperity that will allow population stability. Therefore, it is essential that no Western nation or bloc should interfere with free trade by attempting to impose tariffs on goods made in China, India, Indonesia, Brazil, Russia, or other third-world countries now hoping to enjoy something of the prosperity that we have long been fortunate enough to take for granted.

Is the UN exaggerating the greenhouse effect sevenfold?

Red flag 20: In my testimony, I included a graph demonstrating that the diminution over time in outgoing long-wave radiation from the Earth's surface, as measured by the Earth Radiation Budget Experiment Satellite, was approximately one-seventh of that which the IPCC's computer models had been instructed to predict –



***Smoking gun:** 14 years' **model-predicted (black)** and **ERBE satellite-observed (red)** change in outgoing long-wave radiation. Seven times as much long-wave radiation as the models predict continues to escape to space. Data were tuned to coincide from 1985-1990 so as to show any divergence thereafter. The data closely track changes in global mean surface temperature. **Source:** Wielicki et al. (2002). See also Chou (1994); Covey (1995); Chen et al. (2002); Del Genio & Kovari (2002); Lin et al. (2002); Cess & Udelhofen (2003); Chou & Lindzen (2004); Hatzidimitriou et al. (2004); Clement & Soden (2005).*

The behavior of outgoing long-wave radiation over time is of fundamental importance. Measurement of changes over time in outgoing long-wave radiation provides a direct method of measuring climate sensitivity – i.e. the change in global mean surface temperature in response to a given proportionate increase in atmospheric CO_2 concentration.

As the world warms, whether by natural or by anthropogenic influences, conventional theory holds that positive temperature feedbacks, such as a near-exponential increase in the carrying capacity of the space occupied by the atmosphere for water vapor, will interfere with outgoing long-wave radiation over time at a rate sufficient to retain some of the radiation in the atmosphere, causing it to warm at a predictable rate.

However – and this is crucial – the satellite-measured diminution in outgoing long-wave radiation over time is one-seventh to one-tenth of the diminution predicted by the UN's climate models.

This very substantial discrepancy between prediction and observation – approximately an order of denary magnitude – implies an equally substantial overstatement of temperature response to anthropogenic CO_2 enrichment, because the "blanket" of CO_2, water vapor, and other heteroatomic gases is not thickening as fast as the models assume, or is not as effective in causing warming as the models predict, or both.

Covey (1995), basing his conclusions on data from Chou (1994), concludes that the discrepancy between model-predicted and actually-observed outgoing long-wave radiation implies outgoing long-wave radiation "an order of magnitude [i.e. 10 times] larger than that obtained in the earlier [model-based] studies." Covey concludes –

> "On its face, this implies a climate sensitivity an order of magnitude [i.e. 10 times] smaller than conventional wisdom would claim, especially in the tropics."

Covey's result and Wielicki's result are broadly consistent with one another, and with many other similar results reported in the literature over the past 20 years. Yet Mr. Karl, asked to comment on the Wielicki graph, merely commented that orbital degradation had caused the difference between prediction and observation in the graph.

How, then, can the models relied upon by the UN have come to so very large an exaggeration of the warming effect of additional atmospheric CO_2 concentration? It is very likely that the exaggeration is inadvertent.

The central question in the climate debate is this. How much warming will a given proportionate increase in CO_2 concentration cause? This "climate sensitivity" question is central because if – as I shall show – the warming is very small, then there cannot be and will not be any "climate crisis", none of the disasters imagined in official circles will occur, and the childishly Messianic millenarianism of the more excitable and less scientifically-literate politicians and journalists will have been proven unfounded.

Red flag 21: Arrhenius (1906) estimated 1.6 C° of warming at CO_2 doubling, down from 5 C° in his paper of 1896; however, Al Gore, Sir David King and others cite only the 1896 paper.

Red flag 22: Hansen (1988) estimated 4.2 C° of warming at CO_2 doubling; IPCC (1995) 3.8 C°; IPCC (2001) 3.5 C°; and IPCC (2007) 3.26 ± 0.69 C°. There is plainly no "consensus" as to the magnitude of the effect of CO_2 on temperature (for the IPCC does not even agree with itself), and if there is no consensus on climate sensitivity then there can be no consensus on anything else. Also, the UN's "official" estimates of climate sensitivity – the temperature response to doubling CO_2 concentration – are inexorably falling. How much further must they fall before they start to conform both to scientific theory and to satellite-observed reality?

The UN calculates greenhouse-enrichment-induced temperature change over time as the product of four parameters –

- **the radiative forcing,** which is the extra energy at the top of the atmosphere caused by atmospheric enrichment with a greenhouse gas such as CO_2;
- **the Planck parameter,** which converts the tropopausal radiative forcing to surface temperature change in the absence of feedbacks;
- **the temperature-feedback multiplier,** which amplifies the initial warming in response to net-positive temperature feedbacks; and
- **the natural logarithm of the proportionate increase in CO_2 concentration.**

The relation is logarithmic because each additional CO_2 molecule has less effect on temperature than its predecessors, and – beyond 915 ppmv – it has practically no effect on temperature at all (Myrhe *et al.*, 1998, hold that the logarithmic formula fails at this point).

Red flag 23: It is at once apparent that even a very small exaggeration in the value of each of the four key parameters will cause a very large exaggeration when the four parameters are multiplied together to give the UN's projection of anthropogenic temperature change over time. For instance, even if each of the four parameters is exaggerated by as little as one-third, once the four parameters are multiplied together the projected temperature change will appear to be $(4/3)^4 = 3.16$, or more than thrice what it should be.

However, as I shall demonstrate, the UN has, on average, approximately *doubled* the value of each of the four parameters. That is, when they are multiplied together, the UN's projection of temperature increase to 2100 becomes approximately $2^4 = 16$ times too great. It is this central exaggeration on which all of the UN's excitable conclusions about the impacts of anthropogenic "global warming" absolutely depend.

Yet the vast majority of the scientists who wrote and reviewed the UN's climate reports are unaware of these exaggerations, and unaware that it is the multiplication together of four separate exaggerations that causes the very large overestimates of anthropogenic temperature change over the present century which repeated satellite measurements of changes in outgoing long-wave radiation have demonstrated, and without which the UN's entire case for alarm about our effect on the climate falls away.

Red flag 24: Most scientists are unaware of the magnitude of the UN's exaggeration, because the UN's treatment of the central question of climate sensitivity is obscurantist in the extreme. Consideration of the four key parameters is scattered untidily through several separate chapters of each report: yet the chapters are written and reviewed by different groups of scientists. At no point are the four parameters and the relationships between them drawn explicitly and clearly together.

Some of the parameters are not explicitly quantified. The question of climate sensitivity ought to be the first question dealt with in each major, quinquennial UN climate assessment: however, the topic is neither explicitly nor completely dealt with either in the 2001 or in the 2007 report. Readers of these reports are apparently expected to take the UN's calculations in relation to this central question purely on trust.

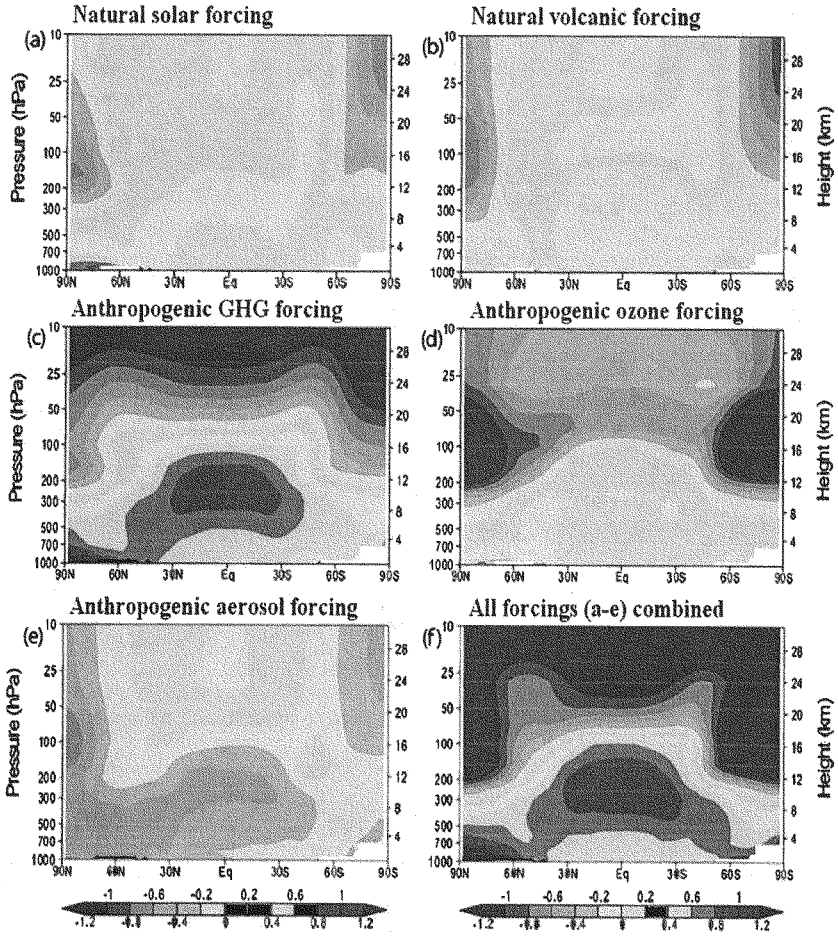
Often, the values selected by the UN exceed those in the very small number of papers that it cites as justification. These are some of the reasons why no one has noticed the large – and perhaps accidental – exaggeration that has demonstrably resulted from the UN's methodology.

As we have already seen, the UN's projection of the rate at which CO_2 accumulates in the atmosphere leads to an unwarrantable near-doubling of its estimate of temperature increase over the present century.

The three other parameters I have mentioned – radiative forcing, the Planck parameter and the feedback factor – are similarly exaggerated, as I shall now show.

The radiative forcing: The UN predicts a distinctive fingerprint of anthropogenic greenhouse warming – a "hot-spot" in the tropical upper troposphere (IPCC, 2007) –

Temperature fingerprints of five forcings, and of all five combined

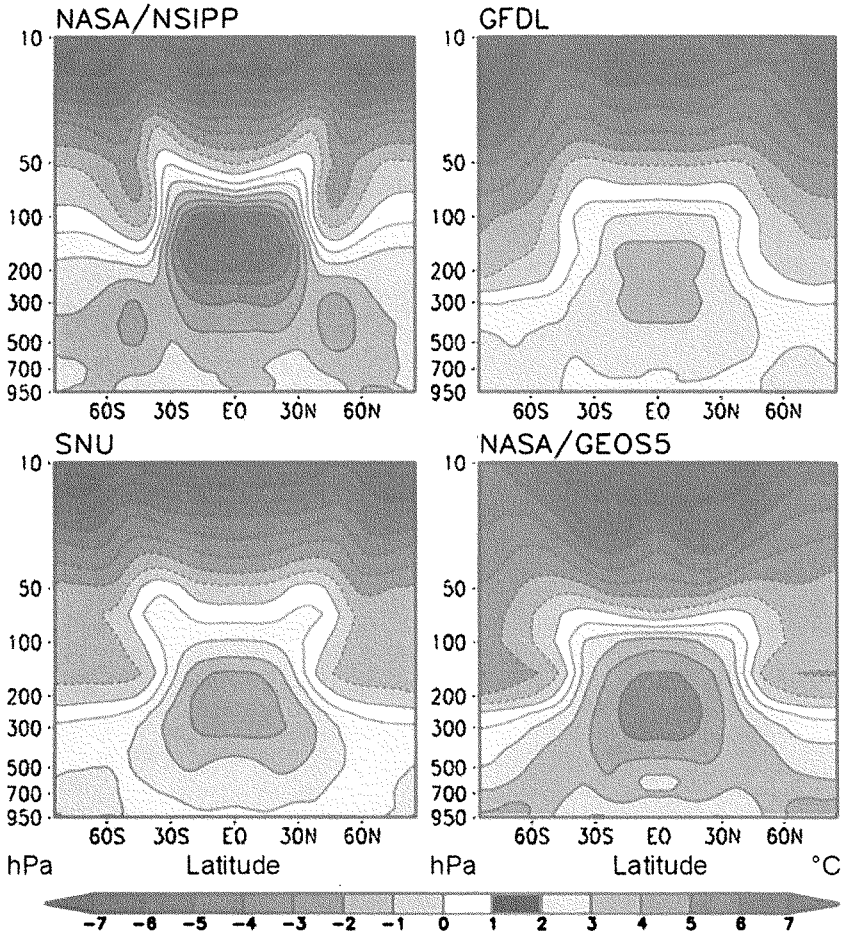


Modelled zonal mean atmospheric temperature change (C°/century, 1890-1999) from five distinct forcings (a-e), and from all forcings combined (f). Altitude is in hPa (left scale) and km (right scale) vs. latitude (abscissa). ***Source:*** *IPCC (2007).*

All of the models on which the UN relies predict that most of the atmospheric warming that arises from greenhouse-gas enrichment of the atmosphere will occur about six miles up in the tropical upper troposphere.

At that altitude, the warming rate is predicted to be 2-3 times that observed at the tropical surface (Lee *et al.,* 2007) –

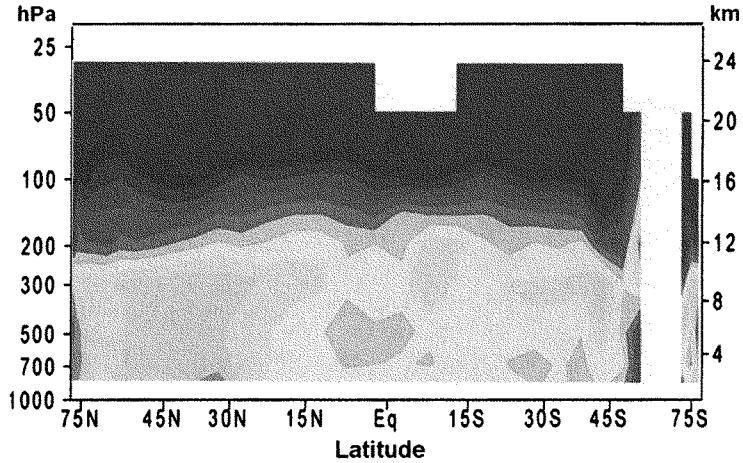
Fingerprints of anthropogenic warming projected by four UN models



Zonal mean equilibrium temperature change (°C) at CO_2 doubling (2x CO_2 – control), as a function of latitude and pressure (hPa) for 4 general-circulation models. All show the projected fingerprint of anthropogenic greenhouse-gas warming: the tropical mid-troposphere "hot-spot" is projected to warm at twice or even thrice the surface rate. ***Source:*** *Lee et al. (2007).*

Red flag 25: Four of the UN's computer models, shown above, predict the "hot-spot's" presence. However, the model-predicted tropical upper-troposphere "hot-spot" does not occur in reality, as Figure 8 shows. It has not been observed in 50 years of radiosonde and drop-sonde measurements. It has not been observed in 30 years of satellite observations. It has not been observed at all. It is not there (HadAT, 2006) –

The absent fingerprint of anthropogenic greenhouse warming



Altitude-vs.-latitude plot of observed relative warming rates in the satellite era. The greater rate of warming in the tropical mid-troposphere that is projected by general-circulation models is absent in this and all other observational datasets, whether satellite or radiosonde. Altitude units are hPa (left) and km (right). ***Source:*** *Hadley Centre for Forecasting (HadAT, 2006).*

In a lecture given in 2008, Professor Lindzen concluded from the absence of the "hot-spot" that –

> "... A doubling of CO_2 leads to surface warming of from about 1.5-3.5 C. By contrast, the observed warming over the past century or so amounts to only about 0.6-0.8 C (not all of which need be due to increased greenhouse gases). ... Using basic theory, modelling results and observations, we can reasonably bound the anthropogenic contributions to surface warming since 1979 to a third of the observed warming, leading to a climate sensitivity too small to offer any significant measure of alarm ...".

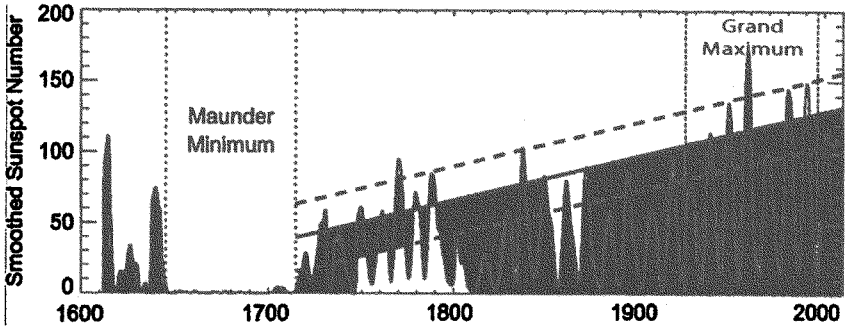
Red flag 26: In short, the absence of the model-predicted "hot-spot" requires us to divide the UN's climate-sensitivity estimates by *at least 3*. Lindzen's result is in line with that of Scafetta & West (2008), who attribute more than two-thirds of the past half-century's "global warming" to the Sun.

Red flag 27: The UN does not consider solar changes to be significant, and has recently reduced its estimate of the solar forcing since 1750. However, it has long been established that a strong and inferentially causative link between variations in sunspot activity and in surface temperature exists.

For instance, it is well known that, during the 70-year Maunder Minimum or Grand Minimum from 1645 to 1715, during which there were fewer sunspots than at any previous period in the past 10,000 years (Hathaway, 2004), the rivers Thames and Hudson regularly froze over for long periods during the winter. Often the freezing was sufficiently intense to allow frost-fairs to be held on the ice. The UN's value for the solar radiative forcing, however, is so low that its reports are unable to provide any explanation of the intense cold that obtained during the Grand Minimum.

From the Maunder Minimum to the 70-year Grand Maximum from 1925 to 1995, during which there was more solar activity than at almost any previous period in the past 11,400 years (Solanki *et al.*, 2005), solar activity as measured by the number of sunspots visible during the maximum of each 11-year solar cycle showed a steady increase –

From Grand Minimum to Grand Maximum, solar activity has increased



It's the Sun, stupid! As solar activity increased over the past 300 years from the 10,000-year low of the Grand Minimum to the 11,400-year high of the Grand Maximum that ended with the 20th century, global temperatures also increased by 0.5-0.7 C°/century (Akasofu, 2008, private communication). During the decades following the peak of the solar Grand Maximum, warming was also observed on Mars, on Jupiter, on Neptune's largest moon, and even on distant Pluto. ***Diagram source:*** *Hathaway, 2004, with the author's added indication of the Grand Maximum.*

Red flag 28: The Planck parameter: The UN also exaggerates the Planck parameter by at least one-third, because it incorrectly takes temperature and radiant-energy values from planetary emitting surfaces six miles apart, effectively repealing the fundamental equation of radiative transfer. Also, the UN fails to make any allowance for diurnal and latitudinal variations, which, according to a private communication from Dr. David Evans, require a further 10% reduction in the value of the Planck parameter.

Red flag 29: The temperature-feedback multiplier: Finally, the UN exaggerates the feedback multiplier. It assumes that feedbacks, which we explained earlier, amplify the original forcing more than threefold. However, it underestimates the cooling effect of evaporation in calculating the water-vapour feedback (Wentz *et al.*, 2007); it fails to notice that relative humidity in the upper troposphere is low, greatly reducing the water-vapour feedback and possibly rendering it negative (Paltridge *et al.*, 2009), and it regards the cloud feedback as strongly positive when it should be net-negative (Spencer, 2007). These three considerations alone suggest that the UN has at least doubled the true value of the feedback multiplier. If the UN's stated maximum values for temperature feedbacks were right, the Earth would suffer from a "runaway greenhouse effect" that has self-evidently not occurred.

Red flag 30: Correcting for the UN's exaggerations of each of the four key parameters reduces climate sensitivity from 3.26 C to little more than 0.25 C by 2100, and near-certainly less than 1 C (Chylek, 2008; Lindzen, 2007; Monckton, 2008; Schwartz, 2007; etc., etc.). It is probably fair to say that the majority of the tiny fraction of papers on the climate that take the trouble to focus on this central question of climate sensitivity find it to be very substantially below the UN's wide but prodigiously-exaggerated range of estimates.

The theoretical considerations that I have briefly outlined support the satellite observations indicating that the UN has very substantially overestimated the effect of anthropogenic CO_2 enrichment on global mean surface temperature. For a more explicitly mathematical and physical treatment of climate sensitivity, see Monckton (2008).

I have now justified the three graphs that were displayed in my testimony before the Committee. I was also specifically asked to justify my assertion that the Accumulated Cyclone Energy Index has recently recorded its least value in the 30-year record, indicating not an increase but a decline in the combined frequency, duration, and intensity of hurricanes, typhoons, and tropical cyclones.

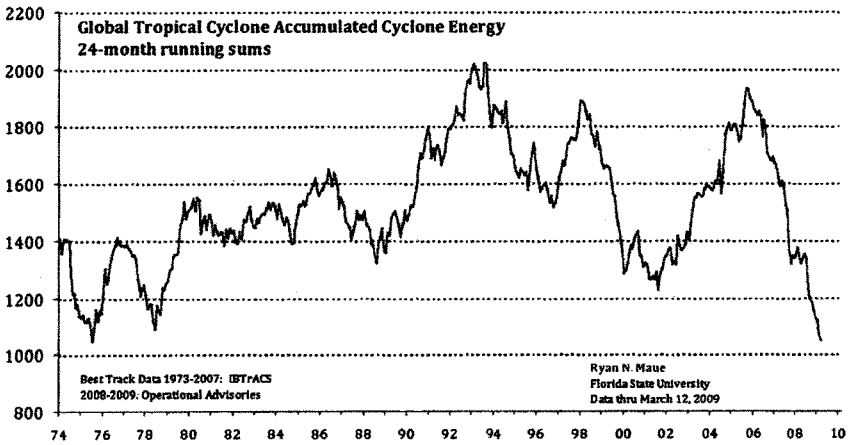
Are hurricanes, typhoons, and tropical cyclones declining?

The Committee asked Mr. Karl and me to comment on whether hurricanes were increasing or declining.

Red flag 31: Mr. Karl said that there had been an increase in the number of intense tropical storms in the Atlantic over the past 150 years. However, even if that had been the case, humankind cannot have been responsible for the warming that occurred during the first 120 of those 150 years. Furthermore, as I established *supra,* the rate of warming during the 23 years 1975-1998 (when "global warming" ceased) was exactly the same as the rate of warming during the 20 years 1860-1880 and the 30 years 1910-1940. During the earlier two periods, humankind could not have had any appreciable warming effect on the climate. Therefore, even if a mere warming were sufficient to engender more frequent or more intense hurricanes and other tropical storms, humankind has had very little to do with it.

My response to the Committee's question was to cite the Accumulated Cyclone Energy Index, which is usually presented as a two-year running sum combining the frequency, duration, and intensity of all hurricanes, typhoons, and tropical cyclones around the globe. I am grateful to Ryan Maue of Florida State University for his recent graph demonstrating that the two-year running sum of the Accumulated Cyclone Energy Index is currently standing at its least value in a third of a century, indicating an exceptionally *low* level of hurricane and tropical storm activity –

Global tropical cyclone energy stands at its lowest for 33 years



Hurricanes hardly happen: *The Accumulated Cyclone Energy Index is now at its least value in a third of a century, indicating that "global warming" over the same period has not led to the increase in hurricanes and other severe tropical storms that had been widely but baselessly predicted.*

A forthcoming paper by Paul Maynard and me for the *Journal of the Chartered Insurance Institute of London* will show that insured financial losses attributable to hurricanes, when adjusted not only for inflation but also for the very substantial growth of the population and infrastructure in harm's way, show – if anything – a falling trend throughout the 20th century.

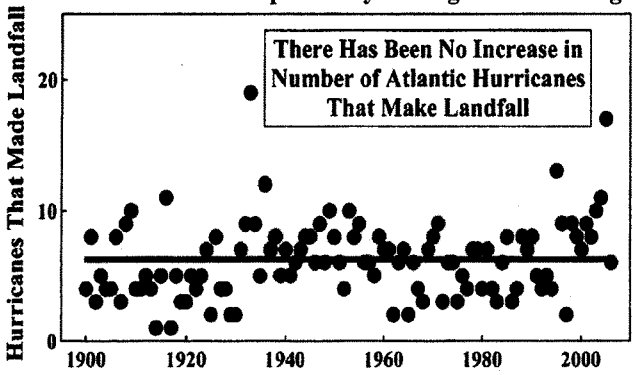
Red Flag 32: During a break in the proceedings during which Congressmen were compelled to leave to attend to other business of the House, Mr. Karl told me he was surprised at my mentioning the Accumulated Cyclone Energy Index. I responded that there had been no trend in the frequency of

landfalling Atlantic hurricanes for at least a century, broadly confirming and extending the result demonstrated in Ryan Maue's graph *supra*. Mr. Karl protested that this was not the case, and showed me a graph which plotted not only the frequency of landfalling Atlantic hurricanes over 150 years but also the frequency of severe Atlantic tropical storms. I pointed out – and Mr. Karl was compelled to concede – that his own graph showed that, as I had said, there had indeed been no trend in the frequency of landfalling Atlantic hurricanes over the entire 150-year period of his graph.

Mr. Karl then said that, nevertheless, the number of intense Atlantic storms had increased markedly over the 150-year period. I pointed out that during the first 120 years there had been no satellites, so it had not been possible to count most of the Atlantic storms. The data for landfalling hurricanes were reliable throughout the period because one did not need a satellite to discern whether the coastline had been struck by a hurricane.

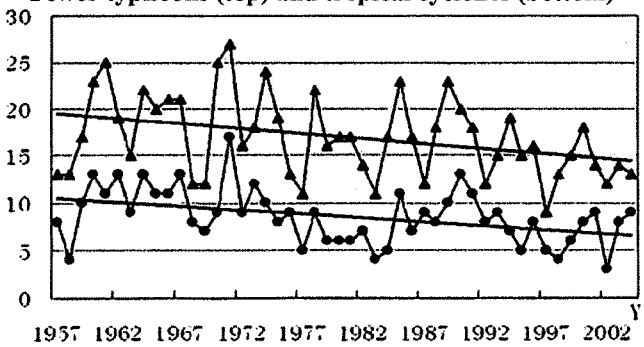
Red flag 33: The following graphs – some based on data from the NCDC, of which Mr. Karl is the Director, demonstrate that, despite frequently-repeated claims that "global warming" has been making tropical storms more frequent or more intense, if anything the warmer weather has resulted in fewer and less intense storms, in part because the temperature differentials that cause storms diminish with warming –

No hurricane trend despite 100 years' 'global warming'



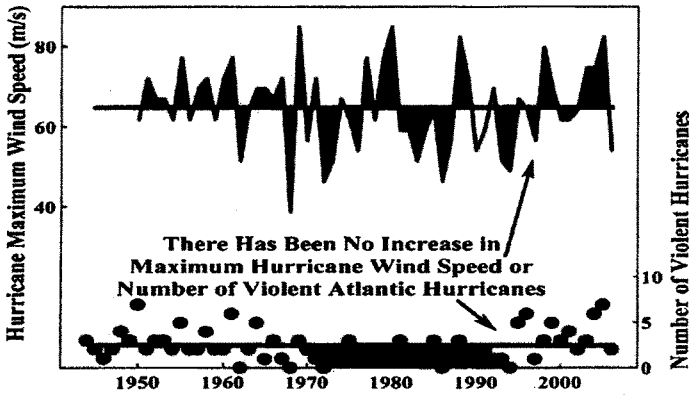
Source: Landsea (2007)

Fewer typhoons (top) and tropical cyclones (bottom)



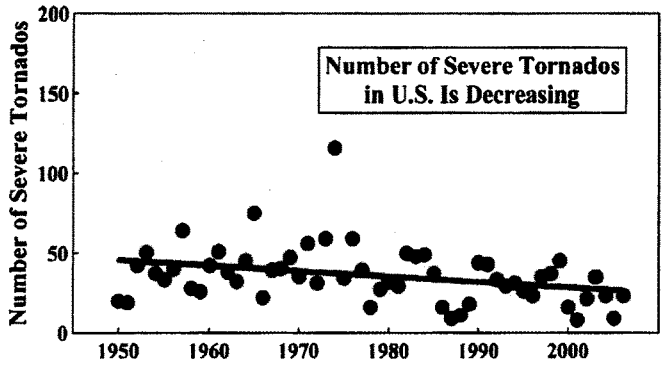
Source: Ren et al. (2006)

No increase in high wind-speed or violent hurricanes



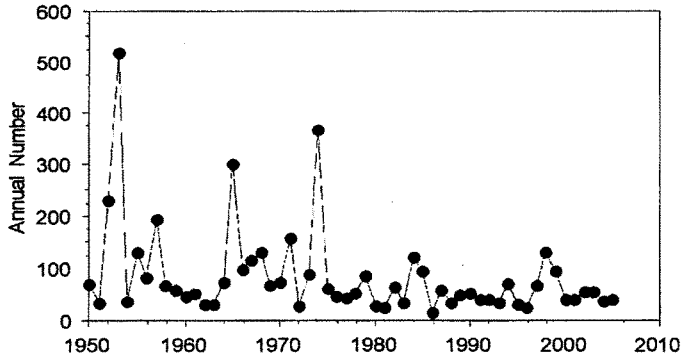
Source: Robinson, Robinson & Soon (2007)

Fewer severe tornadoes in the US



Source: NCDC Climate Review (2006)

Fewer deaths from tornadoes in the US



Source: NCDC Climate Review (2006)

The Committee's further concerns about the impacts of "global warming"

During the hearing, I noted some of the principal concerns about the impacts of "global warming" that were raised by Hon. Members of the Committee. I shall address these concerns. First, it should be self-evident that if, as the theory suggests and the satellite data demonstrate, the amount of warming to be expected as a result of atmospheric CO_2 enrichment is approximately an order of magnitude less than the UN's models predict, none of the disasters, catastrophes, cataclysms, and Apocalypses luridly specified by Mr. Karl and imagined by some Hon. Members will come to pass.

Red flag 34: Schulte (2008), in a review of 539 papers published since January 2004 and containing the search term "global climate change" found that not one paper offered any evidence to the effect that "global warming" would prove to be "catastrophic" in any particular. That is the true scientific consensus. Yet the scientific-technological elite continues to tell politicians that catastrophe is just around the corner.

Chairman Markey said that "global warming" was "getting worse". Since there has been global cooling for seven years, definitively established by all four of the principal global-temperature datasets both individually and collectively, that proposition is erroneous. Furthermore, though *emissions* of carbon dioxide are greater than the UN had predicted, the growth in CO_2 *concentration* is well below the least of the UN's projections.

Red flag 35: Chairman Markey also said that sea level would rise, and would in particular swamp the Maldives. However, in recent years the Maldives have been subjected to a more thorough sea-level analysis than almost anywhere else on Earth, by a talented multi-disciplinary team under Professor Nils-Axel Moerner, the world's ranking expert on sea-level rise, who has written 520 peer-reviewed papers on the subject. The early conclusions of that continuing research, published in 2004, demonstrated that there had been no net sea-level rise in the Maldives for 1250 years. In any event, corals are capable of growing towards the light at ten times the most rapid rate of sea-level rise, which is why it is no mere coincidence that many coral atolls are only a few feet above sea level today, notwithstanding that sea level has risen by 400 feet over the past 10,000 years.

Red flag 36: Sea-level rise is often cited as the most severe consequence of "global warming". In reality, however, sea level is rising at a mere 8-12 in/century, about one-fifth of the mean centennial rate of rise of 4ft/century over the past 10,000 years. There is little sign of acceleration in this rate: indeed, in the past three years there has been no statistically-significant rise in sea level at all (JASON satellite data, 2009).

Red flag 37: Nor is there a shred of evidence that sea level will imminently rise by 20 ft, as suggested by Al Gore in 2005. Gore cannot have believed his own prediction: that year he bought a $4 million apartment in the St. Regis Tower, San Francisco, just feet from the ocean at Fisherman's Wharf. As the London High Court bluntly found in 2007, "The Armageddon scenario that he depicts is not based on any scientific view."

Red flag 38: *A fortiori,* Dr. James Hansen's recent statements that "global warming" will raise sea level by 246 feet may be dismissed as mere rent-seeking rodomontade, tinged with hysteria at the continuing failure of his apocalyptic predictions. Professor Moerner told a recent debate on "global warming" at the University of St. Andrews that "sea level is not an issue". The undergraduates duly rejected a motion that "global warming is a global crisis". The UN has reduced its high-end projection of anthropogenic sea-level rise this century from 3 feet to less than 2 feet, with a central estimate of 17 inches. Moerner (2004) projects a sea-level rise of just 8 inches to 2100, similar to the sea-level rise that was observed in the 20th century.

Certain coastlines may be affected by regional tectonic subduction and other factors that cause the land to subside. These coastlines include that of Chesapeake Bay and of Louisiana. It is important, therefore, to

distinguish carefully between components of sea-level rise – the component that arises from the long-run natural warming trend, the very much lesser component that arises from anthropogenic "global warming" even if the UN's exaggerated climate-sensitivity estimates are correct, and the regionally substantial component that may arise from changes in land surface levels. It is neither prudent nor scientifically justifiable merely to ascribe every encroachment by the sea on to the land to "global warming".

Representative Markey also mentioned the imagined threat from hurricanes. As I have established *supra,* the threat posed by hurricanes occurring more frequently because of "global warming" is more imagined than real.

Representative Upton said "climate change" was a "global problem" that required a "global solution". Climate has always changed, and will continue to do so. Anthropogenic climate change, however, is a non-problem that requires no solution.

Red flag 39: A Representative from Michigan expressed concern about "extinctions". More than 99% of all species that have ever lived became extinct through natural processes long before humankind ever walked the Earth. No one knows how many species there are, even to within three orders of magnitude. No one knows at what rate new species are coming into being, or at what rate old species are dying out. However, it is known that most species on Earth live in the tropics, where it is warm, and fewer than 1% live at the poles, where it is cold. It is cold, not warmth, that causes extinctions. The planet has been 12.5 F° warmer than the present for almost the whole of the past 600 million years: yet we are here. Even if the warming projected by the UN were actually to occur (which it will not, or at any rate not by any human agency), it would be entirely within the natural variability of the climate over the past 10,000 years. The notion of mass extinctions arising from "global warming" is a baseless fantasy.

Representative Shimkus rightly pointed out that the Earth, compared with almost all of the past 600 million years, is currently "carbon-starved". Almost throughout the period since the Cambrian era, atmospheric carbon dioxide concentration has been at least twice what it is today, and has on occasion been 20 times what it is today. It is worth putting the anthropogenic increase in carbon dioxide concentration into perspective. The proportion of the atmosphere occupied by carbon dioxide has increased by just one part in 10,000 in the quarter of a millennium since 1750. That is all.

Red flag 40: A Representative from California spoke of floods and droughts. Once again, it is prudent not to attribute every natural disaster to "global warming": indeed, it has been pointed out repeatedly by the IPCC that it is not possible to attribute *any* particular natural disaster to "global warming". The droughts of the American Great Plains in the early part of the 20th century were far worse than anything that has been seen since: one has only to read John Steinbeck's *The Grapes of Wrath* to appreciate how harsh conditions were then. Likewise, flooding such as the recent floods on the Red River has had many precedents early in the 20th century. Such extreme events are no more common than they were, but they affect more people as population and infrastructure grows, and there is greater awareness of them thanks to the instant television reporting that is available today. It is all too easy to confuse matters and assume that a greater awareness of widely-reported natural disasters indicates that their frequency or severity has increased, when if anything it has diminished.

Red flag 41: A second Representative from California said that infectious diseases would spread because of "global warming". However, as Professor Paul Reiter of the Institut Pasteur has repeatedly pointed out, most of the diseases that are described as "tropical" occur in the tropics solely because bad government and poor public health measures facilitate transmission. To take one example: the *anopheles* mosquito that carries the *plasmodium* parasite that causes malaria requires a minimum temperature of 60 °F during its short breeding season, but is otherwise well capable of surviving Arctic temperatures. The largest outbreak of malaria in modern times occurred in the 1920s in Siberia, not noted for its tropical climate. Some 13 million people were infected; 600,000 died; and 30,000 of the deaths occurred in the Arctic sea-port of Arkhangelsk. There is no basis for the frequent assertion that warmer weather will spread tropical diseases.

The principal reason for the 40 million excess malaria deaths that have occurred in the past 40 years was the scientifically-unfounded decision – by precisely the rent-seekers who now cry "Wolf!" about "global warming (the Environmental Defense Fund, the Environmental Protection Agency, for example) – to ban DDT, the only effective agent against the anopheline mosquito. Dr. Arata Kochi, of the World Health Organization, announcing the official end of the DDT ban on 15 September 2006, said that in this field politics usually prevailed, but that the WHO were now going to take a stand on the science and the data, and were going to recommend DDT once again as the front line of defence against malaria.

Red flag 42: The Representative from California also mentioned drought in the Horn of Africa – a region that has long been prone to extreme drought. However, in the past 30 years the Sahara Desert, for instance, has shrunk by 300,000 square kilometers as vegetation has greened what was once a wasteland. Nomadic tribes have been able to return to lands they had not settled within living memory. Regrettably, the news media tend to comment only on the bad news, omitting the good news. This entrenched bias makes it easier for the wolf-criers to spread their false message of climatic alarm.

Red flag 43: A Representative from Louisiana implied that Hurricane Katrina was caused by "global warming". It was in fact no more than a Category 3 hurricane when it made landfall. It did disproportionate damage not because of "global warming" but because of the failure of the local administration to put pressure on the Corps of Engineers to maintain the levees adequately. As noted *supra,* there is no basis for the assumption that "global warming", if and when it resumes, will cause any appreciable increase in the frequency or intensity of tropical storms.

Red flag 44: The Representative from Louisiana also said that sea temperatures were increasing, leading to inundation of the Louisiania coastline. However, in the five years since the elaborate network of 3175 automated bathythermographs of the Argo project were deployed throughout the world's oceans, there has been no statistically-significant rise in sea temperatures and, indeed, if anything there has been a slight fall. Sea temperatures have of course been many degrees warmer than the present for most of the past 600 million years. Inundation of the Louisiana coastline is not occurring because of sea-level rise but because of a regional subsidence of the coastline.

Red flag 45: A Representative from Wisconsin talked of the Red River flood in North Dakota. This flood cannot be attributed to "global warming". Such events occur from time to time. She also mentioned that snowfall had been 40% higher this winter. On any view, the greater snowfall that accompanies a cold winter cannot be reasonably attributed to "global warming".

A Representative from North Carolina said that global temperatures would continue to rise. First, they will have to stop falling. Though it is in general true that enrichment of the atmosphere with any heteroatomic gas such as carbon dioxide will be more likely than not to cause some warming, I have established *supra* that the amount of warming that is likely to occur is an order of magnitude less than the warming imagined by the UN, and is accordingly harmless and beneficial.

Mr. Karl's testimony colourfully listed many imagined disasters arising from "global warming". None of these disasters is likely to arise: for the effect of humankind on the climate is negligible.

Red flag 46: Mr. Schweiger's testimony, on behalf of the National Wildlife Federation, talked of "unchecked" "global warming" (it has been in check for seven years), and said "global warming" was worse than expected (it cannot be, after seven years of global cooling that not one of the UN's models had predicted).

Red flag 47: He also said that polar bears were threatened with extinction (there are five times as many of them as there were in the 1940s, hardly the profile of a species in imminent danger of extinction); that the "precautionary principle" should rule (but the "precautionary principle" must also be applied to the precautions themselves, otherwise disasters like the biofuel scam will kill millions by starvation, a killing

that has already begun); and that there would be the "extinction of a million species" (a figure plucked from the air).

Mr. Waskow's testimony said that reducing disaster risks "saves $4 for every $1 spent". It might, in theory, do so, but only if there is some rational basis for assuming that a given category of disaster might actually occur. However, the influence of carbon dioxide on temperature is so small, as the temperature and long-wave radiation measurements conclusively demonstrate, that planning for "disaster" caused by "global warming" is a waste of time, labor, and taxpayers' money.

Red flag 48: A Representative from California said that glaciers were in recession and that snowpack was in decline. Neither of these statements is in substance true. Most of the world's 160,000+ glaciers are in Antarctica, and are too high in both latitude and altitude to be affected at all by "global warming", particularly since Antarctica has been cooling for half a century (Doran *et al.,* 2002). A recent attempt to demonstrate that the cooling of Antarctica was really a warming was produced by the same scientists who had attempted to abolish the medieval warm period, and by similarly questionable methods. The 9575 glaciers that debouch from the Himalayas into India are following a pattern of advance and recession that shows no significant change in the 200 years since the Raj first kept records (Professor M. I. Bhat, Indian Geological Survey, personal communication, 2007).

Red flag 49: The Furtwangler glacier at the summit of Mt. Kilimanjaro, a poster-child for "global warming" alarmism, has been receding since at least 1880, and half of its ice had disappeared before Hemingway wrote *The Snows of Kilimanjaro* in 1936. In 30 years of satellite monitoring, the temperature at the summit of Kilimanjaro has never risen above −1.6 °C, with a mean of −7 °C (Molg *et al.,* 2003). The glacier has not, therefore, been melting because of "global warming": it has been ablating (passing directly from the solid to the gaseous state of water) because of regional cooling, combined with desiccation of the atmosphere accelerated by imprudent post-colonial deforestation in the region.

Most other mountain glaciers worldwide have been receding since at least 1880 at a near-linear rate, with little or no evidence of recent acceleration in the rate of recession. In the tropical Andes, all but the very highest peaks in the Cordillera de Merida were ice-free throughout most of the past 10,000 years, but there is now more ice than usual (Polissar *et al.,* 2006). In the Alps, recent glacial recession has revealed mountain roads, forests, and even an entire medieval silver-mine that were covered by snow, firn, and eventually ice as the Medieval Warm Period gave place to the Little Ice Age. In Greenland, some glaciers are receding and others are advancing, much as they have since ice began to accumulate there 850,000 years ago. The Viking burial-ground at Hvalsey, the largest medieval settlement on Greenland, is under permafrost today: it was not under permafrost when the Vikings were buried.

Red flag 50: Finally, Representative Inslee, supported by one or two members of his party, said that ocean acidification was becoming a problem and asked me whether I was concerned about it. There is no need for concern: carbon dioxide concentration has been at least 1000 ppmv (compared with <400 ppmv today) for most of the last 600 million years, without ill effects on marine life.

Indeed, the calcite corals first appeared in the Cambrian era, when carbon dioxide concentration was 7000 ppmv (IPCC, 2001); and the more delicate aragonite corals first appeared in the Triassic era, when the concentration was 6500 ppmv (IPCC, 2001). Representative Inslee said the corals had now become accustomed to low concentrations of carbon dioxide and would be unable to adapt to increasing acidification of the oceans. However, he did not adduce any scientific data to back this insupportable assertion.

The biochemistry of bicarbonate ions is such that powerful homoeostatic mechanisms, some of them only recently discovered, prevent acidification of the oceans. Indeed, even the most imaginative models (in the absence of the worldwide monitoring and sampling over time that would be necessary to arrive at a fair empirical result) do not find that the reduction in ocean alkalinity (the ocean remains safely alkaline) is more than about 0.1 acid/base units. Without objection, Representative Inslee agreed that I might enter

into the record a short book written by my distinguished friend Dr. Craig Idso, summarizing the extensive literature that gives the lie to the notion that "ocean acidification" is a real danger. It is not.

Conclusion

The evidence that I have adduced in this letter confirms that the three graphs that I presented in my testimony before the Committee demonstrate what I had said they demonstrated –

- that **global mean surface temperature** has indeed been declining for seven years on all measures, wiping out one-third of the warming that had occurred over the previous 30 years;
- that **atmospheric carbon dioxide concentration** is no longer rising exponentially, as predicted by the UN, but linearly, and at a rate well below the least of the UN's projections, requiring that all of the UN's temperature projections to 2100 be approximately halved; and
- that **the diminution in outgoing long-wave radiation over time** is one-seventh to one-tenth of that which the UN's models predict, demonstrating that the UN has overstated climate sensitivity sevenfold to tenfold, and that it has overstated the projected anthropogenic temperature increase in the 21st century by as much as sixteenfold.

The UN has reached this sixteenfold exaggeration of the effect of rising CO_2 concentration on temperature inadvertently, by doubling the true values of four parameters that are then multiplied together in the models to yield the projected anthropogenic temperature increase to the year 2100.

Without this prodigious and unfortunate exaggeration (and even if *per impossibile* it were to come to pass), not one of the catastrophes imagined by several witnesses and by certain Hon. Members on the Committee will be at all likely to occur.

There was no "climate crisis"; there is no "climate crisis"; there will be no "climate crisis". The right response to the non-problem of "global warming" is to have the courage to do nothing.

You are the guardians of the public purse: do not loose the purse-strings too readily when the scientists cry "Wolf!"

The measures that your Administration currently proposes by way of addressing the non-problem of "global warming" might have been calculated to do maximum damage to the very poorest voters – those who depend upon the taxes of the prosperous for their very survival; those in low-paid jobs in heavy industries that are heavy emitters; those who run the Mom-and-Pop enterprises that are tomorrow's big businesses; those low-income families who pay a disproportionately large proportion of their income to energy providers.

Rightly, one of the Administration's own supporters on your Committee has stated that the principal purpose of "cap-and-trade" is not to "Save The Planet" – which it would not do even if it worked – but to raise revenue. If you wish to raise excessive revenue, be honest about it. Say that you intend to tax and tax and tax again. But desist from claiming that you are raising the revenue with the aim of preventing "climate crisis". Already, every opinion poll demonstrates that, notwithstanding the most lavishly-funded propaganda campaign by the *classe politique* since Goebbels tried to make Nazism look good, the people are not buying the "global warming" scare any more.

Already, millions face death by starvation, not because of "global warming" (for warmer weather saves lives, while cold weather kills), but because of the misplaced fear of "global warming" that a few malicious and ill-intentioned members of the scientific-technological elite have fraudulently engendered, with the acquiescence of a cloud of what Lenin called "useful idiots" among the academic community who have found it expedient to drift along with the scare by not looking too closely at any of the facts.

The facts are what I have given you in this letter. You need not believe a word I say: for every fact I have given you is taken from the peer-reviewed scientific literature or from the plentiful scientific data that are publicly available. Why not verify what I have said – perhaps by the simple expedient of directing some well-targeted questions at the IPCC?

Thus far, you have accepted what it says, either because maintaining that "global warming" is a "global crisis" is politically expedient, congenial, or convenient, or because you are impressed by the IPCC's reputation. The fallacy of reputation – the *argumentum ad verecundiam* – is one of the well-worn, Aristotelian fallacies of logic. No sound conclusion can be founded upon it. Bernie Madoff had a reputation. He was one of the five founders of NASDAQ. Yet the report identifying some 30 red flags in his pattern of trading was ignored for years by the SEC. Why? Because, as the *classe politique* so often does, it fell for the *argumentum ad verecundiam* rather than getting someone to check out the red flags.

You have been fairly and clearly warned that a single penny more spent on "global warming" would be a penny wasted. Your nation faces many formidable economic problems. Economic problems tend to hit the poor harder than the rich. Do not divert any more of your nation's shrinking capital towards the further enrichment of the scientific-technological elite that has exploitatively abused its *verecundia* and your population's ignorance of science for the sake of its own enrichment – an enrichment that is ultimately and chiefly at the expense of the poor.

I am concerned at the very large number of red flags, indicating the need for further investigation to prevent irregularities, inaccuracies, or exaggerations, that have been thrown up by this single Committee hearing. It is right, therefore, that I should warn the Committee in the plainest terms that numerous powerfully-placed rent-seekers among what Eisenhower called "the scientific-technological elite" appear to be systematically and deliberately overstating the minimal consequences of the minimal warming that is likely to occur.

For convenience, I now enumerate the 50 red flags mentioned in this letter. In each case I indicate the question or questions requiring further investigation to which the red-flagged irregularity gives rise. I should make it plain that, in each instance where it appears that a member of the Committee has been misled, I am not asserting or implying that that Hon. Member is in any way guilty of or complicit in any fraud: merely that he or she has been misled by others who may or may not themselves have deliberately intended to mislead the House.

1. Global temperature has been falling rapidly for seven full years: however, this fact appears to have been kept from the Committee, and the director of an agency whose own global-temperature dataset clearly shows the seven-year decline repeatedly failed to admit when questioned by the Committee that there have indeed been seven full years of global cooling, raising the question why, on the central issue of the rate at which "global warming" is or is not occurring, the official was reluctant to admit the seven-year cooling that his own agency's global-temperature dataset plainly shows.
2. The same official sought to maintain that the methods I had used might not be appropriate for demonstrating that there had been seven years' cooling, when in fact all four of the global-temperature datasets that had been combined to generate the dataset plotted in my temperature graph had shown the seven-year cooling, raising the question why the official was reluctant to admit that, on all individual measures and accordingly on all measures combined, global temperature has been falling rapidly for seven years.
3. The global-temperature dataset of the National Climatic Data Center shows global cooling at a rate little more than one-third of that shown by the other three datasets, raising the question whether there is a methodological bias either in the NCDC's dataset or in the other three datasets.
4. The raw GISS temperature data for the Santa Rosa automated temperature reporting station show a century of falling temperatures, while the adjusted data show a century of rising temperatures, at least in part because 70-year-old temperature records have been amended, raising the question why long-established historical temperature data have been altered many decades *ex post facto*.

5. The adjusted global GISS temperature data for 2008, when compared with the adjusted global GISS temperature data for 1999, show that 70-year-old temperature records have been adjusted more substantially in 2008 than in 1999, raising the question whether the data-tampering at individual stations has increased over time, with the intention of making the 20th-century temperature increase appear substantially greater than it was.
6. The senior official who appeared before the Committee said that if the past seven years' cooling had occurred it had occurred partly because of a cooling event, the La Nina phase of the El Nino Southern Oscillation, that had endured for three years, when his own agency's global-temperature dataset showed that it had endured for just six months and no dataset showed it persisting for more than one year, raising the question why the official had overstated the impact of the La Nina cooling event on the global cooling of the past seven years.
7. The same official said that the global cooling of the past seven years, if it had occurred, was a consequence of natural variability in the climate, raising the question why the official did not also say that the warming of the preceding 300 years might also have been attributable to natural variability.
8. The same official said that 13 of the past 14 years had been the warmest on record, but his own agency's record (which dates back only to 1880) shows only 12 of the past 14 years as being the warmest on record, raising the question why the official regarded the cluster of recent warm years as evidence of anthropogenic warming rather than as continuing evidence of the past 300 years' natural warming.
9. A graph relied upon by the UN's climate panel in its 2007 report, and in a recent lecture by the panel's chairman, Dr. Rajendra Pachauri, and by the US Environmental Protection Agency in the Technical Support Document in support of its forthcoming "Endangerment Finding" against carbon dioxide and five other heteroatomic gases, uses the endpoint fallacy, raising the question whether their conclusion that the rate of "global warming" accelerated between 1850 and 2005 is unscientific and improperly motivated.
10. In one of nine serious "errors" identified by a UK High Court Judge in Al Gore's movie *An Inconvenient Truth,* it is suggested that in the palaeoclimate it was CO_2 concentration that changed before global temperature, when in fact it was temperature that changed before CO_2 concentration, raising the question why Congress (and Her Majesty's Government) still treats Gore as though he were a ranking expert on "global warming".
11. The IPCC's 1990 report showed a graph demonstrating that the medieval warm period was warmer than the present, but the 2001 report showed a graph suggesting that the warm period was cooler than the present, raising the question of the extent to which the imagined "consensus" on "global warming" agrees with itself.
12. The IPCC's purported abolition of the medieval warm period depended critically upon proxies for pre-instrumental temperature derived from the width of tree-rings in bristlecone pines, previously stated by the IPCC to be unsuitable because the tree-rings widen not only when it is warmer but also when it is moister and particularly when there is more carbon dioxide in the atmosphere, raising the question why the IPCC chose to accord to a graph based on a methodology that it had previously found unsound the unique privilege of being reproduced six times at full scale and in full color in its 2001 report.
13. For many years the compilers of the defective graph on which the UN relied refused outright to part with their computer programs or data, raising the questions whether they did not wish their data or methods to be scrutinized by other scientists, and whether it should be a precondition of taxpayer-funded research grants that all methods, programs and data are made publicly available at the time of publication.
14. A proxy data series that appeared to indicate that the present was warmer than any previous period in the past 600 years was given 390 times the weight of a data series that appeared to show the medieval warm period was warmer than the present, raising the question whether the two data series were objectively weighted.
15. The computer program that calculated the graph relied upon by the IPCC in its 2001 report generated graphs indicating that the present is warmer than any previous period in the past 600 years, even when random red noise rather than genuine proxy temperature data was input to the

program, raising the question whether the program had been tuned to bias the results so as to overemphasize the comparative magnitude of recent warming.

16. The US Environmental Protection Agency, in the Technical Support Document underlying its "Endangerment Finding" in respect of CO2 and five other heteroatomic gases, will rely upon a graph showing four datasets from papers by the authors of the proven-defective 600-year northern-hemisphere temperature graph that appeared in the IPCC's 2001 report, and those authors' associates, to show that the medieval warm period was not as warm as the present, raising the question why the EPA has chosen to overlook papers over the past 25 years by at least 670 scientists from 391 institutions in 40 countries confirming the historical record to the effect that the medieval warm period was real, global, and warmer than the present.
17. The Wegman report commissioned for the House noted a suspicious spate of papers apparently confirming the results of the authors of the defective graph that purported to abolish the medieval warm period, raising the questions why almost all of the papers were at odds with the established literature on the temperatures prevalent over the past 600 years, and why almost all of the papers were written by associates of the authors of the defective graph.
18. For fully seven years the increase in atmospheric carbon dioxide concentration has been linear and not (as predicted) exponential, and has been well below the least of the IPCC's predictions for the "business-as-usual" scenario A2, raising the questions why the IPCC cannot (as it admits) add up the atmospheric "carbon budget" to within a factor of two, and why its prediction of this central quantity is so greatly exaggerated.
19. The senior official who testified before the Committee, commenting on the graph showing CO_2 concentration rising at well below the least of the IPCC's predictions, said that CO_2 emissions were rising at well above the greatest of the IPCC's predictions, raising the question why he did not admit that it is the *concentrations* of CO_2 remaining in the atmosphere, not the *emissions,* that influence global temperature.
20. Satellite observation demonstrates that the diminution over time in outgoing long-wave radiation from the Earth's surface is one-seventh to one-tenth of what the models relied upon by the IPCC predict, raising the questions whether global-temperature response to atmospheric enrichment with carbon dioxide has been overstated sevenfold to tenfold, and why the senior official who testified before the Committee attributed the observational results merely to orbital degradation of the satellites.
21. A paper by Svante Arrhenius (1896), in which it is concluded that in response to a doubling of atmospheric carbon dioxide concentration global temperature will increase by some 5 Celsius degrees (9 Fahrenheit degrees), is frequently cited by Al Gore, Sir David King, and other supporters of the "official" position on "global warming", raising the question why they do not also cite Arrhenius' reconsideration of the matter in a paper of 1906, in which – after the Stefan-Boltzmann radiative-transfer equation had become available to him and had enabled a considerable simplification of the calculation – he concluded that temperature response would be not 5 Celsius degrees but just 1.6 Celsius degrees (2.9 Fahrenheit degrees).
22. The IPCC's central estimate of temperature response to doubling carbon dioxide concentration was 3.8 Celsius degrees in 1995; 3.5 in 2001; and 3.26 in 2007, raising the questions whether the "consensus" on this central issue agrees with itself, and how much further the central estimate of climate sensitivity must fall before it accords with both theory and observation.
23. The IPCC's method of calculating temperature increase in response to a given proportionate increase in atmospheric carbon dioxide concentration involves multiplying together four quantities not one of which can be definitively established either by theory or by observation and experiment, raising the question whether small overstatements of the values of each of the four quantities on the part of the IPCC have led to a large exaggeration of the temperature response to atmospheric enrichment with carbon dioxide.
24. Though climate sensitivity is the central issue in the debate over the magnitude of the supposed influence of humankind over the climate, the IPCC's 2001 and 2007 reports do not deal with it at the outset, and its consideration of the four key parameters whose product is anthropogenic temperature increase is scattered among different chapters or sub-chapters written by different authors, raising the questions whether the obscurantism in the IPCC's treatment of this central

issue is deliberate, and whether any of the individual contributors to or reviewers of the IPCC's climate assessment reports realize how prone the IPCC's methodology is to very large exaggerations of climate sensitivity.

25. The models relied upon by the IPCC predict that the warming rate in the tropical mid-troposphere will be thrice the surface warming rate, raising the question why the predicted differential in warming rates has never been observed in 50 years of radiosonde and drop-sonde measurements and in 30 years of satellite observations.
26. The absence of the model-predicted tropical upper-troposphere "hot-spot" requires climate sensitivity to be divided by at least 3, raising the question whether the IPCC has greatly exaggerated the radiative forcing that is thought to arise from atmospheric enrichment with heteroatomic gases such as carbon dioxide.
27. Between the 70-year solar Grand Minimum of 1645-1715, when the Sun was less active than for 10,000 years, and the 70-year solar Grand Maximum of 1925-1995, when the Sun was at least as active as it had been for 11,400 years, solar activity increased rapidly, raising the question whether the IPCC has underestimated the influence of the Sun in causing the 300 years' warming that ended in 1998.
28. The IPCC uses a value for the Planck parameter that is higher than any other in the mainstream scientific literature, raising the question whether it is justified in repealing the fundamental equation of radiative transfer by taking the temperature and radiant-energy inputs to the Planck parameter from planetary emitting surfaces six miles apart.
29. The IPCC imagines that temperature feedbacks more than triple the radiative forcing from atmospheric enrichment with heteroatomic gases, raising the question whether it has overstated the values of certain feedbacks, particularly the water-vapor feedback and the cloud-albedo feedback.
30. The apparent exaggeration by the IPCC of all four of the parameters whose product is anthropogenic temperature increase raises the question whether it has exaggerated that temperature increase as much as sixteenfold.
31. The senior official who testified before the Committee said there had been an increase in the number of tropical storms in the Atlantic over the past 150 years, raising the questions whether the data are sufficient to establish that conclusion given that satellite observation has only been available for 30 years, and why the official did not mention that the number of Atlantic hurricanes that make landfall has shown no trend in 150 years.
32. The senior official who testified before the Committee challenged my use of the Accumulated Cyclone Energy Index, which has just recorded its lowest value in the 30-year satellite record, raising the question why he considered it inappropriate to rely upon the two-year running sum of the combined frequency, duration, and intensity of all hurricanes, typhoons, and tropical cyclones worldwide.
33. The data show that the frequency of typhoons and tropical cyclones has declined throughout the 30-year satellite record; that for 60 years there has been no increase either in maximum wind-speed or in the number of violent Atlantic hurricanes; that for 60 years the number of severe tornadoes in the US has been falling; and that for 60 years the number of deaths from US tornadoes has been falling, raising the question why the official did not consider any of these data relevant enough to bring to the Committee's attention in response to its question about hurricanes and other intense storms.
34. The senior official who testified before the Committee said in his testimony that "global warming" would cause various catastrophes, including sea-level rise, ocean acidification, changes in rainfall, increased frequency and intensity of extreme-weather events such as heatwaves, coastal storms, droughts and heavy downpours, coastal erosion and inundation, changes in crop yields and ocean productivity and in climate-related diseases and pests, raising the question why he did not cite Schulte (2008), who found that of 539 papers containing the search phrase "global climate change" and published since the beginning of 2004 not one had offered any evidence for any catastrophe arising from "global warming".
35. Professor Nils-Axel Moerner, who has published 520 papers on sea-level rise, concluded in a 2004 study of the Maldives that there had been no sea-level rise there for 1250 years, and that

global sea level in the 21st century would rise by 8 inches, as it did in the 20th century, raising the question how the chairman of the Committee had been misled – perhaps by officials – into the belief that sea-level rise, particularly in the Maldives, would be likely to occur in a dangerous degree as a result of "global warming".

36. The senior official who testified before the Committee said that sea-level rise would be a problem because of "global warming", raising the question why he did not tell the Committee that there has been no statistically-significant sea-level rise for three years, and that sea level has risen in the past 16 years at a rate equivalent to no more than 1 ft/century.
37. In 2005, in *An Inconvenient Truth,* Al Gore predicted that sea level would rise imminently by 20 feet, inundating coastlines worldwide, leading a UK High Court Judge to find that "the Armageddon scenario that he depicts is not based on any scientific view", raising the question why in 2005 he spent $4m on a condo in the St. Regis Tower, San Francisco, just feet from the ocean at Fisherman's Wharf.
38. In 2009, Dr. James Hansen of the Goddard Institute for Space Studies wrote that sea level would rise by 246 feet (75 meters) as a result of "global warming", raising the question why exaggerations such as this are becoming ever more flagrant while sea level is not rising at all.
39. The proportion of the atmosphere occupied by carbon dioxide has increased by little more than 1 part in 10,000 over the past 250 years, raising the question how a member of the Committee had been misled into believing that "global warming" might lead to mass extinctions.
40. The IPCC has repeatedly stated that individual extreme-weather events cannot be attributed to "global warming", and the droughts of the Great Plains, and the great US floods, in the first half of the 20th century were worse than anything seen since, raising the question how a member of the Committee had been misled into believing that particular droughts or floods could be attributed to "global warming".
41. Most "tropical" diseases occur in the tropics not because the weather is warm but because public health measures are poor, and, in particular, it is known that the malaria mosquito can survive in Arctic temperatures, and that the largest outbreak of malaria in modern times occurred in Siberia, killing tens of thousands in the Arctic, raising the question how a member of the Committee had been misled into believing that "global warming" might facilitate the transmission of "tropical" diseases.
42. The Sahara has shrunk by 300,000 square kilometers in the past 30 years as vegetation has greened what was once a wasteland, allowing nomadic tribes to return to lands they had not settled in living memory, raising the question how a member of the Committee had been misled into believing that drought in the Horn of Africa (where drought is permanent) could have been caused by "global warming".
43. Hurricane Katrina was a Category 3 storm when it made landfall, and the damage it did was caused by the failure of the New Orleans levees, raising the question why a member of the Committee had been misled into sharing Al Gore's view, condemned by a UK High Court Judge as baseless, that Hurricane Katrina was attributable to "global warming".
44. The 3175 automated bathythermographs of the Argo network, deployed throughout the world's oceans in 2003, have shown that in the past five years there has been a slight cooling of the oceans, raising the question how a member of the Committee had been misled into believing that the oceans had been warming and might lead to inundation of the Louisiana coastline, where subsidence of the land rather than rising sea level is known to be the cause of coastal inundation.
45. Increased snowfall cannot reasonably be attributed to "global warming", raising the question how a member of the Committee had been misled into believing that a 40% increase in snow cover in North Carolina this winter was attributable to "global warming", particularly when there has been a seven-year period of global cooling.
46. Global temperatures have been falling for seven years, and the rate of increase in carbon dioxide concentration in the same period has been well below the least of the IPCC's projections, raising the question why the representative of the National Wildlife Federation told the Committee that "global warming" is "worse than expected".
47. Polar bears evolved 200,000 years ago from land-based brown bears and, therefore, survived the last interglacial period 125,000 years ago, when global temperatures were 11 Fahrenheit degrees

warmer than the present, and their population has quintupled since the 1940s, for it is hunting that was the real threat to them and that is now controlled, raising the question why the representative of the National Wildlife Federation told the Committee that polar bears were threatened with extinction.

48. Most of the world's 160,000+ glaciers are in Antarctica, at altitudes and latitudes too high to be affected by "global warming", and Antarctica has cooled for half a century, and the 9575 glaciers that debouch from the Himalayas into India show no change in the pattern of advance and recession in the 200 years since the Raj first monitored them, raising the question how a member of the Committee was misled into believing that "global warming" is causing glacial recession and decline in snow cover, which has shown no trend in half a century and reached a record high extent last winter.
49. The summit glacier of Kilimanjaro has not been melting because of "global warming" but ablating because of regional cooling and imprudent postcolonial deforestation, raising the question why Al Gore blames the recession of the glacier (half of which had already receded before Hemingway wrote *The Snows of Kilimanjaro* in 1936) on "global warming", a conclusion with which a UK High Court Judge has disagreed.
50. Carbon dioxide concentration has been up to 20 times today's levels in the palaeoclimate, and yet the creatures of the ocean survived and flourished, which they could not have done if the higher carbon dioxide concentration had appreciably acidified the oceans, raising the question how a member of the Committee had been misled into believing that current geologically-low concentrations of carbon dioxide could cause any appreciable or dangerous acidification of the oceans, which remain pronouncedly alkaline and contain 70 times as much carbon dioxide as the atmosphere.

Recommendation

At root, all of the red-flagged irregularities, errors, and exaggerations identified herein have their origin in the IPCC's central exaggeration of the four parameters whose product is the temperature response to anthropogenic increases in carbon dioxide concentration.

I recommend, therefore, that the Committee should consider again, and carefully, the question whether the anthropogenic effect on global mean surface temperature has – albeit inadvertently – been considerably exaggerated. Upon this question all else depends. If climate sensitivity is as low as theory and the satellite data are agreed in showing it to be, then that is the end of the "climate crisis", and it would be foolish to spend trillions on addressing a non-problem when there are so many real problems that need to be addressed.

I shall be happy to answer any further questions from the Committee if required.

With all good wishes,

MONCKTON OF BRENCHLEY

Attached: Technical paper on verification of IPCC projections, as promised to Representative Barton during the hearing.

Mr. MARKEY. Good show, Lord Monckton. Very good show. Our next witness is Mr. David Waskow. Mr. Waskow is the climate change program director at Oxfam America. Before joining Oxfam, he worked for Friends of the Earth where he focused on a range of international, environmental, and development issues. We welcome you, sir.

STATEMENT OF DAVID WASKOW

Mr. WASKOW. Good morning. Thank you. Oxfam is an international development and humanitarian organization that works in more than 120 countries, including the United States, and I am here today because our staff and partners are already responding to the serious impacts of climate change, including heat waves, severe storms, sea level rise, and reduced water supplies.

Both in the United States and abroad, we believe it has become essential to develop innovative and effective adaptation strategies for vulnerable communities. And, as I will note in a moment, we also believe these strategies are an opportunity for economic growth, both at home and abroad.

We witnessed the reality of climate impacts firsthand in our operations in the Gulf Coast, responding to the aftermath of Hurricane Katrina. And although a particular weather-related event like Katrina cannot be specifically attributed to climate change, its impacts do stand as a tragic warning sign of the consequences if we fail to develop robust adaptation strategies.

And let me just note for a moment here that I think our approach to climate change in general should be a proactive one, not reactive. And that is the case both in terms of reducing our emissions and also in doing adaptation, which is a matter of promoting resilience in a proactive manner.

In the United States, low income and other vulnerable populations will be disproportionately affected by climate change, as has been noted earlier. According to the recent findings of the Federal U.S. Climate Change Science Program, many of the expected health effects are likely to fall heaviest on the poor, the elderly, the disabled, and the uninsured. Health waves and extreme weather events are but two examples of climate impacts that will disproportionately affect the low income and other vulnerable populations.

As a first step to addressing these challenges in our country, the federal government should establish a national climate adaptation strategy, coordinate actions across agencies, and provide capacity building assistance to state and local governments. All of these climate adaptation strategies should prioritize and include the participation of vulnerable communities, including improving the management of emergency response strategies for those who are most vulnerable.

Internationally, the capacity of vulnerable communities in developing countries is even more limited and is being stretched even further that is the case here in the United States. Agricultural practices, water systems, disaster preparedness, and health systems will all need to be strengthened and improved in order to be more climate resilient.

In these countries, the consequences of climate change reach significantly beyond direct impacts of course. Stability and security

will be undermined by climate change, and recently retired U.S. admirals and generals recommended that the U.S. take serious action to build climate resilience in those countries.

Climate resilience, however, is not only a necessity both in the United States and around the world. It is also smart economically. Taking preventive action now will pay for itself many times over, and studies have shown that reducing disaster risk saves $4 for every dollar spent on disaster preparedness.

Adaptation strategies are also a key economic opportunity that we should seize. Innovative solutions can be an integral part of a global transition to a clean and climate-resilient economy. From developing climate resilient buildings to buttresses sustainable transport systems to improving water systems and agricultural practices around the world, we can find substantial economic benefits from adaptation strategies.

In the Gulf Coast, we have been involved with a promising example of climate resilient economic development building green, climate resilient housing. And we are seeing the development of new markets at home and abroad for technologies and services to help communities build resilience. Water pumps, infiltration devices, irrigation equipment, early warning systems for weather events, and weather index microinsurance.

U.S. companies and workers are well poised to partner with communities at home and abroad in deploying these technologies and services. For example, Pent Air, a Minnesota-based company, manufactures pumps and filters for the entire water cycle and recently installed and maintained filtration systems in rural communities in India and Honduras.

The development of new, clean energy technologies to support climate adaptation and resilience, both here and in developing countries, is another economic opportunity. And I would just take a moment to note that in many cases, off-grid renewable energy technologies are, in fact, the most cost effective, best way to provide energy sources to the poor in developing countries.

Out of necessity, a wave of innovation is possible if we seize this opportunity to tackle climate adaptation and resilience that stands before us. So I encourage you to seize that opportunity. Thank you.

[The prepared statement of Mr. Waskow follows:]

Testimony of
David Waskow
Climate Change Program Director, Oxfam America

Before the
Subcommittee on Energy and Environment
House Energy and Commerce Committee

March 25, 2009

Introduction

Good morning Mr. Chairman, Representative Upton, and Members of the Subcommittee. I am David Waskow, the Climate Change Program Director at Oxfam America.

Oxfam America is an international development and humanitarian organization that works with communities and partner organizations in more than 120 countries, including the United States itself, to create lasting solutions to poverty, hunger, and injustice. Oxfam has come to see climate change as one of the greatest challenges to our efforts in the 21st century to promote development and reduce poverty. In our operations, our staff and partners are already responding to the serious impacts of climate change, from water scarcity to increasingly severe weather events.

Both in the United States and abroad, it has become essential to develop innovative and effective adaptation strategies for vulnerable communities. In our operations responding to the aftermath of Hurricane Katrina in the Gulf Coast, we witnessed this reality. While a particular weather-related event like Katrina cannot specifically be attributed to climate change, its impacts stand as a tragic warning sign of the potential consequences of global warming if we fail to build resilience to its impacts.

Building resilience in the face of climate change is both a necessity and an economic opportunity that should be seized. Innovative adaptation solutions can be an integral part of a global transition toward a clean and climate-resilient economy. From developing climate-resilient housing, restoring natural storm buffers, and buttressing sustainable transport systems in the United States, to improving water systems and agricultural

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practices around the world, adaptation can provide substantial economic benefits. Already, we are seeing a need for and development of new markets for technologies and services to help communities build resilience to climate change impacts, such as water pumps and filtration devices, irrigation equipment, early warning systems to forecast storms, flood, and drought, weather-indexed micro-insurance programs, and renewable energy systems to support adaptive strategies.

Beyond promoting a wave of innovation, climate-resilient strategies can also save money. Taking preventive action now will pay for itself many times over. For example, the National Institute of Building Sciences found that reducing disaster risks saves nearly four dollars for every dollar spent on disaster preparedness. Reducing risks from climate-related disasters, ensuring that water resources are optimized, and addressing adverse health impacts from climate change are all examples of the ways in which climate adaptation can be part of a sound economic strategy.

Taking these actions is all the more urgent because of the increasingly serious impacts from climate change we are already seeing today. The most important preventive action the United States can take now is a dramatic, immediate reduction in greenhouse gas emissions. Indeed, adaptation needs will be far greater in the future if we do not take concerted action now to limit those emissions. Yet it is also increasingly clear that the consequences of climate change are already being felt today, and that those consequences are often experienced first and worst by vulnerable, poor communities. As the Stern Review has noted, even if emissions were to be eliminated today, we would still face at least two decades of increasing global temperatures.[1]

Earlier this month, the International Scientific Congress on Climate Change warned that global warming is outpacing even recent scientific projections. "Recent observations confirm that, given high rates of observed emissions, the worst-case [Intergovernmental Panel on Climate Change] scenario trajectories (or even worse) are being realised. For many key parameters, the climate system is already moving beyond the patterns of natural variability within which our society and economy have developed and thrived. These parameters include global mean surface temperature, sea-level rise, ocean and ice sheet dynamics, ocean acidification, and extreme climatic events. There is a significant risk that many of the trends will accelerate, leading to an increasing risk of abrupt or irreversible climatic shifts."

Given this sobering reality, we must invest today in both a low-carbon energy economy and a climate-resilient global economy to promote new growth and to prevent future costs. Congress can help spur new innovations that will save lives worldwide, provide jobs, and pave the way towards a clean and climate-resilient future.

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[1] Nicholas Stern, "The economics of climate change: The Stern review" (Cambridge, UK: Cambridge University Press, 2007), available at www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm.

Promoting climate adaptation and climate resilience in the United States

The recent *Scientific Assessment of the Effects of Global Change on the United States*, produced by the U.S. Government's Climate Change Science Program, found that climate change is already changing conditions here at home. The number of U.S. heat waves has grown. Coastal states are grappling with sea-level rise. The proportion of heavy precipitation events has grown. Snow cover has decreased, reducing water supplies. Many of these impacts are predicted to worsen and other consequences of climate change, such as exacerbated drought and stronger storms, are expected to occur. These impacts threaten our health and well-being and the nation's infrastructure, agricultural sector, water supply, coastal zones, and the fragile ecosystems on which we depend.

Moreover, low-income and other vulnerable populations in the United States will likely be disproportionately affected by these and other climate change impacts. Many of these disparities will be seen in the health impacts experienced by vulnerable populations. According to the recent findings of the federal U.S. Climate Change Science Program's *Analyses of the Effects of Global Change on Human Health and Welfare and Human Systems*, "[m]any of the expected health effects are likely to fall disproportionately on the poor, the elderly, the disabled, and the uninsured."

For instance, studies of heat waves find that poor housing conditions, including lack of air conditioning, are significant risk factors for heat related illness and mortality. Senior citizens are among those particularly vulnerable to the heat-related impacts of climate change, and the concentration of poverty in inner-city neighborhoods will contribute to disproportionate health impacts related to urban heat islands. Similarly, extreme weather events are also likely to have disproportionate effects on particularly vulnerable populations, including loss of life and acute trauma, while also causing indirect health impacts such as damage to housing and health facilities.

These types of effects were seen in the aftermath of Hurricane Katrina. A post-storm analysis of FEMA storm damage estimates revealed that the hurricane's impact disproportionately affected renters, the poor, the unemployed, and African American communities. Almost 46 percent of homes in damaged areas were occupied by renters compared to 31 percent in undamaged areas. Twenty-one percent of households in damaged areas had incomes below the poverty line, compared to 15.3 percent in undamaged areas. In addition, 45.8 percent of areas damaged or destroyed by Hurricane Katrina were occupied primarily by African Americans; undamaged areas had approximately 27 percent African American residents. The slow pace of recovery and rebuilding is having a similarly disproportionate impact on low-income people and communities of color.

Taking action to protect vulnerable populations in our efforts to address climate change is vital. We must act to ensure that all communities, particularly those that are most vulnerable, have the resources necessary to prepare for and adapt to the impacts of climate change and to increase their resilience <u>before</u> disaster strikes. Doing so is in part an economic imperative. For example, in its report *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities*, the Multi

Hazard Mitigation Council of the National Institute of Building Sciences conducted an extensive analysis of FEMA spending on addressing hazards from severe weather and other events. The study concluded that hazard mitigation not only saves lives but money as well, *saving $3.65 from the federal treasury for every dollar spent.*

As a first step to address the challenges posed by climate change, the federal government should establish a national climate adaptation plan, coordinate action across agencies, and integrate climate impact assessments into all agencies' decision-making and planning processes. In addition, the federal government should provide capacity-building assistance to state and local governments, including regional impact assessments, climate model information, updated flood maps, early warning systems, and planning tools. Critically, all of these climate adaptation strategies should prioritize – and directly include the participation of – particularly vulnerable populations, including low-income families, communities of color, immigrants, and tribal communities.

Ensuring better management of climate-related risks and disasters, particularly the evacuation, emergency response and recovery needs of vulnerable populations, is also an essential component of a complete adaptation strategy. When Hurricane Katrina hit the Gulf Coast, the nation quickly learned that we were ill prepared to respond to a catastrophic disaster. The flawed post-disaster emergency shelter and housing response further traumatized people who had already lost their homes to the storms and floods. The poorest and most vulnerable communities were the most negatively affected by this lack of preparation.

Some significant improvements to disaster response have already been enacted in the Post-Katrina Emergency Management Reform Act, most notably the requirement that FEMA create a National Disaster Housing Strategy. However, in order for the response to the next disaster to be more effective and equitable, further reforms are needed. Enhanced assistance for catastrophic disasters should be provided, and the provision of post-disaster shelter and temporary housing must be provided in an accessible and fair manner. Federal policy should also be targeted to ensure that communities and populations at risk are identified and that strategies are put in place to address their unique circumstances before and after disasters. Equally important, federal agencies should be required to partner with local organizations on relief, recovery and rebuilding work. To streamline and expedite assistance, organizations with existing relationships in affected communities should be supported and funded.

Hurricane Katrina also illuminated the unique circumstances faced by immigrants before and during disasters. Many immigrants in the worst-hit areas of Louisiana and Mississippi were unprepared for the hurricane due to the government's failure to issue warnings, evacuation instructions, or hazard and safety precautions in languages accessible to them. A multilingual strategy for disaster preparation and response should be employed, and the Department of Homeland Security should also develop a standing policy, reiterated in times of disaster, not to conduct immigration enforcement in association with any phase of disaster preparedness or recovery.

Building economic opportunity through climate resilience in the United States

Developing climate resilience in the United States, while a necessity, can also play a role as an economic driver. To make the most of our adaptation strategies, we should make investments in sustainable, resilient, and durable economic growth, and we should train citizens for the jobs that will be needed to adapt infrastructure, products and services to new climate realities – as part of a rising "climate-resilient green economy."

A promising example of climate-resilient economic development has been initiated by Oxfam in the Gulf Coast, in partnership with architecture students at MIT and the Terrebonne Readiness and Assistance Coalition (TRAC). The project involves the rebuilding of coastal Louisiana communities with hurricane-resistant homes called Lift Houses. The homes are designed to withstand hurricane force winds and floods, and are well-insulated and well-ventilated to conserve energy – a good example of the synergy between projects and technologies that address adaptation to climate change while reducing greenhouse gas emissions.

Another adaptation strategy includes strategic wetlands restoration in coastal areas where wetlands serve as a critical natural buffer against rising sea levels and hurricane winds and floods. Oxfam partners in the Gulf Coast such as Bayou Interfaith Shared Community Organizing, Bayou Grace Community Services and Zion Travelers Cooperative Center are working with local residents to restore Louisiana's wetlands and provide solutions to coastal erosion that create good local jobs and improve the climate resilience and economic revitalization of the region.

Other regions are also developing innovative approaches to building a climate-resilient economy, a number of which have been documented by the Center for Clean Air Policy as part of its Urban Leaders Adaptation Initiative. In King County, Washington, for example, the Brightwater Water Reclamation Project will help to absorb the projected increase in demand on the county wastewater infrastructure system within the next decade caused by increases in storm water runoff, an impact of climate change. Reclaimed water from the system can be used to irrigate farmland, thereby taking pressure off of drinking water sources that may be affected by decreased snowpack in the future, another climate change impact. To supply the increased demand for water in King County in spite of projected decreases in the water supply resulting from climate change, the county added water reclamation and distribution technology to the Brightwater infrastructure plans.

Local communities and municipalities are already integrating climate resilience into their economic recovery plans. However, these activities need to be further supported and bolstered by the federal government. Developing a national adaptation plan is one step towards this goal, but a long-term, integrated strategy will require that climate resilience is streamlined throughout all government agencies, programs, and priorities.

Impacts on vulnerable communities in developing countries

While the United States is facing a significant challenge in addressing the consequences of climate change, the capacity of vulnerable communities in developing countries to cope with climate-related impacts is even more limited and is being stretched further by by the adverse effects of climate change impacts.

In 2007, there were 874 weather-related disasters worldwide, a 13 percent increase over 2006 and the highest number since recordkeeping began in 1974. Weather-related disasters around the world have been on the rise for decades; on average, annual weather disasters have more than doubled since the 1980s.[2] People living in developing countries are ill-prepared to cope and are 20 times more likely to be affected by climate-related disasters compared to those living in the industrialized world. In the 1990s alone, nearly two billion people in developing countries were affected by climate-related disasters.[3]

The estimates of climate change's contribution to worsening conditions are disturbing. By 2020, up to 250 million people across Africa are expected to face increasingly severe water shortages, according to the Intergovernmental Panel on Climate Change (IPCC). By mid-century, more than a billion people will face water shortages and hunger, including 600 million in Africa alone. Weather extremes, food and water scarcity, and climate-related public health threats are projected to displace between 150 million and one billion people as climate change unfolds.

Perhaps the most significant consequence of climate change will be felt as developing countries struggle to maintain food security in the face of declining agricultural productivity and the loss of crops due to shifting weather patterns and weather-related disasters. In developing countries, more than 75 percent of people depend on agriculture as the main component of their livelihoods. The very lifeline of the world's poorest countries is being frayed to the breaking point.

As a result, the economic imperative to promote climate resilience is increasingly clear. The Stern Review concluded that global warming may cost the world close to $10 trillion by next century due to rising sea levels, famine, storms and other environmental harm. Even at current levels of global warming, the World Bank has estimated that the cost of protecting new investments in developing countries from climate impacts ranges from $10-40 billion annually. However, this estimate does not include the costs of protecting already existing investments from climate impacts, nor does it address community-level needs for climate adaptation (such as reinforcing housing stock).

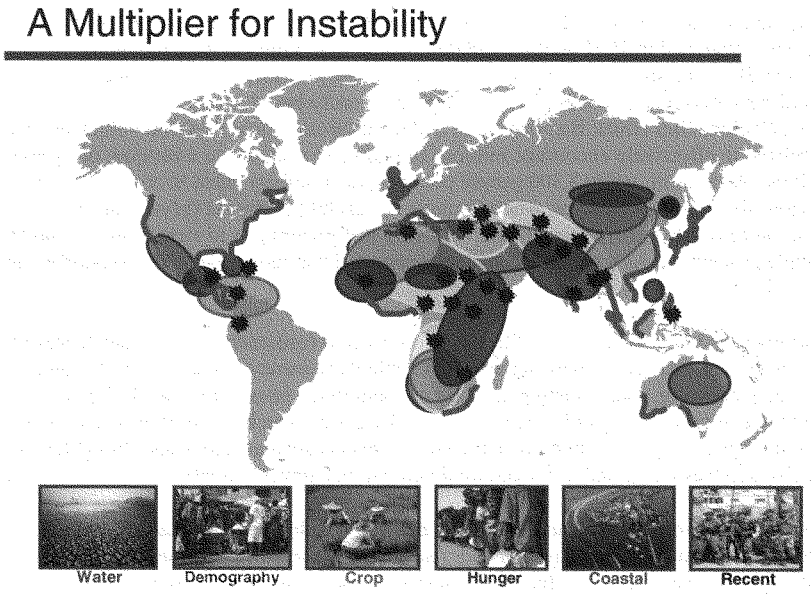
An Oxfam analysis of the costs of adapting to climate impacts in developing countries has found that the needs are at least $50 billion annually, and potentially higher, when the protection of existing investments and community-level adaptation needs are incorporated. The 2008 Human Development Report of the United Nations Development

[2] Löw, Petra. October 2, 2008. Weather-related Disasters Dominate, Worldwatch Institute.
[3] Jonathan Pershing (World Resources Institute): testimony to the House of Representatives Subcommittee on Energy and Air Quality, Committee on Energy and Commerce; Hearing on Climate Change, International Issues, and Engaging Developing Countries; March 27, 2007.

Program (UNDP) estimates that the adaptation needs of developing countries will total up to $86 billion per year from 2015 onward, including the costs of integrating climate-resiliency into development activities (such as with irrigation systems and preventive health programs), strengthening infrastructure such as schools and roads, and adding to disaster preparedness and response capacity.

Yet the consequences of climate change reach significantly beyond direct impacts. Global stability and security will be undermined by increasing migration and refugee crises, by conflicts over ever-scarcer natural resources, and by economic destabilization as poverty and food insecurity grow. For instance, the increased scarcity of natural resources has contributed to conflicts in areas such as Darfur. The recent conflict there coincides with a 40% decline in precipitation in Sudan, which has been linked by scientists to global temperature change and changes in rainfall patterns tied to warming in the Indian Ocean. Such examples provide us with a glimpse at what is to come in the developing world if we do not build resilience to the consequences of climate change.

In a report from CNA, a number of retired U.S. admirals and generals refer to climate change as a "threat multiplier," presenting significant national security challenges for the United States. Our national security interest will be well-served, and dollars well-spent, by addressing the adaptation and mitigation needs internationally. One of the recommendations of the CNA report is for the U.S. "to assist nations at risk to build the capacity and resiliency to better cope with the effects of climate change. Doing so now can help avert humanitarian disasters later."



Source: World Resources Institute

Adaptation as catalyst for new growth and resiliency

Acting today to reduce disaster risks and improve livelihoods in agriculture and other sectors is essential in avoiding even greater costs later. Improving irrigation and water retention systems will help reduce future food aid costs in times of scarcity or famine. Similarly, protecting infrastructure or putting in place natural sea buffers such as mangrove or cypress forests will help reduce future disaster assistance costs.

The financial benefits from taking preventive action have been demonstrated widely. According to an analysis by the U.S. Geological Survey and the World Bank, an investment of $40 billion to reduce disaster risk is capable of preventing disaster losses of $280 billion. A study conducted by the British international development agency finds that for every dollar invested in pre-disaster risk management activities in developing countries, seven dollars in post-disaster costs can be prevented. Evidence from a mangrove-planting project designed to protect coastal populations from storm surges in Viet Nam estimated economic benefits that were 52 times higher than costs. In Brazil, a flood reconstruction and prevention project designed to break the cycle of periodic flooding in 2005, resulted in a return on investment of greater than 50% by reducing residential property damages.

Bangladesh provides a particularly compelling example of the benefits of prudent planning and risk reduction. In 1970, up to 500,000 people perished in the Bhola cyclone in Bangladesh, and in 1991 another 138,000 people were killed in the Chittagong cyclone. Bangladesh then instituted a national cyclone preparedness program that includes shelters, early warning systems and community-based preparedness measures. When Cyclone Sidr struck Bangladesh in 2007, a network of some 34,000 volunteers was mobilized to effectively encourage millions of people to evacuate to a network of cyclone shelters. As a result, while 3,300 people perished, the numbers paled in comparison to previous disasters. By contrast, when Cyclone Nargis hit the Burma (Myanmar) delta region in May 2008, there was a broad failure by the government to alert residents and to provide protection. As a result, UN agencies reported that more than 100,000 perished in the cyclone.

Working with vulnerable communities in building their resilience to the consequences of climate change can also provide a means to enable these same communities to become more economically, socially and politically resilient in the broadest sense. Reliable access to essential services like sanitation and clean water can help build the capacity of communities to respond to unpredictable climate events such as floods and drought, and can also serve as a foundation for economic growth and development.

Often, building resilience means enhancing existing development approaches, such as improving agricultural techniques or water supply systems. At other times, however, the challenges will be new and different. For instance, some communities will have to adapt to rapidly melting mountain glaciers—creating excessive runoff and the potential for

unprecedented floods now while leading to scarcer water supplies in future years once the glaciers are gone. These communities could benefit from the creation of reservoirs and water impoundments to capture and store water resources that will become increasingly scarce in the future. Alternatively, these communities may have to create flood warning systems to deal with higher water flows and may have to change agricultural practices and the crops they grow to deal with water abundance in the short term and scarcity sometime in the future.

Vulnerable communities are engaging in a variety of resilience-building approaches that promote economic development and poverty and improve climate change resilience. Some examples include:

- In the Arequipa region of Peru, small farmers are installing a new system of gravity-fed irrigation to ensure that pastures are properly watered, an increasingly difficult task as water supplies decrease due to the overly rapid melting of glacial water sources. Other initiatives in the region include installing radio networks to ensure that remote communities are informed of any severe weather patterns.

- In Karnataka, India, the local government has initiated an innovative watershed development project. Small dams now catch the water from monsoon rains before the water disappears from the watershed, and the water is slowly absorbed into the ground to replenish the local aquifer and refill dry wells.

- In Ethiopia, farmers are being trained in practices such as appropriate crop spacing and crop rotation, techniques which also increase farm productivity. Farmers have also learned skills and strategies such as water harvesting and carefully selecting seeds based on their capacity to cope with climate variability. In addition, distribution of energy-saving stoves has decreased unsustainable use of firewood and the workload of the women and children who gather it.

Responding to climate change impacts that affect poor communities may also present new business opportunities and spur economic development in some of the poorest regions of the world. Recent interest in "climate-risk" insurance products by the insurance industry offers one indication that global financial institutions understand the costs and benefits of emissions reduction and building climate resilience aimed at hedging future climate risks. In Ethiopia, where 85% of the population is dependent on rain-fed agriculture, Oxfam is working with the insurance company Swiss Re and small-scale farmers to pilot a weather-indexed micro-insurance project.

Meanwhile, cutting-edge companies with major U.S. operations are beginning to develop and deploy innovative technologies and services to help communities adapt to droughts, floods, storms, and other climate-change impacts. Climate resilience solutions take many forms. For example, Pentair, a Minnesota-based company with nearly $3.5 billion in annual revenue, manufactures technologies for the entire water cycle – from pumps to filters. The company has installed and maintained filtration systems that provide clean drinking water to rural communities in India and Honduras.

The development of new, clean energy technologies to support climate adaptation and resilience in developing countries is another arena for business opportunities. Energy poverty, or the absence of access to reliable energy services, affects approximately one-third of the world's population, with 80% of those in South Asia and Sub-Saharan Africa. Building a renewable energy future in vulnerable countries will provide the developing world with the infrastructure needed for critical adaptation strategies while also helping them grow along a low-carbon pathway. For example, General Electric's Homespring system has found a new way to harness solar energy to power water apparatuses in off-the-grid communities in Africa and Asia.

Carefully crafted policy incentives to scale up this sort of innovative technology cooperation can create green jobs for American workers, while also strengthening communities' ability to withstand climate change.

Conclusion

Mr. Chairman, we appreciate this subcommittee's leadership on climate change and the ways in which we can deal with its consequences. It is still not too late to act and to demonstrate our resolve to lead in addressing what we believe to be one of the greatest challenges of this century. Congress can pass legislation that harnesses innovative opportunities to build climate resilience, enhance economic growth, and develop and create new opportunities for companies and workers in the United States.

Thank you for the opportunity to appear before you today. I am glad to answer any questions that you may have.

Mr. MARKEY. Thank you so much, sir. And our final witness is Bishop Callon Holloway who was recently elected to his third term as bishop of the Southern Ohio Synod of the Evangelical Lutheran Church in America. Prior to that, he served as assistant to the bishop of the Southern Ohio Synod and pastor of the Western Lutheran Church in Dayton. Please begin whenever you feel comfortable, Bishop.

STATEMENT OF BISHOP CALLON HOLLOWAY

Bishop HOLLOWAY. Thank you very much. Good morning, Chairman Markey and Congressman Upton and members of the committee. I thank you for the opportunity to testify today, and I am with the Evangelical Lutheran Church in America and also representing the National Counsel of Churches. Between them, the five million members of the ELCA and 45 million in the National Counsel of Churches, I speak in their behalf.

I am delighted to have the opportunity to speak from the perspective of those of us involved in the faith community as we are called and to speak with you about global climate change, particularly our concern for those who are living in poverty around the world and here who are already facing the impacts of this climatic change.

For many people of faith, the call to be good stewards of the earth is grounded in God's command in Genesis to keep and to till the earth. Christians look to Christ's example and heed the call to seek justice, care for our neighbor, and provide for those who are living in poverty or are otherwise suppressed. And our response to climate change must reflect the principles of stewardship and justice. Particularly for those who are living in poverty around the world, they are the ones who are least responsible for the changes taking place and most likely to suffer from its impact.

The diverse coalition of faith communities including Catholics, Protestants, evangelicals, and our inter-faith partners have endorsed the climate fairness agenda, which unites our communities behind the goal of working to ensure that the United States government aggressively reduces greenhouse and gas emissions while providing for the most vulnerable here in our own country and around the world.

And I would like to submit to you for the record a document "Climate Fairness Agenda: A Religious Call to Address Global Climate Change and Poverty."

Mr. MARKEY. We will include that in the record without objection.

Bishop HOLLOWAY. Thank you very much, sir. In its 2007 assessment reports, the Intergovernmental Panel on Climate Change, the IPCC, paints a pretty bleak picture of God's creation and those already struggling with hunger and disease. The report details how climate change will increase insecurity in places where food is already scarce while reversing progress made to fight against hunger in other regions. Rising temperatures will increase water scarcity and some areas and spread of disease, such as malaria, fever, West Nile virus.

More severe natural disasters and longer-term drought will lead to increased migration. I have seen this with my own eyes and

worked with those who are working with the people who are most affected by this. I have been privileged to see this in my own church and our response to global climate change, through my own synod's companionships in Tanzania, Brazil, and also in Kazakhstan most recently.

And I have met with farmers who are struggling with extreme weather pattern changes and unpredictable rainfalls, and our people are working hard, fast, furiously, and in partnership with great numbers and diversity of other people and organizations to provide basic water supply, cleanliness, and opportunities to eat.

For us, we are blessed in our country with waking in the morning and deciding what color tie to wear or what color iPod to have having from our sides while most people around the world deciding if they are going to eat that day. Although churches and other NGOs are already working to assist communities adapting to climate change, the reality is that the changes are far too great for us to manage alone. We cannot do that alone. We are not structured for it. It is not our primary calling.

A number of proposed bills in the House during the 110th Session including, Chairman Markey, your recommendations with the iCAP bill and Counselman Doggett's Climate MATTERS bill and the Boxer/Warner/Lieberman bill in the Senate include an international adaptation assistance language and funding.

There are several items I would like to get to in this report. That funds should be appropriately targeted in terms of recipient countries by 10 percent. Local communities must be engaged in a participatory process through transparent mechanisms, and funds should be provided to fund the current levels of official development assistance. The funds should be targeted for climate impact, and legislation should enhance developing country efforts to reduce greenhouse gas emissions.

The U.S. must acknowledge its role, both claimed and granted, in the responsibility for this global crisis and should commit to providing substantial financial support reaching between $7 and $21.5 billion a year by 2030.

Some will say we cannot afford to make this sort of investment at a time of global economic turmoil. I counter that if we do not do it, we cannot afford that either. I thank you very much as we look to protect creation and God's people.

[The prepared statement of Bishop Holloway follows:]

Testimony of Bishop Callon Holloway
Bishop of the Southern Ohio Synod
Evangelical Lutheran Church in America

March 25, 2009

Good morning Chairman Markey, Congressman Upton and members of the committee. Thank you for the invitation to testify today. I am Callon Holloway, Bishop of the Southern Ohio Synod for the Evangelical Lutheran Church in America (ELCA). I am here today representing both the ELCA, the largest Lutheran denomination in the United States representing nearly 5 million people, and the National Council of Churches (NCC), an organization that represents 35 Christian denominations, 100,000 congregations and approximately 45 million people in the United States.

I am delighted to have the opportunity to discuss the perspective of the faith community on global climate change with you. Specifically, I will address the need for US legislation to address the challenges that the poorest people in the world are already facing due to the warming of our earth's atmosphere. As you may know, a broad and diverse coalition of faith communities, including Evangelicals, Protestants, Catholics and others, stand united in the conviction that the U.S. Government must aggressively reduce greenhouse gas emissions while ensuring that any climate change legislation provide for the most vulnerable here at home and around the world. As you draft climate change legislation in the coming weeks, I urge you to include language supporting mechanisms for international assistance for moral, economic and security reasons.

For many people of faith, the conviction to be good stewards of the earth is grounded in God's command in Genesis to keep and till the earth (Genesis 2:15). We do not view the riches of our earth simply as material to be exploited, but rather as treasure we are called to protect, preserve and utilize in sustainable ways for the well-being of God's people and God's creation. The Christian community also approaches the issue of global climate change through the lens of justice. Just as Christ worked for justice on behalf of the marginalized and impoverished, we are also called to serve those most in need and add our voices to the chorus of those living in extreme poverty who had the least to do with causing global climate change but will be most severely affected by the subsequent changes.

In its most recent report, the Intergovernmental Panel on Climate Change (IPCC) states that by 2020 – in just eleven years – rising temperatures caused by global warming may reduce yields of rain-fed agriculture in Africa by up to 50 percent. As the climate grows warmer, food insecurity will increase in places where food is already scarce, like many countries in Africa, and will also rise in parts of the world that have seen progress in the fight against hunger like Latin America. One to two billion people will face water scarcity this century and by 2020 approximately 250 million will face water scarcity in Africa.

Millions of individuals around the world will be at greater risk of contracting diseases such as malaria, dengue fever, and West Nile virus because of climactic changes and increasing ranges for the insects that carry these disease vectors.

Other impacts predicted by the IPCC and others include increased migration, both within and outside of national borders, due to increases in natural disasters such as storms and long-term drought. In addition, predicted rising sea levels will likely lead to the permanent displacement of entire communities and even entire nations in the case of small islands. The cultural impact of these displacements, together with the impact that they have on the economic security of the displaced, lend a sense of urgency both to efforts to mitigate climate impacts now and to efforts to provide adaptation assistance that may enable people to stay in their own communities. In addition, large numbers of environmental migrants, coupled with increased competition for scarce resources among people and nations, are potentially destabilizing forces that cannot be ignored.

A 2008 report by the National Council of Churches outlines the impact that many of these changes will have on people living in poverty around the globe and also on the ministries of U.S. churches and our global partners. For example, the ELCA supports relief, disaster response and development work in many countries through our World Hunger Appeal, which provides financial assistance to the work of our global communion, the Lutheran World Federation; to national Lutheran churches in developing countries; and to U.S. based development agencies, Lutheran World Relief and Church World Service (CWS).

I have been privileged to see the results of the Churches response to global climate change though my synod's companion relationships with Lutheran churches Tanzania and Brazil. In Tanzania, I met farmers struggling to cope with extreme weather patterns and unpredictable rain falls. Lutheran ministries are working with pastoralist groups to diversity their livelihood by supplementing traditional animal grazing, threatened by desertification, with cultivation of drought resistant crops like cassava. And, as the glaciers and ice caps melt on Mount Kilimanjaro, reducing flows in rivers that supply water to nearby communities and endangering a major source of tourism dollars to the region. The Tanganyika Christian Refugee Service is working with local villages to increase alternative household waters supplies through rainwater harvesting and sand dams. Our work in Tanzania is only one example of how our ministries are already confronting the effects of a changing climate; there are many more.

While Churches and other non-governmental organizations are working assist communities in ongoing development and adaptation measures, the reality, as the NCC report concludes, is that the challenges are just too great for us to manage alone. The UN Framework Convention on Climate Change and the UN Development Program estimate that the cost for developing countries to adapt to climate impacts could be up to $86 billion per year. Governments of both developed and developing nations must play a role in addressing these needs.

The U.S. must assume a leadership role in an effort to help developing countries prepare for the impacts of climate change that we can no longer prevent. While our great nation represents a mere five percent of the global population, we are the world's largest historical emitter currently responsible for approximately a quarter of the world's greenhouse gas emissions. This reality is a justice issue.

The U.S. also has tremendous economic and security incentives for acting now. In today's global economy, the United States relies on other nations to be stable and prosperous. International adaptation assistance will be vital to ensure the economic and political stability of dozens of developing nations throughout the world, many of which are also hardest hit by the current global economic crisis. This assistance is critical to help countries manage the societal strains that will result from floods, drought, famine and migration. It will also provide emergency relief assistance for disasters that are inevitable as a result the earth's warming. Lastly, international adaptation assistance can help mitigate the emissions of developing countries, helping to ensure they develop in a sustainable, low carbon manner.

A number of proposed bills in the House during the 110th session included international adaptation assistance in the form of financial support to developing nations. Congressman Markey's 2008 iCAP bill (H.R. 6186) included significant assistance for those living in poverty around the world in the form of $185 billion over the life of the bill. Congressman Doggett also included international adaptation assistance in his 2008 bill, Climate MATTERS (H.R. 6316), with more than $33 billion dollars going to developing countries from 2012-2018. In addition, Congressman Waxman also included the need for international assistance in his climate principles that were endorsed by 152 members of the House of Representatives. The faith community also worked closely with Senator Warner last year in developing international adaptation assistance language for the Climate Security Act (S. 2191) that was voted on last June. This bill included more than $320 billion dollars over the life of the legislation for those in developing countries.

Building on this clear precedent to address the international concequences of global climate change, I urge the Committee to include the following legislative objectives related to international adaptation assistance in any climate bill:

(1) The funds should be appropriately targeted in terms of recipient countries; they should go to the "most vulnerable developing countries" (with the legislation including an agreed-upon definition of what that means) and no more than 10% should go to any one country in any single year.

(2) Local communities must be engaged in a participatory process through transparent mechanisms with adequate monitoring and evaluation.

(3) The funds provided should be in addition to current funding levels of official development assistance (ODA).

(4) The funds should be appropriately targeted to adapting to climate impacts, including impacts related to drought, natural disasters, diseases, refugees, etc.

(5) Legislation should also address the need to reduce greenhouse gas emissions in developing nations by reducing emissions from deforestation and providing for transfer of clean energy technologies.

The US must acknowledge its responsibility for this global crisis and should commit to providing substantial financial support reaching between $7 and $21.5 billion a year by 2030 and further increasing with time.

Some will say we cannot afford to make this sort of investment at a time of global economic turmoil. I would counter that we cannot afford *not* to.

As a matter of justice, adaptation assistance for vulnerable communities abroad must be a part of any climate policy. We look forward to working with the committee as you develop legislation that protects God's good creation and all of God's people. Thank you.

Caring for Creation: Vision, Hope, and Justice

This social statement was adopted by a more than two-thirds majority vote as a social statement of the Evangelical Lutheran Church in America by the third Churchwide Assembly on August 28, 1993, at Kansas City, Missouri.

Prologue

Christian concern for the environment is shaped by the Word of God spoken in creation, the Love of God hanging on a cross, the Breath of God daily renewing the face of the earth.

We of the Evangelical Lutheran Church in America are deeply concerned about the environment, locally and globally, as members of this church and as members of society. Even as we join the political, economic, and scientific discussion, we know care for the earth to be a profoundly spiritual matter.

As Lutheran Christians, we confess that both our witness to God's goodness in creation and our acceptance of caregiving responsibility have often been weak and uncertain. This statement:

- offers a vision of God's intention for creation and for humanity as creation's caregivers;
- acknowledges humanity's separation from God and from the rest of creation as the central cause of the environmental crisis;
- recognizes the severity of the crisis; and
- expresses hope and heeds the call to justice and commitment.

This statement summons us, in particular, to a faithful return to the biblical vision.

I. The Church's Vision of Creation

A. God, Earth and All Creatures

We see the despoiling of the environment as nothing less than the degradation of God's gracious gift of creation.

Scripture witnesses to God as creator of the earth and all that dwells therein (Pss 24:1). The creeds, which guide our reading of Scripture, proclaim God the Father of Jesus Christ as "maker of heaven and earth," Jesus Christ as the one "through [whom] all things were made," and the Holy Spirit as "the Lord, the giver of life" (Nicene Creed).

God blesses the world and sees it as "good," even before humankind comes on the scene. All creation, not just humankind, is viewed as "very good" in God's eyes (Gen 1:31). God

continues to bless the world: "When you send forth your spirit, they are created; and you renew the face of the ground" (Pss 104:30). By faith we understand God to be deeply, mysteriously, and unceasingly involved in what happens in all creation. God showers care upon sparrows and lilies (Mat 6:26-30), and brings "rain on a land where no one lives, on the desert, which is empty of human life" (Job 38:26).

Central to our vision of God's profound involvement with the world is the Incarnation. In Christ, the Word is made flesh, with saving significance for an entire creation that longs for fulfillment (Rom 8:18-25). The Word still comes to us in the waters of baptism, and in, with, and under the bread and wine, fruits of the earth and the work of human hands. God consistently meets us where we live, through earthy matter.

B. Our Place in Creation

Humanity is intimately related to the rest of creation. We, like other creatures, are formed from the earth (Gen 2:7, 9, 19). Scripture speaks of humanity's kinship with other creatures (Job 38-39; Pss 104). God cares faithfully for us, and together we join in singing the "hymn of all creation" (*Lutheran Book of Worship*, page 61; Pss 148). We look forward to a redemption that includes all creation (Eph 1:10).

Humans, in service to God, have special roles on behalf of the whole of creation. Made in the image of God, we are called to care for the earth as God cares for the earth. God's command to have dominion and subdue the earth is not a license to dominate and exploit. Human dominion (Gen 1:28; Ps 8), a special responsibility, should reflect God's way of ruling as a shepherd king who takes the form of a servant (Phil 2:7), wearing a crown of thorns.

According to Gen 2:15, our role within creation is to serve and to keep God's garden, the earth. "To serve," often translated "to till," invites us again to envision ourselves as servants, while "to keep" invites us to take care of the earth as God keeps and cares for us (Num 6:24-26).

We are called to name the animals (Gen 2:19-20). As God names Israel and all creation (Pss 147:4; Isa 40:26, 43:1) and as the shepherd calls by name each sheep (John 10:3), naming unites us in a caring relationship. Further, we are to live within the covenant God makes with every living thing (Gen 9:12-17; Hos 2:18), and even with the day and night (Jer 33:20). We are to love the earth as God loves us.

We are called to live according to God's wisdom in creation (Prov 8), which brings together God's truth and goodness. Wisdom, God's way of governing creation, is discerned in every culture and era in various ways. In our time, science and technology can help us to discover how to live according to God's creative wisdom.

Such caring, serving, keeping, loving, and living by wisdom sum up what is meant by acting as God's stewards of the earth. God's gift of responsibility for the earth dignifies humanity without debasing the rest of creation. We depend upon God, who places us in a web of life with one another and with all creation.

II. The Urgency

A. Sin and Captivity

Not content to be made in the image of God (Gen 3:5; Ezek 28:1-10), we have rebelled and disrupted creation. As did the people of ancient Israel, we experience nature as an instrument of God's judgment (cf., Deut 11:13-17; Jer 4:23-28). A disrupted nature is a judgment on our unfaithfulness as stewards.

Alienated from God and from creation, and driven to make a name for ourselves (Gen 11:4), we become captives to demonic powers and unjust institutions (Gal 4:9; Eph 6:12; Rev 13:1-4). In our captivity, we treat the earth as a boundless warehouse and allow the powerful to exploit its bounties to their own ends (Amos 5:6-15). Our sin and captivity lie at the roots of the current crisis.

B. The Current Crisis

The earth is a planet of beauty and abundance; the earth system is wonderfully intricate and incredibly complex. But today living creatures, and the air, soil, and water that support them, face unprecedented threats. Many threats are global; most stem directly from human activity. Our current practices may so alter the living world that it will be unable to sustain life in the manner we know.

Twin problems--excessive consumption by industrialized nations, and relentless growth of human population worldwide--jeopardize efforts to achieve a sustainable future. These problems spring from and intensify social injustices. Global population growth, for example, relates to the lack of access by women to family planning and health care, quality education, fulfilling employment, and equal rights.

Processes of environmental degradation feed on one another. Decisions affecting an immediate locale often affect the entire planet. The resulting damages to environmental systems are frightening:

- depletion of non-renewable resources, especially oil;
- loss of the variety of life through rapid destruction of habitats;
- erosion of topsoil through unsustainable agriculture and forestry practices;
- pollution of air by toxic emissions from industries and vehicles, and pollution of water by wastes;
- increasing volumes of wastes; and
- prevalence of acid rain, which damages forests, lakes, and streams.

Even more widespread and serious, according to the preponderance of evidence from scientists worldwide, are:

- the depletion of the protective ozone layer, resulting from the use of volatile compounds containing chlorine and bromine; and
- dangerous global warming, caused by the buildup of greenhouse gases, especially carbon dioxide.

The idea of the earth as a boundless warehouse has proven both false and dangerous. Damage to the environment eventually will affect most people through increased conflict over scarce resources, decline in food security, and greater vulnerability to disease.

Indeed, our church already ministers with and to people:

- who know firsthand the effects of environmental deterioration because they work for polluting industries or live near incinerators or waste dumps;
- who make choices between preserving the environment and damaging it further in order to live wastefully or merely to survive; and
- who can no longer make their living from forests, seas, or soils that are either depleted or protected by law.

In our ministry, we learn about the extent of the environmental crisis, its complexities, and the suffering it entails. Meeting the needs of today's generations for food, clothing, and shelter requires a sound environment. Action to counter degradation, especially within this decade, is essential to the future of our children and our children's children. Time is very short.

III. The Hope

A. The Gift of Hope
Sin and captivity, manifest in threats to the environment, are not the last word. God addresses our predicament with gifts of "forgiveness of sins, life, and salvation" (Luther, *Small Catechism*). By the cross and resurrection of Jesus Christ, God frees us from our sin and captivity, and empowers us to be loving servants to creation.

Although we remain sinners, we are freed from our old captivity to sin. We are now driven to God's promise of blessings yet to come. Only by God's promise are we no longer captives of demonic powers or unjust institutions. We are captives of hope (Zech 9:11-12). Captured by hope, we proclaim that God has made peace with all things through the blood of the cross (Col 1:15-20), and that the Spirit of God, "the giver of life," renews the face of the earth.

Captured by hope, we dream dreams and look forward to a new creation. God does not just heal this creation wounded by human sin. God will one day consummate all things in "new heavens and a new earth, where righteousness is at home" (2Pet 3:13). Creation--now in captivity to disruption and death--will know the freedom it awaits.

B. Hope in Action
We testify to the hope that inspires and encourages us. We announce this hope to every people, and witness to the renewing work of the Spirit of God. We are to be a herald here and now to the new creation yet to come, a living model.

Our tradition offers many glimpses of hope triumphant over despair. In ancient Israel, as Jerusalem was under siege and people were on the verge of exile, Jeremiah purchased a

plot of land (Jer 32). When Martin Luther was asked what he would do if the world were to end tomorrow, he reportedly answered, "I would plant an apple tree today." When we face today's crisis, we do not despair. We act.

IV. The Call to Justice

Caring, serving, keeping, loving, and living by wisdom--these translate into justice in political, economic, social, and environmental relationships. Justice in these relationships means honoring the integrity of creation, and striving for fairness within the human family.

It is in hope of God's promised fulfillment that we hear the call to justice; it is in hope that we take action. When we act interdependently and in solidarity with creation, we do justice. We serve and keep the earth, trusting its bounty can be sufficient for all, and sustainable.

A. Justice Through Participation
We live within the covenant God makes with all living things, and are in relationship with them. *The principle of participation means they are entitled to be heard and to have their interests considered when decisions are made.*

Creation must be given voice, present generations and those to come. We must listen to the people who fish the sea, harvest the forest, till the soil, and mine the earth, as well as to those who advance the conservation, protection, and preservation of the environment.

We recognize numerous obstacles to participation. People often lack the political or economic power to participate fully. They are bombarded with manipulated information, and are prey to the pressures of special interests. The interests of the rest of creation are inadequately represented in human decisions.

We pray, therefore, that our church may be a place where differing groups can be brought together, tough issues considered, and a common good pursued.

B. Justice Through Solidarity
Creation depends on the Creator, and is interdependent within itself. *The principle of solidarity means that we stand together as God's creation.*

We are called to acknowledge this interdependence with other creatures and to act locally and globally on behalf of all creation. Furthermore, solidarity also asks us to stand with the victims of fire, floods, earthquakes, storms, and other natural disasters.

We recognize, however, the many ways we have broken ranks with creation. The land and its inhabitants are often disenfranchised by the rich and powerful. The degradation of the environment occurs where people have little or no voice in decisions -- because of racial, gender, or economic discrimination. This degradation aggravates their situation and swells the numbers of those trapped in urban or rural poverty.

We pray, therefore, for the humility and wisdom to stand with and for creation, and the fortitude to support advocates whose efforts are made at personal risk.

C. Justice Through Sufficiency
The earth and its fullness belong to the Lord. No person or group has absolute claim to the earth or its products. *The principle of sufficiency means meeting the basic needs of all humanity and all creation.*

In a world of finite resources, for all to have enough means that those with more than enough will have to change their patterns of acquisition and consumption. Sufficiency charges us to work with each other and the environment to meet needs without causing undue burdens elsewhere.

Sufficiency also urges us to care for arable land so that sufficient food and fiber continue to be available to meet human needs. We affirm, therefore, the many stewards of the land who have been and are conserving the good earth that the Lord has given us.

We recognize many forces that run counter to sufficiency. We often seek personal fulfillment in acquisition. We anchor our political and economic structures in greed and unequal distribution of goods and services. Predictably, many are left without resources for a decent and dignified life.

We pray, therefore, for the strength to change our personal and public lives, to the end that there may be enough.

D. Justice Through Sustainability
The sabbath and jubilee laws of the Hebrew tradition remind us that we may not press creation relentlessly in an effort to maximize productivity (Exod 20:8-11; Lev 25). *The principle of sustainability means providing an acceptable quality of life for present generations without compromising that of future generations.*

Protection of species and their habitats, preservation of clean land and water, reduction of wastes, care of the land--these are priorities. But production of basic goods and services, equitable distribution, accessible markets, stabilization of population, quality education, full employment--these are priorities as well.

We recognize the obstacles to sustainability. Neither economic growth that ignores environmental cost nor conservation of nature that ignores human cost is sustainable. Both will result in injustice and, eventually, environmental degradation. We know that a healthy economy can exist only within a healthy environment, but that it is difficult to promote both in our decisions.

The principle of sustainability summons our church, in its global work with poor people, to pursue sustainable development strategies. It summons our church to support U.S. farmers who are turning to sustainable methods, and to encourage industries to produce

sustainably. It summons each of us, in every aspect of our lives, to behave in ways that are consistent with the long-term sustainability of our planet.

We pray, therefore, for the creativity and dedication to live more gently with the earth.

V. Commitments of this Church

We of the Evangelical Lutheran Church in America answer the call to justice and commit ourselves to its principles--participation, solidarity, sufficiency, and sustainability. In applying the principles to specific situations, we face decisions made difficult by human limitation and sin. We act, not because we are certain of the outcome but because we are confident of our salvation in Christ.

Human behavior may change through economic incentive, guilt about the past, or fear about the future. But as people of biblical faith, who live together in trust and hope, our primary motivation is the call to be God's caregivers and to do justice.

We celebrate the vision of hope and justice for creation, and dedicate ourselves anew. We will act out of the conviction that, as the Holy Spirit renews our minds and hearts, we also must reform our habits and social structures.

A. As Individual Christians
As members of this church, we commit ourselves to personal life styles that contribute to the health of the environment. Many organizations provide materials to guide us in examining possibilities and making changes appropriate to our circumstances.

We challenge ourselves, particularly the economically secure, to tithe environmentally. Tithers would reduce their burden on the earth's bounty by producing ten percent less in waste, consuming ten percent less in non-renewable resources, and contributing the savings to earthcare efforts. Environmental tithing also entails giving time to learn about environmental problems and to work with others toward solutions.

B. As a Worshipping and Learning Community
1. The Congregation as a Creation Awareness Center Each congregation should see itself as a center for exploring scriptural and theological foundations for caring for creation.

Awareness can be furthered by many already in our midst, for example: Native people, who often have a special understanding of human intimacy with the earth; scientists, engineers, and technicians, who help us to live by the wisdom of God in creation; experts in conservation and protection of the environment; and those who tend the land and sea. We also will learn from people suffering the severe impact of environmental degradation.

2. *Creation Emphases in the Church Year* Congregations have various opportunities during the year to focus on creation. Among these are Thanksgiving, harvest festivals, and blessings of fields, waters, and plants and animals. Many congregations observe

Earth Day or Soil and Water Stewardship Week. As a church body, we designate the Second Sunday after Pentecost as Stewardship of Creation Sunday, with appropriate readings (as a development of the traditional Rogationtide).

3. *Education and Communication* This church will encourage those who develop liturgical, preaching, and educational materials that celebrate God's creation. Expanded curricula, for use in the many contexts of Christian education, will draw upon existing materials. We will promote reporting on the environment by church publications, and encourage coverage of this church's environmental concerns in public media.

4. *Programs Throughout this Church* This church commends the environmental education taking place through synodical and regional efforts; camps and outdoor ministries; colleges, seminaries, and continuing education events; and the churchwide Hunger Program. We especially commend this church's Department for Environmental Stewardship in the Division for Church in Society, for its network of caregivers, its advice to church members and institutions on innovative caregiving, and its materials for use in environmental auditing.

C. As a Committed Community

As congregations and other expressions of this church, we will seek to incorporate the principles of sufficiency and sustainability in our life. We will advocate the enviromental tithe, and we will take other measures that work to limit consumption and reduce wastes. We will, in our budgeting and investment of church funds, demonstrate our care for creation. We will undertake environmental audits and follow through with checkups to ensure our continued commitment.

D. As a Community of Moral Deliberation

As congregations and other expressions of this church, we will model the principle of participation. We will welcome the interaction of differing views and experiences in our discussion of environmental issues such as:

- nuclear and toxic waste dumps;
- logging in ancient growth forests;
- personal habits in food consumption;
- farming practices;
- treatment of animals in livestock production, laboratory research, and hunting;
- land-use planning; and
- global food, development, and population questions.

We will examine how environmental damage is influenced by racism, sexism, and classism, and how the environmental crisis in turn exacerbates racial, gender, and class discrimination. We will include in our deliberation people who feel and suffer with issues, whose economic security is at stake, or who have expertise in the natural and social sciences.

We will play a role in bringing together parties in conflict, not only members of this church but also members of society at large. This church's widespread presence and credibility provide us a unique opportunity to mediate, to resolve conflict, and to move toward consensus.

E. As an Advocate
The principles of participation, solidarity, sufficiency, and sustainability will shape our advocacy--in neighborhoods and regions, nationally and internationally. Our advocacy will continue in partnership, ecumenically and with others who share our concern for the environment.

Advocacy on behalf of creation is most compelling when done by informed individuals or local groups. We will encourage their communication with governments and private entities, attendance at public hearings, selective buying and investing, and voting.

We will support those designated by this church to advocate at state, national, and international levels. We will stand with those among us whose personal struggles for justice put them in lonely and vulnerable positions.

1. *Private Sector* This church will engage in dialogue with corporations on how to promote justice for creation. We will converse with business leadership regarding the health of workers, consumers, and the environment. We will invite the insights and concerns of business leadership regarding responsible environmental actions. We will urge businesses to implement comprehensive environmental principles.

Government can use both regulations and market incentives to seek sustainability. We will foster genuine cooperation between the private and public sector in developing them.

2. *Public Sector* This church will favor proposals and actions that address environmental issues in a manner consistent with the principles of participation, solidarity, sufficiency, and sustainability.

These proposals and actions will address: excessive consumption and human population pressures; international development, trade, and debt; ozone depletion; and climate change. They will seek: to protect species and their habitats; to protect and assure proper use of marine species; and to protect portions of the planet that are held in common, including the oceans and the atmosphere.

This church will support proposals and actions to protect and restore, in the United States and Caribbean, the quality of:

- natural and human habitats, including seas, wetlands, forests, wilderness, and urban areas;
- air, with special concern for inhabitants of urban areas;
- water, especially drinking water, groundwater, polluted runoff, and industrial and municipal waste; and

- soil, with special attention to land use, toxic waste disposal, wind and water erosion, and preservation of farmland amid urban development.

This church will seek public policies that allow people to participate fully in decisions affecting their own health and livelihood. We will be in solidarity with people who directly face environmental hazards from toxic materials, whether in industry, agriculture, or the home. We will insist on an equitable sharing of the costs of maintaining a healthy environment.

This church will advance international acceptance of the principles of participation, solidarity, sufficiency, and sustainability, and encourage the United Nations in its caregiving role. We will collaborate with partners in the global church community, and learn from them in our commitment to care for God's creation.

Claiming the Promise

Given the power of sin and evil in this world, as well as the complexity of environmental problems, we know we can find no "quick fix"--whether technological, economic, or spiritual. A sustainable environment requires a sustained effort from everyone.

The prospect of doing too little too late leads many people to despair. But as people of faith, captives of hope, and vehicles of God's promise, we face the crisis.

We claim the promise of "a new heaven and a new earth" (Rev 21:1), and join in the offertory prayer (*Lutheran Book of Worship*, page 109): "Blessed are you, O Lord our God, maker of all things. Through your goodness you have blessed us with these gifts. With them we offer ourselves to your service and dedicate our lives to the care and redemption of all that you have made, for the sake of him who gave himself for us, Jesus Christ our Lord. Amen."

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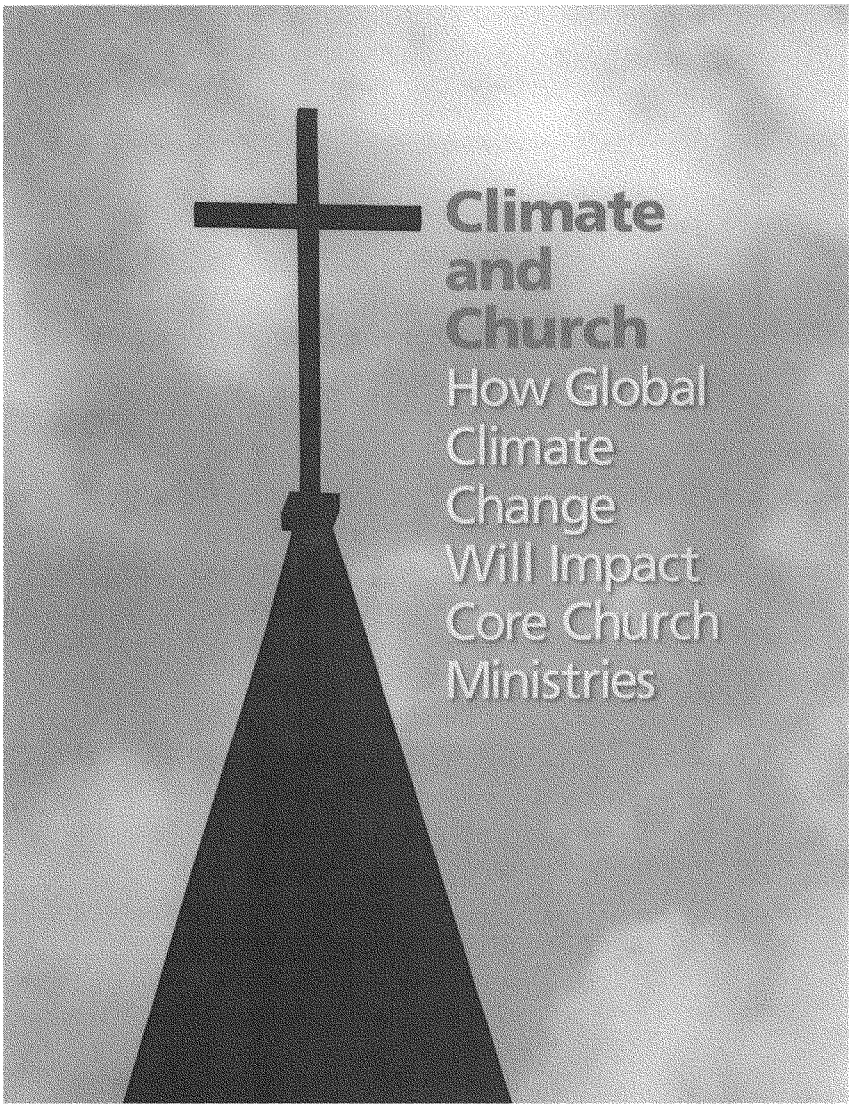
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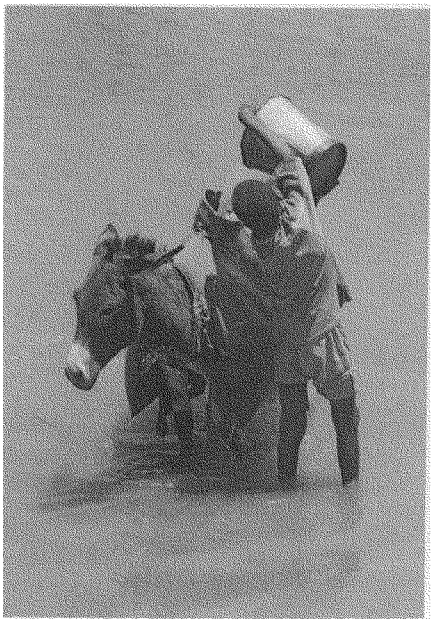

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EXECUTIVE SUMMARY

The impacts of global climate change threaten all of God's creation and will make it more difficult for people of faith to care for those in need. With expected increases in drought, storm intensity, disease, species extinction, and flooding, the impacts of global climate change will increase the lack of food, shelter, and water available, particularly to those living in or near poverty. Although global climate change will affect all human populations across the globe, it will hit those living in poverty the hardest because they depend on the surrounding physical environment to supply their needs and have limited ability to cope to climate variability and extremes. According to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, developing countries are expected to suffer the most from the negative impacts of climate change.[1]

Though many understand the devastating impacts that climate change will have on human communities around the world, few understand the impacts that climate change will have on core church ministries such as refugee resettlement, feeding the hungry, and disaster relief. The impacts of global climate change is already calling on the church to provide more financial resources and volunteer services to meet the growing needs of people in poverty in the U.S. and around the globe.

REFUGEE RESETTLEMENT. In order to maintain their current level of assistance, as global climate change increases the number of refugees, faith-based organizations and churches will need to dramatically increase their support to help refugees coming to the US. For instance, to maintain the same percentage level of support (40.6 percent) for refugees coming into the U.S., Church World Service and Lutheran Immigration and Refugee Service will have to support an additional 82,989 refugees each year, costing an estimated $278.4 million, six times the current budget for Church World Service and Lutheran Immigration and Refugee Service.

FOOD SECURITY. Through crop development and financial support many denominations and faith-based organizations provide food security for hundreds of thousands of people around the world. Fifteen faith-based organizations and denominations partner with the Foods Resource Bank (FRB), a non-profit program that works through projects in the U.S. to provide financial assistance to communities abroad, enabling them to become food secure.[2] In 2006, the FRB and its members contributed $2.5 million dollars to these impoverished communities.[3] Currently, National Council of Churches (NCC) affiliated denominations and communions account for more than 48 percent of FRB's funding. To meet the growing need in food security caused in part by global climate change, NCC-affiliated denominations and communions would collectively need to provide $2.24 million a year to developing countries, a substantial increase in current budget.

DISASTER RELIEF. As witnessed during Hurricanes Katrina and Rita, the faith community continues to serve as first responders to those impacted by disasters, providing essential food, water, and shelter to individuals who cannot fend for themselves. With an expected rise in severe hurricanes because of global climate change,[4] the

faith community will be asked to provide a greater amount of disaster relief, not just in terms of financial resources, but also in terms of human services such as temporary shelter, meals, volunteers for home and church repairs, counseling, and medical care. If, over the next 30 years, as the current trend indicates, more than half of hurricanes are category 4 and 5, to maintain the same level of financial support, the faith community will need to increase funding for relief and development by more than 42 percent. It is evident that the cost and damages by hurricanes will only increase, calling on the faith community to provide more support to congregations and communities in need.

The reality of the growing global climate change crisis calls for the church to be not just reactive in its response to global climate change but to prescribe to the world a need to reduce carbon emissions in order to prevent the catastrophic impacts of global climate change. Global climate change's impacts are already being felt and will continue to be felt, requiring the church and the larger global community to help impoverished communities adapt to the changes. However, these impacts can be lessened by reducing global carbon emissions globally and in our own communities. Churches can help mitigate carbon emissions by reducing their own carbon footprint and insist that businesses and governments do the same.

INTRODUCTION

While ultimate ownership of creation is God's, we have a responsibility to care for all of God's creation—both human and nonhuman. And as God's people, we have a responsibility to work for justice and protect the "least of these," those communities that are in need.

The impacts of global climate change threaten all of God's creation and will make it more difficult for people of faith to care for those in need. The increase in greenhouse gas emissions is warming the Earth to dangerous levels and will continue to result in increased drought, storm intensity, disease, species extinction, and flooding.[5] These impacts will increase the lack of food, shelter, and water available, particularly to those living in or near poverty. Although global climate change will affect all human populations across the globe, it will hit those living in poverty the hardest because they depend on the surrounding physical environment to supply their needs and have limited ability to cope to climate variability and extremes. Global climate change will reduce access to drinking water, limited access to food, and negatively impact human health particularly in countries such as Africa, Asia, and Latin America. According to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, developing countries are expected to suffer the most from the negative impacts of climate change.[6]

"And the LORD God took the man and put him into the garden of Eden to till it and to keep it."
Genesis 2:15

"The balance of evidence suggests that there is a discernible human influence on global climate."
Intergovernmental Panel on Climate Change

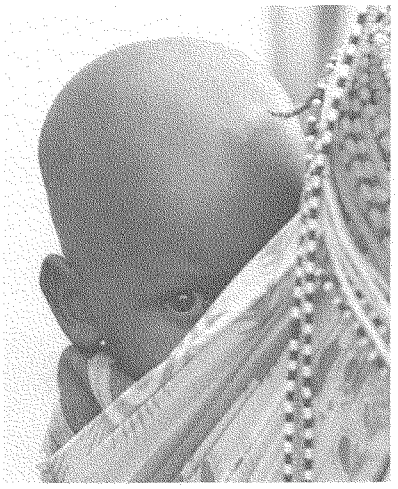
Churches, acting as the body and heart of Christ, remain firm in their dedication to feed the hungry, house the homeless, welcome the stranger, eradicate poverty, and rescue those in crisis. As evidenced in the Gulf Coast after Hurricane Katrina, the Church rises to the challenges of the day and provides great service and comfort to those in need. However, global climate change, because of its sweeping and devastating impacts, challenges the Church

as never before. Christians are called to help those in need, which will increase to unprecedented numbers as a result of global climate change.

In many ways, the impending crisis of global climate change represents a moral failure on our part as stewards of God's creation and harbingers of justice. The United States, and other industrialized nations contribute more carbon emissions than their developing neighbors.[7] And, developing countries will more acutely feel the impacts of our carbon emissions. Our responsibility as Christians, to be good stewards of God's creation and to work for justice, means that we must address global climate change with a determined heart, mind, and voice.

GLOBAL CLIMATE CHANGE IMPACTS ON CORE CHURCH MINISTRIES

Local Christian churches traditionally work to minister to those in need through programs such as soup kitchens, crisis centers, food pantries, homeless shelters, and senior visitation. The larger church, as Christian institutions, have broader ministries that include refugee resettlement, disaster relief, and addressing international poverty and hunger. Though many understand the devastating impacts that climate change will have on human communities around the world, few understand the impacts that climate change will have on these core church ministries. The impacts of global climate change calls on the church to provide more financial resources and volunteer services to meet the growing needs of people in poverty in the U.S. and around the globe.



GLOBAL CLIMATE CHANGE AND POVERTY

Climate change and poverty are intricately connected. Studies indicate that people in poverty around the world will be the least able to deal with the effects of climate change. Increased drought, flooding, and disease will only exasperate the already dire conditions of those living in poverty. While those living in poverty in the U.S. feel the squeeze of global climate change, the negative impacts of climate change fall hardest on the impoverished in developing nations. The faith community plays a critical role in addressing poverty, acting as a voice for the voiceless and providing financial assistance when possible. Climate change both undermines current assistance and increases the need for support in the U.S. and abroad.

In Ethiopia and Kenya, two of the world's most drought prone countries, children age 5 and under are 36-50 percent more likely to be malnourished if they were born during a drought. In Ethiopia, an additional 2 million children were malnourished in 2005. Drought areas in sub-saharan Africa could expand by 60-90 million hectares with these dry land zones suffering losses of approximately $26 billion dollars.

- The additional number of people affected by malnutrition could rise to 600 million by 2080.
- An additional 1.8 billion people could be living in a water scarce environment by 2080.
- Up to 330 million people being permanently/temporarily displaced through flood.
- An additional 220-400 million people could be exposed to malaria.

REFUGEE RESETTLEMENT

Historically, people flee and become refugees to avoid persecution, war, terrorism, extreme poverty, famine, and natural disasters. The faith community in the U.S. has responded by working to ensure that refugees arriving in the United States have the financial resources to resettle here and support their families. Because of a predicted rise in famine, natural disasters, sea levels, catastrophic flooding, and expanding deserts as a result of global climate change, refugee resettlement in the United States is projected to increase over the years.[8] Church communities, therefore, will be called upon to provide for settling refugees in greater measure.

The United Nations University calculates that there were 19.1 million environmental refugees in 2005[9] and according to the International Federation of Red Cross, climate change already causes more population displacement than war and persecution.[10] It is estimated that if global climate change continues as projected, there will be as many as 50 million refugees in the world by 2010.[11] In 2006, there were 8.4 million known refugees in the world.[12] Of those, 41,279 came and resettled in the US.[13] Assuming similar refugee acceptance rates and US recognition of environmental refugees, an estimated 245,700 environmental refugees will enter the U.S. annually beginning 2010.

The religious community provides a great deal of support for refugee resettlement in the U.S. For instance, the Lutheran Immigration and Refugee Service, the second biggest refugee organization in the US, resettles about 12,000 refugees per year.[14] Church World Service, a sister organization to the National Council of Churches that provides relief, development, and refugee assistance, resettled 4,768 refugees in 2006.[15] In total, these two organizations helped resettle 16,768 refugees in 2006, which is 40.6 percent of the total number of the 41,279 refugees resettled in the U.S.

"Do not neglect to show hospitality to strangers, for by doing that some have entertained angels without knowing it."
Hebrews 13:2

Environmental refugees are individuals displaced from their homes because of sea level rise, expanding deserts, catastrophic flooding, and other environmental concerns.

In 2006, Church World Service and Lutheran Immigration and Refugee Service spent an average of $2,791 for each refugee. However, according to the World Health Organization, total estimated costs of initial resettlement in the first four months is closer to $8,000 per refugee.[16] Much of the additional funding and support for refugees comes from local organizations and offices supported by local church and community groups.

In order to maintain their current level of assistance, as global climate change increases the number of refugees, faith-based organizations and churches will need to dramatically increase their support to help refugees coming

According to the United Nations Millennium Project Report (2005), more than 800 million people go to bed hungry every day, of which 300 million are children. More than 90 percent of these 300 million children are suffering long-term malnourishment and micronutrient deficiency. Every 3.6 seconds, another person dies of starvation and the large majority are children under the age of five. In addition, more than 40 percent of Africans do not even have the ability to obtain sufficient food on a day-to-day basis.

to the US. For instance, to maintain the same percentage level of support (40.6 percent) for refugees coming into the U.S., Church World Service and Lutheran Immigration and Refugee Service will have to support an additional 82,989 refugees each year, costing an estimated $278.4 million, six times the current budget for Church World Service and Lutheran Immigration and Refugee Service.

As followers of Christ, we are called to care for those who wish to make a new home, as we are all strangers in this world (1 Peter 2:11). However, working to address global climate change sooner rather than later will protect our brothers and sisters around the globe by reducing the need for them to be displaced from their homes and their cultures because of environmental crises.

CLIMATE CHANGE, HUNGER, AND AGRICULTURE

Jesus commands us to care for those who are the "least of these"—the hungry, the thirsty, the poor, and the vulnerable. Yet, the world is filled with people who go to bed hungry and spend their days in thirst. Unfortunately, global climate change will exacerbate the issues of hunger and lack of access to water. Food production will be affected by rainfall, flood, drought, and changing temperatures.[17] Access to water resources will also be impacted by global climate change. Food and water shortages will hit people in poverty, especially those in least developed countries, the hardest.

"For I was hungry and you gave me food, I was thirsty and you gave me something to drink, I was a stranger and you welcomed me... just as you did it to one of the least of these who are members of my family, you did it to me."
Matthew 25:35, 40

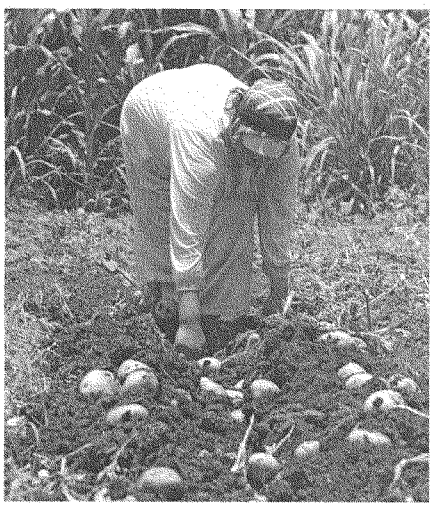
The Church has a long history of providing food, clothing, and shelter to those in developing countries. One of the primary areas of focus is food security, ensuring that people have a way to obtain the calories they need every day. Through crop development and financial support many denominations and faith-based organizations provide food security for hundreds of thousands of people around the world.

Fifteen faith-based organizations and denominations partner with the Foods Resource Bank (FRB), a non-profit program that works through growing projects in the U.S. to provide financial assistance to communities abroad, enabling them to become food secure.[18] In 2006, the FRB and its members contributed $2.5 million dollars to these impoverished communities. Of that money, $1.2 million was donated by NCC- affiliated denominations and communions, the majority of which went to African communities and assisted almost a half a million people in their efforts to achieve food security.[19]

FOOD SECURITY: AFRICA IN FOCUS The Intergovernmental Panel on Climate Change's Fourth Assessment predicts that by 2020 crops yields will decline by 50 percent in Africa,[20] further exacerbating an already dire situation. With increased drought, rising temperatures, and more erratic rainfall, the UN Development Program predicts up to 600 million more people will face malnutrition.[21] Semi-arid areas of sub-Saharan Africa, which have some of the highest concentrations of poverty in the world, will face the danger of potential productivity losses of 26 percent by 2060.[22] Because Africa's local food production is necessary to ensure health and food security for its people, reduced water availability and rising sea levels

as a result of global climate change will have life-threatening impacts. If rain-fed agriculture yields are reduced by 50 percent,[23] 263.25 million people whose food security and livelihoods depend upon this type of agriculture will be negatively affected.

In addition, agriculture currently accounts for 30 percent of Africa's gross domestic product (GDP) and 50 percent of Africa's total export value.[24] Seventy percent of Africa's population depends on agriculture for their livelihood. In addition, 90 percent of the rural population depends on rain-fed agriculture for income and food security (65 percent of Africa is considered rural).[25] Economists suggest that crop revenues could drop by 90 percent by the year 2100 as a result of climate change.[26] In a continent whose agricultural production accounts for 30 percent of its GDP, this would have devastating consequences.



According to the UN Development Program, up to 332 million people in coastal and low-lying areas globally could be displaced through increased flooding and tropical storm activity. Over 70 million Bangladeshis, 22 million Vietnamese, and six million Egyptians could be affected by global warming-related flooding.

Because of the high prevalence of food security problems on the continent, the faith community focuses on food assistance in Africa. In 2006, almost 400,000 people were assisted in Africa by more than $1.5 million in funds by FRB.[27] Of those assisted by FRB in Africa, more than half of them will experience severe crop devastation and loss of food security in the future, forcing individuals to possibly flee their native lands and become refugees. Since FRB spends $4.12 per person,[28] to maintain their same level of support , they will need to increase their spending to more than $2.9 million dollars, 187 percent higher than their current level of financial support.

Currently, NCC-affiliated denominations and communions account for more than 48 percent of FRB's funding. To meet the growing need in food security globally, NCC-affiliated denominations and communions would collectively need to provide $2.24 million a year to developing countries, a substantial increase in current budget.

More than 2.6 billion people, representing forty percent of the world's population, do not have basic sanitation, and more than one billion people still use unsafe sources of drinking water. Five million people, mostly children, die each year from water-borne diseases.[29] Communities around the world are already struggling and global climate change will only exasperate these impacts.

Africa food security issues and the example of FRB provides an illustration of how global climate change will financially impact church ministries that aim to provide food security for millions around the world. The grim reality of global climate change will put additional burdens on these important ministries, taxing financial resources and leaving churches with a larger role to fill in order to provide for those who are in need.

Africa's population is approximately 900 million people with 65 percent of Africa's population living in a rural area (approx. 585 million people) 90 percent of that rural population depends on rain-fed agriculture (approx. 526.5 million people).

Water scarcity is already a major problem for the world's poor. The number of people impacted by water scarcity is projected to increase from about 1.7 billion people today to around 5 billion people by 2025, independent of climate change.[30] Climate change is projected to further reduce water availability in many water scarce regions, particularly in the subtropics, due to increased frequency of droughts, increased evaporation, and changes in rainfall patterns and run-off. According to a recent (2007) United Nations Development report, an additional 1.8 billion people will face water stress by 2080, with large areas of South Asia and northern China facing a grave ecological crisis as a result of glacial retreat and changed rainfall patterns.[31]

GLOBAL CLIMATE CHANGE AND DISASTER RELIEF

The raw fuel for tropical storms is a warm sea, so scientists predict that global warming, by driving up ocean surface temperatures, will intensify Atlantic hurricanes and typhoons. The numbers of category 4 and 5 hurricanes have doubled since 1970[32] and the percentage of category 4 and 5 hurricanes have steadily increased and now account for 30 percent of hurricanes as compared to 20 percent in the 1970s.[33] As warmer waters increase hurricane intensity, the U.S. and the rest of the world will experience greater loss of life and property damage. A recent study shows that the total number of hurricanes may also be increasing.[34]

"For he has not despised or disdained the suffering of the afflicted one; he has not hidden his face from him but has listened to his cry for help." Psalm 22:24

Millions of individuals around the world live in coastal areas that are threatened by an increase in storm intensity. In the U.S., many communities along the coast are living in poverty, forced to live on marginal flood plain lands because of cheaper real estate. These individuals and families with limited income are less equipped to evacuate when storms approach and are at a substantial disadvantage financially during recovery and rebuilding efforts. Few people can forget the devastating images of more than 20,000 people stranded in the city of New Orleans in the aftermath of Hurricane Katrina in 2005.

In 2007, for the first time in history, two category 5 Atlantic hurricanes made landfall, causing thousands of people to be displaced from their homes and killing several hundred people.[35] With an increase in category 5 hurricanes, there is also a corresponding increase in lives lost and property damage. While a category 3 hurricane costs an average of about $1 billion in damages, a category 5 hur-

ricane, according to the Saffir-Simpson Intensity Scale, costs an average of $6 billion, about 6 times the financial costs of a category 3 storm.[36]

As witnessed during Hurricanes Katrina and Rita, the faith community continues to serve as first responders to those impacted by disasters, providing essential food, water, and shelter to individuals who cannot fend for themselves. With an expected rise in severe hurricanes, the faith community will be asked to provide a greater amount of disaster relief, not just in terms of financial resources, but also in terms of human services such as temporary shelter, meals, volunteers for home and church repairs, counseling, and medical care.

An average Category 5 hurricane that hits the U.S. costs $15.8 billion dollars. Because of extreme flooding in New Orleans, total costs for Hurricane Katrina, a category 3 storm once it hit the U.S. Gulf Coast, equaled $84 billion. After Hurricane Katrina hit the Gulf Coast in 2005, NCC-affiliated communions and denominations contributed significantly to hurricane relief efforts, with a total of $250 million given for recovery efforts.

If, over the next 30 years, as the current trend indicates, more than half of hurricanes are category 4 and 5, to maintain the same level of financial support, the faith community will need to increase funding for relief and development by more than 42 percent. It is evident that the cost and damages caused by hurricanes will only increase, calling on the faith community to provide more support to congregations and communities in need.

COSTS OF CATEGORY 5 HURRICANES

1935 Labor Day Hurricane $90 million[37]

1969 Hurricane Camille $8 billion[38]

1992 Hurricane Andrew $38.9 billion[39]

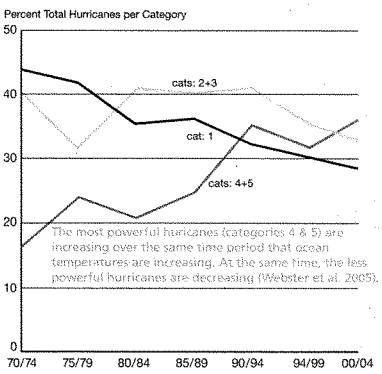
(dollars factored for inflation and are in 2007 US dollar equivalents)

RESPONDING TO GLOBAL CLIMATE CHANGE

Global climate change clearly impacts all of God's creation. Although human communities around the globe feel the effects of global climate change, least developed nations and people living in poverty disproportionately feel the impacts. The church community strives to especially serve these communities through ministries such as food assistance, disaster relief, and refugee resettlement. These church ministries will continue to keenly feel the impacts of global climate change and people of faith serving these communities will be looked upon to provide more financial assistance and volunteer services to those in need.

The reality of this growing crisis calls for the church to be not just reactive in its response to global climate change but to prescribe to the world a need to reduce carbon emissions in order to prevent the catastrophic impacts of

HIGHER PERCENT OF CATEGORY 4 & 5 HURRICANES WORLDWIDE

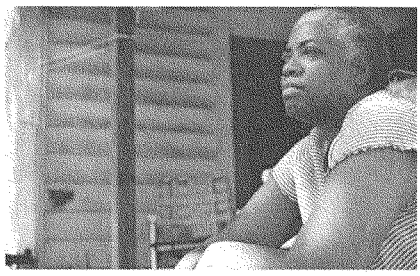


The most powerful huricanes (categories 4 & 5) are increasing over the same time period that ocean temperatures are increasing. At the same time, the less powerful hurricanes are decreasing (Webster et al. 2005).

THE INJUSTICE OF GLOBAL CLIMATE CHANGE ON COMMUNITIES OF COLOR

Global climate change will be more keenly felt by communities of color.[40] As Christians, we are called to work for justice and correct the injustices of global climate change.

- Asthma will increase because of global climate change and will disproportionately impact African Americans, which are nearly three times as likely to be hospitalized or killed by asthma than whites.
- African Americans are disproportionately impacted by deaths during heat waves and from worsened air pollution. Future heat waves will be most lethal in the inner cities of the northern half of the country, such as New York City, Detroit, Chicago, and Philadelphia, where many African American communities are located.
- Unemployment and economic hardship associated with climate change will fall most heavily on the African American community.
- According to a report from the Congressional Black Caucus Foundation, reducing emissions to fifteen percent below 1990 levels would mitigate these adverse health effects of climate change, while concomitantly decreasing air pollution related mortality, saving an estimated 10,000 African American lives per year by 2020.



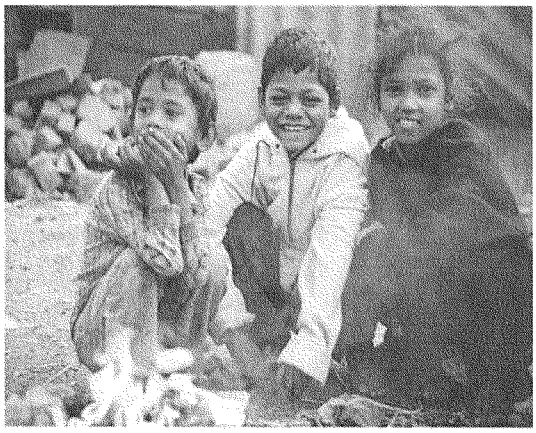
global climate change. Global climate change's impacts are already being felt and will continue to be felt, requiring the church and the larger global community to help impoverished communities adapt to the changes. However, these impacts can be lessened by reducing global carbon emissions globally and in our own communities. Churches can help mitigate carbon emissions by reducing their own carbon footprint and insist that businesses and governments do the same.

Christians are indeed called to respond to those in need. As Christians, we are also called to protect God's creation from harm and to work towards a just and sustainable world. Addressing global climate change in our own churches, communities, and nation will bring about the justice and protection of God's creation that we seek.

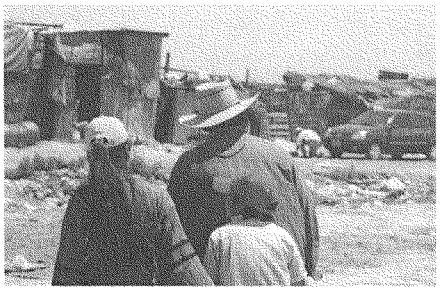
THE IMPACTS OF GLOBAL CLIMATE CHANGE ON THE ELDERLY

The elderly, who are particularly vulnerable to changes in the environment, will, according to studies be disproportionately impacted by global climate change both here in the U.S. and abroad. The National Institute of Health and the Center for Disease Control are preparing for these climate impacts, which include: heat waves and noxious air (resulting from increased carbon dioxide in the atmosphere) as well as droughts, floods, and extreme weather events. In 2003, a heat wave killed nearly 15,000 people in France most of them elderly[41] and recent heat waves in the U.S. have killed hundreds of elderly around the country. Projections have indicated that if a similar heat wave to the one in Europe in 2003 were to hit the United States, more than 3,000 people would die in New York City in a day and thousands more in big cities across the country. The elderly in the U.S. and abroad are most vulnerable to the impacts of climate change and as the effects become more significant this age group will need assistance to cope.[42]

THE IMPACTS OF GLOBAL CLIMATE CHANGE ON YOUTH



Today's youth will be left with a crippled Earth if we fail to take action to curb our carbon emissions and prevent catastrophic climate change. Though scientists are just beginning to understand the impacts of climate change on the world's youth, early reports indicate that climate change will enhance the factors that already threaten children's health. Worsening air quality, extreme weather events, and more frequent and intense heat stress events all burden children disproportionately. Worsening air quality leads to a higher incidence of asthma. Extreme weather events threaten the lives of children who are more vulnerable to weather extremes, especially those living in developing countries who don't have the resources to escape impending disaster. Heat stress also overtakes young children whose bodies are unable to adjust as easily to changing temperature and who are unable to communicate that they are uncomfortable and overheating.[63]



Note: The calculations and projections referenced in this paper are estimates and are intended to provide a general understanding of the impacts of climate change on the churches ministries. This document is meant to serve as an educational piece for National Council of Churches communions and its members and is subject to change based on findings in the scientific community.

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A Social Statement on:

Sufficient, Sustainable Livelihood for All

Adopted by a more than two-thirds majority vote by the sixth Churchwide Assembly of the Evangelical Lutheran Church in America, meeting in Denver, Colorado, August 16-22, 1999.

Economic life pervades our lives—the work we do, the income we receive, how much we consume and save, what we value, and how we view one another. An economy (*oikonomia* or "management of the household") is meant to meet people's material needs. The current market-based economy does that to an amazing degree; many are prospering as never before. At the same time, others continue to lack what they need for basic subsistence. Out of deep concern for those affected adversely, we of the Evangelical Lutheran Church in America here assess economic life today in light of the moral imperative to seek ***sufficient, sustainable livelihood for all.***

To an unprecedented degree, today's market economy has become global in scope, intensity, and impact. Common brand names appear throughout the world. Many companies based in the United States generate most of their revenues and profits abroad. Daily foreign exchange trading has increased a hundredfold over the past quarter century. Billions of dollars of capital can flow out of one country and into another with a few computer keystrokes. This economic globalization has brought new kinds of businesses, opportunities, and a better life for many. It also has resulted in increasing misery for others. Intensive global competition can force a company to relocate if it is to survive—generating jobs elsewhere, while leaving behind many workers who lose their jobs. Sudden shifts in globalized capital and financial markets can dramatically affect the economic wellbeing of millions of people, for good or for ill.

Human beings are responsible and accountable for economic life, but people often feel powerless in the face of what occurs. Market-based thought and practices dominate our world today in ways that seem to eclipse other economic, social, political, and religious perspectives. To many people, the global market economy feels like a free-running system that is reordering the world with few external checks or little accountability to values other than profit. Economic mandates often demand sacrifices from those least able to afford them. When any economic system and its effects are accepted without

question—when it becomes a "god-like" power reigning over people, communities, and creation—then we face a central issue of faith.

The Church confesses

If the economic arena becomes a reigning power for us, the question arises: in what or whom shall we place our trust and hope? The First Commandment is clear: "You shall have no other gods before me" (Exodus 20:3). Or as Jesus said, "You cannot serve God and wealth" (Matthew 6:24c, Luke 16:13). To place our trust in something other than God is the essence of sin. It disrupts our relationships with God, one another, and the rest of creation, resulting in injustices and exploitation: "For from the least to the greatest of them, everyone is greedy for unjust gain" (Jeremiah 6:13).

As a church we confess that we are in bondage to sin and submit too readily to the idols and injustices of economic life. We often rely on wealth and material goods more than God and close ourselves off from the needs of others. Too uncritically we accept assumptions, policies, and practices that do not serve the good of all.

Our primary and lasting identity, trust, and hope are rooted in the God we know in Jesus Christ. Baptized into Christ's life, death, and resurrection, we receive a new identity and freedom, rather than being defined and held captive by economic success or failure. In the gathered community of Christ's Body, the Church, we hear the Word and partake of the Supper, a foretaste of the fullness of life promised by Jesus, "the bread of life" (John 6:35). Through the cross of Christ, God forgives our sin and frees us from bondage to false gods. Faith in Christ fulfills the First Commandment. We are called to love the neighbor and be stewards in economic life, which, distorted by sin, is still God's good creation.

God who "executes justice for the oppressed, who gives food to the hungry" (Psalm 146:7) is revealed in Jesus, whose mission was "to bring good news to the poor . . . release to the captives and recovery of sight to the blind, to let the oppressed go free, to proclaim the year of the Lord's favor" (Luke 4: 18-19). The kingdom of God he proclaimed became real through concrete acts of justice: feeding people, freeing them from various forms of bondage, embracing those excluded by the systems of his day, and calling his followers to a life of faithfulness to God.

God's reign is not a new system, a set of prescriptive laws, or a plan of action that depends on what we do. Nor is it a spiritual realm removed from this world. In Jesus Christ, God's reign intersects earthly life, transforming us and how we view the systems of this world. Our faith in God provides a vantage point for critiquing any and every system of this world, all of which fall short of what God intends. Human impoverishment, excessive accumulation and consumerism driven by greed, gross economic

disparities, and the degradation of nature are incompatible with this reign of God.

Through human decisions and actions, God is at work in economic life. Economic life is intended to be a means through which God's purposes for humankind and creation are to be served. When this does not occur, as a church we cannot remain silent because of who and whose we are.

Our obligation and ongoing tensions

Based on this vantage point of faith, "***sufficient, sustainable livelihood for all***" is a benchmark for affirming, opposing, and seeking changes in economic life. Because of sin we fall short of these obligations in this world, but we live in light of God's promised future that ultimately there will be no hunger and injustice. This promise makes us restless with less than what God intends for the world. In economic matters, this draws attention to:

- the scope of God's concern "**for all**,"
- the means by which life is sustained "**livelihood**,"
- what is needed "**sufficiency**," and
- a long-term perspective "**sustainability**."

These criteria often are in tension with one another. What benefits people in one area, sector, or country may harm those elsewhere. What is sufficient in one context is not in another. What is economically sufficient is not necessarily sustainable. There are difficult and complex trade-offs and ambiguities in the dynamic processes of economic life. As believers, we are both impelled by God's promises and confronted with the practical realities of economic life. We often must choose among competing claims, conscious of our incomplete knowledge, of the sin that clouds all human judgments and actions, *and* of the grace and forgiveness given by Christ.

Economic assumptions can conflict with what we as a church confess. Who we are in Christ places us in tension with priorities given to money, con sumption, competition, and profit in our economic system.

- While autonomy and self-sufficiency are highly valued in our society, as people of faith we confess that we depend on God and are interdependent with one another. Through these relationships we are nurtured, sustained, and held accountable.

- While succeeding or making something of themselves is what matters to many in economic life, we confess that in Christ we are freely justified by grace through faith rather than by what we do.

- While a market economy emphasizes what individuals want and are willing and able to buy, as people of faith we realize that what human beings *want* is not necessarily what they *need* for the sake of life.

- While a market economy assumes people will act to maximize their own interests, we acknowledge that what is in our interest must be placed in the context of what is good for the neighbor.

- While competitiveness is key to economic success, we recognize that intense competitiveness can destroy relationships and work against the reconciliation and cooperation God desires among people.

- While economic reasoning assumes that resources are scarce relative to people's wants, we affirm that God promises a world where there is enough for everyone, if only we would learn how to use and share what God has given for the sake of all.

- While economic growth often is considered an unconditional good, we insist that such growth must be evaluated by its direct, indirect, short-term, and long-term effects on the wellbeing of all creation and people, especially those who are poor.

When we pray in the Lord's Prayer, "***Give us this day our daily bread,***" we place ourselves in tension with economic assumptions of our society. Rather than being self-sufficient, we need and depend on what God *gives* or provides through people, practices, and systems. "*Daily bread*" is not earned by efforts of individuals alone, but is made possible through a variety of relationships and institutions.[1] God gives in ways that expand our notions of who "*us*" includes, from people close at hand to those around the globe. In stark contrast to those who seek unchecked accumulation and profit, our attention is drawn to those who are desperate for what will sustain their lives for just *this day*.

For all: especially those living in poverty

"For all" refers to the whole household of God—all people and creation throughout the world. We should assess economic activities in terms of how they affect "all," especially people living in poverty.

We tend to view economic life by how it affects us personally. The cross of Christ challenges Christians to view this arena through the experience of those of us who are impoverished, suffering, broken, betrayed, left out, without hope. Through those who are "despised" and "held of no account" (Isaiah 53:3) we see the crucified Christ (Matthew 25:31-46), through whom God's righteousness and justice are revealed. The

power of God's suffering, self-giving love transforms and challenges the Church to stand with all who are overlooked for the sake of economic progress or greed. Confession of faith ought to flow into acts of justice for the sake of the most vulnerable.

Outrage over the plight of people living in poverty is a theme throughout the Bible. The poor are those who live precariously between subsistence and utter deprivation. It is not poor people them selves who are the problem, but their lack of access to the basic necessities of life. Without such, they cannot maintain their human dignity. Strong themes in Scripture indicate that people are poor because of circumstances that have afflicted them (such as "aliens, orphans, widows"), or because of the greed and unjust practices of those who "trample on the poor" (Amos 5:11). The basic contrast is between the weak and the greedy. The psalmist decries that "the wicked draw the sword and bend their bows to bring down the poor and needy" (Psalm 37:14). The prophet rails against those "who write oppressive statutes to turn aside the needy from justice" (Isaiah 10:1-2). Their moral problem is that they have followed greed rather than God. As a result, the poor lose their basic productive resource (their land), and fall into cycles of indebtedness. Poverty is a problem of the whole human community, not only of those who are poor or vulnerable.

In relation to those who are poor, Martin Luther's insights into the meaning of the commandments against killing, stealing, and coveting are sobering. We violate "you shall not kill" when we do not help and support others to meet their basic needs. As Luther explained, "If you see anyone suffer hunger and do not feed [them], you have let [them] starve."[2] "To steal" can include "taking advantage of our neighbor in any sort of dealing that results in loss to him [or her] . . . wherever business is transacted and money is exchanged for goods or labor."[3] "You shall not covet" means "God does not wish you to deprive your neighbor of anything that is [theirs], letting [them] suffer loss while you gratify your greed."[4] Related Hebraic laws called for leaving produce in the fields for the poor (Deuteronomy 24:21), a periodic cancellation of debts (Deuteronomy 15:1), and a jubilee year in which property was to be redistributed or restored to those who had lost it, so that they might again have a means of livelihood (Leviticus 25).

Today, well over a billion people in the world are deprived of what they need to meet their basic needs. Far more lack clean water, adequate sanitation, housing, or health services. They use whatever limited options are available to them in their daily struggle to survive. Thousands die daily. Millions pursue economic activities that are part of the underground or informal economy, and are not counted in economic statistics. Children often have no option but to labor under unjust conditions to provide for themselves and their families. Political struggles, militarism, and warfare add to this travesty, displacing masses of people from their homes.[5] In many of the poorest countries, incomes continue to decline, and people subsist on less and less. Although most of the impoverished live in developing countries, where their numbers continue to grow at alarming rates, many millions are in the industrial ized countries. Millions of poor people live in communities

in the United States and the Caribbean where the Evangelical Lutheran Church in America is present.

Developing countries that have opened their economies to global markets have generally reduced poverty over time more than those that have not, but the terms of trade often work to the disadvan tage of developing countries. Seeking more just exchanges "for all" through investment and trade is a significant challenge. The danger is that less developed parts of the world, or less powerful groups within a country, will be exploited or excluded from participation in global markets.

When a developing country becomes heavily indebted, the poorest are usually the most adversely affected. A huge share of a country's income must be used to pay off debt, which may have been incurred unjustly or under corrupt rulers. Structural adjustment programs to pay off debt typically divert funds from much needed educational, health, and environmental efforts, and from infrastruc tures for economic development.

God stands in judgment of those in authority who fall short of their responsibility, and is moved with compassion to deliver the impoverished from all that oppresses them: "Give justice to the weak and the orphan; maintain the right of the lowly and the destitute" (Psalm 82:3). The rich are expected to use wealth to benefit their neighbors who live in poverty here and throughout the world.

In light of these realities, ***we commit ourselves*** as a church [6] and urge members to:

- address creatively and courageously the complex causes of poverty;
- provide opportunities for dialogue, learning, and strategizing among people of different economic situations and from different regions who are harmed by global economic changes;
- give more to relieve conditions of poverty, and invest more in initiatives to reduce poverty.

We call for:

- scrutiny of how specific policies and practices affect people and nations that are the poorest, and changes to make policies of economic growth, trade, and investment more beneficial to those who are poor;
- efforts to increase the participation of low-income people in political and civic life, and citizen vigilance and action that challenges governments and other sectors when they become captive to narrow economic interests that do not represent the good of all;
- shifts throughout the world from military expenditures to purposes that serve the needs of low-income people;

- support for family planning and enhanced opportunities for women so that population pressures might be eased; [7]
- reduction of overwhelming international debt burdens in ways that do not impose further deprivations on the poor, and cancellation of some or all debt where severe indebtedness immobilizes a country's economy;
- investments, loan funds, hiring practices, skill training, and funding of micro-enterprises and other community development projects that can empower low-income people economically.

Livelihood: vocation, work, and human dignity

Vocation: Our calling from God begins in the waters of Baptism and is lived out in a wide array of settings and relationships. Freed through the Gospel, we are to serve others through arenas of responsibility such as family, work, and community life. Although we continue to be ensnared in the ambiguities and sin of this world, our vocation is to seek what is good for people and the rest of creation in ways that glorify God and anticipate God's promised future.

"Livelihood" designates our means of subsistence or how we are supported economically. This occurs through paid jobs, self-employment, business ownership, and accumulated wealth, as well as through support of family, community networks, and government assistance.

Strong families, neighborhoods, and schools should support and help prepare persons for livelihood. Churches, businesses, financial institutions, government, and civil society also play key roles. Through these relationships people can be enabled and obligated to pursue their livelihoods as they are able. When these infrastructures for livelihood are absent, weak, or threatened (as they are for many today), people are more likely to be impoverished materially, emotionally, or spiritually.

Through these relationships and structures, individuals can learn important virtues, such as:

- trust, accountability, and fidelity in relationships;
- discipline, honesty, diligence, and responsibility in work;
- frugality, prudence, and temperance in the use of resources;
- compassion and justice toward other people and the rest of creation.

These virtues, along with perspectives and skills acquired through education and training, make it more likely that individuals will be able to flourish in their livelihood.

We commit ourselves as a church and urge members to:

- develop God-given capacities and provide stable, holistic, loving development of children and youth through families, neighborhoods, congregations, and other institutions;
- support and encourage one another as we live out our vocation in ways that serve the neighbor and contribute to family and community vitality;
- pray and act to provide livelihood for ourselves and others through the institutions of our day, trusting in God's providential care for all.

We call for:

- policies that promote stable families, strong schools, and safe neighborhoods;
- addressing the barriers individuals face in preparing for and sustaining a livelihood (such as lack of education, transportation, child care, and health care).

Work: In Genesis, work is to be a means through which basic needs might be met, as human beings "till and keep" the garden in which God has placed them (Genesis 2:15). Work is seen not as an end in itself, but as a means for sustaining humans and the rest of creation. Due to sin, the work God gives to humans also becomes toil and anguish (Genesis 3:17,19). Injustice often deprives people of the fruits of their work (Proverbs 13:23), which benefits others instead.

God calls people to use their freedom and responsibility, their capacities and know-how to participate productively in God's world. As stewards of what God has entrusted to us, we should use available resources to generate jobs for the livelihood of more people, as well as to create capital for the growth needed to meet basic needs. Wealth should serve or benefit others so that they also might live productively.

What matters in many jobs today, rather than a sense of vocation, is the satisfaction of wants or desires that the pay from work makes possible. Work becomes a means toward increased consumerism. Many also feel a constant sense of being judged, having to measure up according to an unrelenting bottom line of productivity or profit. We are freed from such economic captivity by the forgiveness, new life, and dignity that is ours in Christ.

Competitive economic forces, as well as changing technologies and consumer demands, significantly affect the kinds of jobs available and the nature of work. Increased productivity and technological innovation continue to make some jobs obsolete, while creating others. A growing proportion of jobs are part-time, temporary, or contractual, without the longevity and security assumed in the past. Workers in the United States increasingly produce services rather than tangible goods. Many people choose to be self-

employed. A large number lose their jobs when companies merge, downsize, or move to areas with lower labor costs.

Job transitions can be enriching, but also painful. Feeling invested in one's job as a calling or being able to count on a future livelihood can be difficult when work is continually in flux. Many workers feel treated as if they are dispensable. Amid these changes, our faith reminds us that our security and livelihood rest ultimately on God. Our hope is grounded in God's promise—that people "shall long enjoy the work of their hands" (Isaiah 65:21). This gives us courage to ask why changes are occurring, to challenge forces of greed and injustice when they deny some people what they need to live, and, when necessary, to seek new possibilities for livelihood.

Therefore, ***we commit ourselves*** as a church and urge members to:

- deliberate together about the challenges people face in their work;
- counsel and support those who are unemployed, underemployed, and under going job transitions;
- provide skill and language enhancement training that will enable the most vulnerable (including new immigrants) to become better prepared for jobs.

We call for:

- public and private sector partnerships to create jobs and job retention pro grams;
- national economic policies that support and advance the goal of low unem ployment.

Human dignity: Human beings are created "in God's image" (Genesis 1:27) as social beings whose dignity, worth, and value are conferred by God. Although our identity does not depend on what we do, through our work we should be able to express this God-given dignity as persons of integrity, worth, and meaning. Yet work does not constitute the whole of our life. When we are viewed and treated only as workers, we tend to be exploited.

Employers have a responsibility to treat employees with dignity and respect. This should be reflected in employees' remuneration, benefits, work conditions, job security, and ongoing job training. Employees have a responsibility to work to the best of their potential in a reliable and responsible manner. This includes work habits, attitudes toward employers and co-workers, and a willingness to adapt and prepare for new work situations. No one should be coerced to work under conditions that violate their dignity or freedom, jeopardize their health or safety, result in neglect of their family's wellbeing, or provide unjust compensation for their labor.

Our God-given dignity in community means that we are to participate actively in decisions that impact our lives, rather than only passively accept decisions others make for us. People should be involved in decision making that directly affects their work. They should also be free to determine their lives independent of particular jobs. Public policy can provide economic and other conditions that protect human freedom and dignity in relation to work.

Power disparities and competing interests are present in most employment situations. Employers need competent, committed workers, but this does not necessarily presume respect for the personal lives and needs of individual workers. Individual workers depend on the organization for employment as their means of livelihood, but this does not necessarily presume respect for the organization's interest and goals. Management and employees move toward justice as they seek cooperative ways of negotiating these interests when they conflict. Because employees often are vulnerable and lack power in such negotiations, they may need to organize in their quest for human dignity and justice. When this occurs, accurate information and fair tactics are expected of all parties involved.

We commit ourselves as a church to:

- hire without discriminating on the basis of race, ethnicity, gender, age, disabilities, sexual orientation, or genetic factors;
- compensate all people we call or employ at an amount sufficient for them to live in dignity;
- provide adequate pension and health benefits, safe and healthy work conditions, sufficient periods of rest, vacation, and sabbatical, and family-friendly work schedules;
- cultivate participatory workplaces, support the right of employees to organize for the sake of better working conditions and to engage in collective bargaining, and refrain from inten tionally undercutting union organizing activities, or from permanently replacing striking workers.

We call for:

- other employers to engage in similar practices;
- government enforcement of regulations against discrimination, exploitative work conditions and labor practices (including child labor), and for the right of workers to organize and bargain collectively;
- public policies that ensure adequate social security, unemployment insur ance, and health care coverage;
- a minimum wage level that balances employees' need for sufficient income with what would be significant negative effects on overall employment;
- tax credits and other means of supplementing the insufficient income of low-

paid workers in order to move them out of poverty.

Sufficiency: enough, but not too much

"Sufficiency" means adequate access to income and other resources that enable people to meet their basic needs, including nutrition, clothing, housing, health care, personal development, and participa tion in community with dignity. God has created a world of sufficiency for all, providing us daily and abundantly with all the necessities of life.[8] In many countries, the problem is not the lack of resources, but how they are shared, distributed, and made accessible within society. Justice seeks fairness in how goods, services, income, and wealth are allocated among people so that they can acquire what they need to live.

Human need and the right to ownership often are in tension with each other. The biblical understand ing of stewardship is that what we have does not ultimately belong to us. We are called to be stewards of what God has given for the sake of all. This stewardship includes holding economic, political, and social processes and institutions responsible for producing and distributing what is needed for sufficiency for all. Private property is affirmed insofar as it serves as a useful, yet imperfect means to meet the basic needs of individuals, households, and communities.

Government is intended to serve God's purposes by limiting or countering narrow economic interests and promoting the common good. Paying taxes to enable government to carry out these and other purposes is an appropriate expression of our stewardship in society, rather than something to be avoided. Government often falls short of these responsibilities. Its policies can harm the common good and especially the most vulnerable in society. Governing leaders are to be held accountable to God's purposes: "May [they] judge your people with righteousness, and your poor with justice. . . . May [they] defend the cause of the poor of the people" (Psalm 72:2).

The lack of material sufficiency for some within the human community is itself a spiritual problem. "How does God's love abide in anyone who has the world's goods and sees a brother or sister in need and yet refuses to help?" (1 John. 3:17). Sin disrupts our bonds with and our sense of responsibility for one another. We live separated from others on the basis of income and wealth, and resent what others have. Huge disparities in income and wealth, such as those we face in this country, threaten the integrity of the human community.

Those who are rich and those who are poor are called into relationships of generosity from which each can benefit. Within the Church, those in need and those with abundance are brought together in Christ. On this basis and in the face of disparities in the church of his day, Paul calls for "a fair balance between your present abundance and their need, so that their abundance may be for your need." In so doing, "the one who

had much did not have too much, and the one who had little did not have too little." (2 Corinthians 8:9, 13-15).

God's mandate is clear. "Is not this the fast that I choose: to loose the bonds of injustice . . . and to break every yoke? Is it not to share your bread with the hungry, and bring the homeless poor into your house; when you see the naked to cover them, and not to hide yourself from your own kin?" (Isaiah 58:6-7). God's lavish, justifying grace frees us from self-serving preoccupations and calls us to a life of mutual generosity as we relate to all who are our neighbors. Faith becomes active through personal relationships, direct assistance, and wider policy changes in society.

Not enough: In the United States, tens of millions of people live in poverty, although many refuse to think of themselves as "poor." Some make daily choices as to which necessities they will have to live without. Many work part- or full-time, but on that basis, are still unable to lift their families out of poverty. Others are physically or mentally unable to work. Many lack the family, educational, and community support important for making good choices in their lives. Although those living in poverty are particularly visible in cities, their more hidden reality in suburban, small town, and rural areas can be just as painful. A greater proportion of people of color live in conditions of poverty. The poor are disproportionately women with their children.9 Systemic racism and sexism continue to be evident in the incidence of poverty.

In light of these realities, ***we commit ourselves*** as a church and urge members to:

- provide counsel, food, clothing, shelter, and money for people in need, in ways that respect their dignity;
- develop mutual, face-to-face, empowering relationships between people who have enough and people living in poverty, especially through congregational and synodical partnerships;
- advocate for public and private policies that effectively address the causes of poverty;
- generously support organizations and community-based efforts that enable low-income people to obtain more sufficient, sustainable livelihoods;
- continue working to eradicate racism and sexism.

We call for:

- government to provide adequate income assistance and related services for citizens, documented immigrants, and refugees who are unable to provide for their livelihood through employment;
- adequate, consistent public funding for the various low-income services non-profit organiza tions provide for the common good of all;
- scrutiny to ensure that new ways of providing low-income people with

assistance and services (such as through the private sector) do not sacrifice the most vulnerable for the sake of economic efficiency and profit;

- correction of regressive tax systems, so that people are taxed progressively in relation to their ability to pay;
- opposition to lotteries and other state-sponsored gambling because of how these regressive means of raising state revenues adversely affect those who are poor.[10]

Too much: Because most of us in the United States have far more than we need, we can easily fall into bondage to what we have. We then become like the young man Jesus encountered, whose bondage to his possessions kept him from following Jesus (Matthew 19:16-22; Mark 10:17-22; Luke 18:18-25).

We consume goods and use services to meet our needs. To increase consumption and expand sales, businesses stimulate ever new *wants*. Rather than human need shaping consumption, advertising and media promotion both shape and expand *wants*. Our very being becomes expressed through what we have or desire to possess. When consuming to meet basic needs turns into consumerism as an end in itself, we face a serious crisis of faith.

Endless accumulation of possessions and pursuit of wealth can become our god as we yearn for a life without limits. "Ah, you who join house to house, who add field to field, until there is room for no one but you" (Isaiah 5:8). Many look to material possessions and money as the means for participating in the "fullness of life," and thus become ever more dependent on economic transactions. But Jesus asks, "What does it profit them if they gain the whole world, but lose or forfeit themselves?" (Luke 9:25).

In the United States, people's worth and value tend to be measured by the size of their income and wealth. If judged by their multimillion dollar compensations, top corporate officers and sports superstars would seem to be the most highly valued in our society. Enormous disparities between their compensations and the average wages of workers are scandalous.

The economic power of large transnational corporations continues to grow, making some of them larger than many national economies. Along with this financial strength comes an inordinate potential to influence political decisions, local and regional economies, and democratic processes in society. The power they wield, enhanced through mergers and buyouts, can have positive effects, but it can also hold others captive to transnational corporate interests. The global community must continue to seek effective ways to hold these and other powerful economic actors more accountable for the sake of sufficient, sustainable livelihood for all.

In light of these realities, ***we commit ourselves*** as a church and urge members to:

- examine how we are in bondage to our possessions and can be freed to be faithful stewards of them;
- serious and ongoing consideration in our families and congregations of how to resist the allure of consumerism and live lives less oriented toward the accumulation of goods and financial assets;
- educate one another, beginning with the young, on how to deal responsibly with money, credit, and spending within one's means;
- give generously of our wealth (for example, through tithing and planned giving), especially for purposes that serve the needs of others.

We call for:

- corporate policies that lessen the disparities between compensations of top corporate executives and that of the workers throughout an organization;
- corporate governance that is accountable for the effects of a company's practices on workers, communities, and the environment here and throughout the world;
- scrutiny of the tax breaks, subsidies, and incentives many companies receive, to assure that they serve the common good;
- enforcement of laws to prevent the exercise of inordinate market power by large corporations;
- appropriate government regulatory reform so that governments can monitor private sector practices more effectively and efficiently in an ever-changing global economy.

Sustainability: of the environment, agriculture, and low-income communities

"Sustainability" is the capacity of natural and social systems to survive and thrive together over the long term. What is sufficient in providing for people's wants often is in tension with what can be sustained over time. Sustainability has implications for how we evaluate economic activity in terms of its ongoing effects on the wellbeing of both nature and human communities. Economic life should help sustain humans and the rest of creation—now and in the future.

Efforts to provide a sufficient livelihood must be sustainable economically. Individuals and families should not borrow more than they are able to pay back and still meet their future needs. Governments should not finance their spending by excessive borrowing or money creation that reduces national income and production, and threatens the liveli-

hood of future generations. Tax rates and government regulations must not be so burdensome as to stifle the production of the very goods and services people need to live.

"The earth is the Lord's and all that is in it, the world, and those who live in it" (Psalm 24:1). As God created, so God also sustains: "When you send forth your spirit . . . you renew the face of the ground" (Psalm 104:30). God makes a covenant with Noah, his descendants, and every living creature that they will not be destroyed (Genesis 9:8-17). In God's promise of "new heavens and a new earth . . . they shall build houses and inhabit them; they shall plant vineyards and eat their fruit" (Isaiah 65:17, 21). The vantage point of the kingdom of God motivates us to focus on more than short-term gains. Humans, called to be stewards of God's creation, are to respect the integrity and limits of the earth and its resources.

Sustaining the environment: The growth of economic activity during the twentieth century, and the industrialization and consumerism that fueled it, radically changed the relationship between humans and the earth. Too often the earth has been treated as a waste receptacle and a limitless storehouse of raw materials to be used up for the sake of economic growth, rather than as a finite, fragile ecological system upon which human and all other life depends.

Instead of being stewards who care for the long-term wellbeing of creation, we confess that we have depleted non-renewable resources, eroded topsoil, and polluted the air, ground, and water. Without appropriate environmental care, economic growth cannot be sustained. Caring for creation means that economic processes should respect environmental limits. "When we act interdependently and in solidarity with creation, we *do* justice. We serve and keep the earth, trusting its bounty can be sufficient for all, and sustainable." [11]

We commit ourselves as a church and urge members to:

- use less, re-use, recycle, and restore natural resources;
- plan for careful land use of church property, and receive and manage gifts of land and real estate in sustainable ways.

We call for:

- appropriate policies and regulations that help reverse environmental destruction;
- planning that accounts for the impact of regional growth on communities and ecosystems;
- ending subsidies for economic activities that use up non-renewable natural resources;

- companies to pay more fully for the wider social and environmental costs of what they produce; the development and use of more energy-efficient technologies.

Sustaining agriculture: Agriculture is basic to the survival and security of people throughout the world. Through the calling of agriculture, farmers produce the grain for our daily bread and the rest of our food supply. Without a bountiful and low-cost food supply, most Americans would not enjoy the livelihood they do. Farmers face the challenge of producing this food in ways that contribute to the regeneration of the land and the vitality of rural communities. At the same time, society as a whole must address the high levels of risk farmers face and the low prices they often receive. Changing agricultural policies and the growing power of large agribusiness corporations make this even more challenging.

We commit ourselves as a church and urge members to:

- pray for and support those who farm the land;
- pursue new ways for consumers to partner with small farmers in sharing the risks and yields of farming.

We call for:

- changes to assure that farmers will receive a greater proportion of the retail food dollar;
- adequate prices for agricultural products so that farmers can be compensated fairly for their labor and production costs;
- sustainable agricultural practices that protect and restore the regenerative capacities of the land, rather than practices that deplete the land (for ex ample, by measuring productivity only by short-term agricultural yields);
- more just work conditions for farm workers, especially immigrants, and opportunities for them to acquire their own land.

Sustainable development of low-income communities: In many low-income communities, disinvestment and neglect have taken their toll. In contrast to this are examples of sustainable community economic development that take into account the overall health and welfare of people, the environment, and the local economy. Such an approach creates jobs, prepares people for work, generates income that is re-circulated several times in the community, and sustains and renews environmental resources, all for the sake of a community's long-term viability.

Instead of a top-down approach focused on a community's deprivation and its lack of economic growth, effective community development draws upon its assets and empha-

sizes quality and diverse production. Effective policies build and enhance a community's social relationships, values, and institutions, which together can further economic development. Local residents determine the future of their community by initiating, supporting, and sustaining new projects. Their capacities, skills, and assets help shape the vision and plan for the community.

Through broad-based community organizing people can be mobilized to address economic and other issues that directly affect them. Government and the private sector also must invest in health, education, and infrastructures necessary for sustainable development. When people and resources are connected in ways that multiply their power and effectiveness, this will help bring about productive results and meaningful participation in community and economic life.

Therefore, ***we commit ourselves*** as a church and urge members to:

- learn about, participate in, and provide financial support for community economic development and organizing strategies that enhance the current and future wellbeing of communities and the environment;
- support community development corporations and locally-owned or pro ducer-owned cooperatives;
- integrate social values into our investment decisions, and invest more in socially responsible companies and funds that sustain businesses as well as workers, consumers, the environment, and low-income communities.

We call for:

- support of the above strategies by governments, financial institutions, and the wider society;
- alternatives to gambling as a means of community economic development;
- grants and low-interest loans that enable small companies and farms to get started, develop, and expand in order to provide livelihood for more people in low-income communities.

In conclusion, a vision renewed

Pursuing policies and practices that will lead to "sufficient, sustainable livelihood for all" is such a formidable challenge that to many it seems unrealistic or not worth the effort. The Church as an employer, property owner, consumer, investor, and community of believers can be as caught up in the reigning economic assumptions as the rest of society. But despite the Church's failings, through the Word and the sacraments, we are forgiven, renewed, and nourished. At the Table, we together receive the same bread and drink of the same cup. What we receive is sufficient; it does sustain us. We are strength-

ened to persist in the struggle for justice as we look forward to the coming of God's kingdom in all its fullness.

We are sent forth into the world to bear witness to God's promised reign. The world is the whole household of God that economic life is intended to serve. The Spirit of God expands our vision and transforms our priorities. We realize that we do not eat alone; everyone needs to eat. The multitudes present around God's global table become our neighbors rather than competitors or strangers. Empowered by God, we continue to act, pray, and hope that through economic life there truly will be sufficient, sustainable livelihood for all.

Implementing Resolutions

To recommend that the 1999 Churchwide Assembly of the Evangelical Lutheran Church in America adopt the following resolutions:

1. To adopt "Sufficient, Sustainable Livelihood for All" as a social statement of the Evangelical Lutheran Church in America, in accordance with "Policies and Procedures of the Evangelical Lutheran Church in America for Addressing Social Concerns" (1997);

2. To call upon members of this church to pray, work, and advocate that all might have a sufficient, sustainable livelihood, and to draw upon this statement in forming their own judgments and actions in their ministries in daily life;

3. To call upon our bishops, pastors, and other rostered leaders to give renewed attention to how Scripture, liturgy, preaching, hymnody, and prayers may express God's will for economic life and empower a faith active for justice, and to provide leadership in seeking economic justice in their communities;

4. To challenge all congregations, synods, and churchwide units to carry out the substance and spirit of this statement and intensify their work with various ecumenical, interfaith, and secular groups in pursuit of its commitments;

5. To encourage the education, service, and outreach ministries of this church in their work for economic justice;

6. To urge churchwide units and affiliated organizations (social ministry organizations, schools, colleges/ universities, and seminaries) to review and adjust their programs and practices in light of this social statement;

7. To direct the Division for Church in Society, in cooperation with other churchwide units, to provide leadership, consultation, and educational and worship resources on the basis of this statement, particu larly through the development of resources that interpret

this statement and develop its implications for different arenas of responsibility;

8. To direct the Division for Church in Society to expand its work in advocating for corporate social responsibility, in assisting with community economic development, and in public policy advocacy that furthers the various commitments made in this statement;

9. To call upon the members of this church to give generously to the World Hunger Appeal of the Evangeli cal Lutheran Church in America, so that the Lutheran World Federation, Lutheran World Relief, domestic hunger grants, and our partner ecumenical agencies might do more in helping to alleviate the causes and consequences of hunger, poverty, and injustice; and to call upon the members of this church to participate actively in supporting these and similar ministries; and

10. To call upon the educational institutions of this church schools, colleges, universities, seminaries, continuing education centers, camps, and retreat centers to develop programs and educational resources in light of this statement so people can be better prepared to respond to the challenges of economic life.

Notes

All Scriptural references are from the New Revised Standard Version Bible, Division of Christian Education of the National Council of the Churches of Christ in the United States of America (1989).

1. See Martin Luther's discussion of this in "The Large Catechism," The Book of Concord, Theodore G. Tappert, transl. and ed. (Philadelphia: Fortress Press, 1959), 430-431.

2. The Fifth Commandment as discussed in "The Large Catechism," BC, 391.

3. The Seventh Commandment as discussed in "The Large Catechism," BC, 395.

4. The Ninth and Tenth commandments, "The Large Catechism," BC, 406.

5. See the ELCA Message, "Immigration" (1998) and the ELCA Social Statement, "For Peace in God's World" (1995), available from the Division for Church in Society (Call 800-638-3522, extension 2712, for this and other ELCA statements and studies).

6. In this and subsequent "we commit" sections, "church" includes congregations, synods, the churchwide organization, and where relevant, this calls upon affiliated organizations such as seminaries, schools, colleges and universities, and social ministry organizations to adjust their policies and practices accordingly.

7. "Global population growth, for example, relates to the lack of access by women to family planning and health care, quality education, fulfilling employment, and equal rights." ELCA Social Statement, "Caring for Creation: Vision, Hope, and Justice" (1993), 3-4.

8. See how Luther explains the First Article of the Creed in the Small Catechism.

9. See the Women and Children Living in Poverty Strategy of the Evangelical Lutheran Church in America (800-638-3522, extension 2863).

10. See "Gambling: A Study for Congregations" (Division for Church in Society, 1998), 20-22.

11. "Caring for Creation . . . " (1993).

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Mr. MARKEY. Thank you, Bishop Holloway and to the other six witnesses. Watching you go one minute over, I went to religious school every day from age 6 to 26, 20 years in a row, and I don't have it within me to tell anyone wearing a collar when to stop. Okay, so I am disciplined that way. So I apologize to the other witnesses, but I was gripped by the admonitions of those 20 years every day, religious school. The gentleman from Texas.

Mr. BURGESS. Mr. Chairman, would you yield for a question?

Mr. MARKEY. I will be glad to yield.

Mr. BURGESS. May I inquire as to whether or not this hearing is being covered on one of the C-SPAN channels?

Mr. MARKEY. You mean one of the internal House channels.

Mr. BURGESS. No, one of the broadcast channels so people could—we have an incredible panel of witnesses and——

Mr. MARKEY. It is not being covered, but that is not our decision. That is a decision that is made by C-SPAN or by the internal House——

Mr. BURGESS. But none of your gripping hearings have been covered on any broadcast television. I think that is a mistake, just to watch the body language of Lord Monckton while Mr. Waskow was testifying, and vice versa, I think would have been worth the price of admission for our C-SPAN audience. And I regret that my constituents aren't able to tune in.

Mr. MARKEY. I am with you. We don't have to go to Piccadilly. Piccadilly comes to us, you know, and I am very, you know, honored that we have all these people. But again it is not within our control, okay. The cameras are there. They are working if anyone wants to pick it up, it is their decision, not our decision at all. And I—for my purpose, we are better off having this full discussion. I would have wanted everyone to have just heard Bishop Holloway tell us what our moral obligations our, but it is not my decision.

Mr. BURGESS. Well, just for the record, Mr. Chairman, you are infinitely more interesting than a budgetary hearing. And I will yield back.

Mr. MARKEY. I thank the gentleman, I think. The chair will recognize himself for a round of questions. I am going to go to you, Dr. Karl, and relate back to Lord Monckton. Can you tell me based upon 150 years of data from the World Meteorological Association and extensive analysis of public data by governments around the world, including the United States government, is the Earth cooling in the long term, or is it warming as a result of human activity?

Mr. KARL. I can make this answer very short, Chairman. There is no question the Earth is warming. Out of the last 14 years, 13 of them have been the warmest in our recorded history in terms of——

Mr. MARKEY. Can you say that again please?

Mr. KARL. Of the last 14 years, 13 have been the warmest on record in our observed climate record case.

Mr. MARKEY. So when Lord Monckton goes back to 1998 and he says since then we have been on a cooling trend, is it a little bit like saying well, you know, Babe Ruth, you know, when he started hitting his home runs, there had never been any more than 20, and when he hit 60 in 1927, there was a decline after that? Looking,

of course, at Hank Greenburg's 58, Hack Wilson's 56, Jimmy Fox's 58, so it was kind of a downward trend because no one could quite match Babe Ruth. On the other hand, Babe Ruth had just completely eclipsed anything that had existed before that? Isn't that a little bit like what Lord Monckton is doing here in saying there has been a decline from 1998, without reflecting upon the fact that, as you pointed out, can you give me that number again?

Mr. KARL. Of the last 14 years, 13 have been the warmest on record going back on——

Mr. MARKEY. The warmest on record. Thank you. So there is a little bit of disengenuineness in Lord Monckton's testimony, and I think that the incompleteness historically in his testimony is something that doesn't serve the committee really that well because it is these longer-term trends that are at much higher levels by a significant amount in terms of their warming impact that is of great concern and why the United Nations put together that group of 3,000 scientists, to reflect upon that and to make recommendations to the world and to the United States.

Mr. Schweiger, could you reflect upon what Mr. Karl just pointed out?

Mr. SCHWEIGER. One of the ways to think about this is to think about what is happening to the Earth. And if you look at what is going on in the Arctic Region, the melt of the Arctic is setting all sorts of new records. The thing that concerns me most is this carbon storage that we find in the Arctic Region is now being given off at, I think, quite significant rates.

The leakage of methane, the Boreal Forest in Canada, for example, are going to be giving off more carbon in the next 10 years than they are going to be storing. Nine of the next 10 years are going to be net producers of carbon. So as the Earth warms, it begins to behave in ways that are very troubling.

So I would suggest to us that we are in a second phase of global warming, that phase where humans are not only contributing, but we are now seeing nature giving back some of its carbon stores. And I would ask the committee to pay close attention to that.

Mr. MARKEY. Thank you, Mr. Schweiger, very much. Dr. Karl, the legislation I introduced last year, it established the national climate service. Does the administrator of NOAA support a climate service? And could you distinguish between what a weather service and a climate service would provide in terms of information for ourselves and for the rest of the world?

Mr. KARL. Yes, in fact, Administrator Lojanko has made it clear during her testimony for her confirmation hearing that she does support the development of a national climate service, similar scope as compared to a national weather service. The differences between a climate service and a weather service is that a climate service would be focusing on aspects of climate change mitigation and adaptation, as we are discussing here today, delivering products and services in that respect.

I have often been asked the question about well, would the weather service and climate service, would there be a demarcation between what time scale a weather service addresses and a climate services addresses? And I think the way to think about this is that obviously a weather is going to continue to protect us, get us out

of harm's way, protect life and property, forecasting the kind of weather events that occur in a real-time basis. But as Congressman Baldwin pointed out, when we have floods like we had last year, we want to be able to better understand whether there are anthropogenic influences that may be causing such floods. And so a climate service would want to be there helping to explain those conditions, intense and severe hurricane seasons are the contributions that humans may be adding to those kinds of events. So that is the best I could do in terms of helping to describe the differences.

Mr. MARKEY. Thank you, Dr. Karl, very much. Chair recognizes the gentleman from Michigan, Mr. Upton.

Mr. UPTON. Thank you, Mr. Chairman. I think Lord Monckton wanted to have a say in that first question you posed. So Lord Monckton?

Mr. MONCKTON. Certainly, sir. Yes, I do. If you want it put in perspective, let us put it in perspective. Let us go back 600 million years to the Cambrian Era. Yes, I remember it well.

Mr. UPTON. Just for the record, that, I think is when the Chicago Cubs last won the title. I don't know if you know baseball as well, sir.

Mr. MONCKTON. I will ride with that. Certainly 600 million years ago, there was about 20 times as much carbon dioxide in the atmosphere as there is today, and global temperature was about 12.5 Fahrenheit degrees warmer than today. That is how much extra carbon dioxide you have to put in the atmosphere to get that kind of increase. And for most of the last 600 million years, it has been around 12.5 degrees warmer than today Fahrenheit.

However, if we come more recently to the last 10,000 years since the end of the last Ice Age, for most of the last 10,000 years, it has been around 4 or 5 Fahrenheit degrees warmer than today. Most recently in the Minoin and Roman and Medieval warm periods, it was warmer than today.

There was then a period of considerable cooling. Indeed the sun, between 1645 and 1715 was at its lowest level of activity in 10,000 years according to sunspot records. Now, thereafter the sun's activity gradually increased until, in the last 70 years of the 20th Century, it reached, what is known to solar physicists, as a solar grand maximum. That coincided with a considerable period of warming.

However, the warming period of 1975 to 1998 when it stopped, there was no greater warming rate then than there was between 1860 and 1880 and again between 1910 and 1940. There is therefore no anthropogenic signal whatsoever in the temperature record so far. The IPCC has predicted global warming, and yet for the last seven years, there has been global cooling. Now, that global cooling is, of course, a consequence of natural variability just as very nearly all of the global warming of the 300 years that preceded it is, on any view, also attributable to natural climate variability. There is, therefore, nothing in the temperature record that should give us any cause of concern to day.

Mr. UPTON. Thank you. Mr. Karl, I regret that I didn't bring this publication, but I read a story just this week it was made public. The Chinese apparently had indicated that they had not—they didn't have any more recent data than, I believe, 1994 in terms of specific emissions within their country. And I think South America

or was it Brazil was close to the same. How do we actually monitor what other nations are doing?

One of the concerns that a good number of us have is if we imposed a cap-and-trade scheme that particularly countries like China and India would welcome that because they would see that job growth be exported from the U.S. to those countries. And as we have seen with China building a new coal plant literally two every single week, how is it that we are going to actually monitor the emissions from those nations when, in fact, they are at least, as we saw this week, putting up their hands and saying it is not any of your business? What type of tools do we have?

Mr. KARL. Yeah, right now, NOAA has something called a carbon tracker program. You can actually go on the web and take a look at our best estimates as to how carbon is being moved around the world. And this is actually into the atmosphere. We actually have observatories in the North Pole, Barro, and several other locations. We have a global monitoring network. We collect flask samples from across the world to try and measure atmospheric concentrations.

This kind of information is used in models, and there are some technical methods that are used to try and go back to the sources. And we actually measure the amount of carbon in the atmosphere so we can better understand where they are actually being emitted and being absorbed.

It is an area in which NOAA is very interested and continue to improve our capabilities here, and we have actually put forth a number of proposals.

Mr. UPTON. Did you see the report that was put out this week by the Chinese?

Mr. KARL. No, I have not.

Mr. UPTON. We will get it, and I would like you to maybe comment in writing. We will get it to you and do that. I see my time has expired. I yield back.

Mr. MARKEY. The gentleman's time has expired. The chair recognizes the gentlelady from—I am sorry. The chair recognizes the gentleman from Michigan. I have an obstructed view seat here. The chair recognizes the gentleman from Michigan, Mr. Dingell. Mr. Dingell, if you could—okay, thank you.

Mr. DINGELL. Last year, Mr. Boucher and I introduced or rather released a draft which we addressed the question of using some of the resources generated by the cap-and-trade to see to it that we could use these allowances for safeguarding wildlife natural resources from the effects of climate change. We also have the intention of seeing to it that we would preserve wetlands, marshes, mountains, forests, grasslands and things of that kind. Have you seen that draft?

Mr. SCHWEIGER. Yes, I have, sir, and I wanted to thank both of you for that sponsorship.

Mr. DINGELL. Do you support that?

Mr. SCHWEIGER. We do support that.

Mr. DINGELL. Natural wildlife does?

Mr. SCHWEIGER. And a number of other organizations that are signed on to our statement also support that effort. We believe that it is important to take some of the revenues that are generated

from a cap and invest program and apply them to protect these vital resources. The number that was in the Senate Environment and Public Works Committee last year is a good number, I think, to start with for our efforts going forward. But we clearly think the wildlife need funding, that adaptation needs to be implemented. There are plans that are beginning to be developed. Much more needs to be done across the entire country in fact.

Mr. DINGELL. Would you equate this with adaptation, the language that Mr. Boucher and I have released? Would you equate that with adaptation in a good form?

Mr. SCHWEIGER. Absolutely.

Mr. DINGELL. Very good. Given the extensive conservation investments that we have made in the Congress, going back to Pip and Robertson, Dingell, Johnson, and all of the other programs of this kind, how much risk is there that these investments could be squandered if we fail to invest now in natural resource adaptation?

Mr. SCHWEIGER. One example of the risk that we face, there was a recent assessment of the National Wildlife refugees, and over 60 percent of those refugees that were studied will be out of their biome if we continue to—on the course that we are on today. So what that means is the natural diversity that existed on those refugees will no longer be able to survive in the warming climate in those locations. So there is a great urgency to help in that transition.

Mr. DINGELL. Thank you. Now, going across, starting with you, Bishop Holloway, if you please. Do you support the idea of adaptation?

Bishop HOLLOWAY. Absolutely.

Mr. DINGELL. Next witness, do you? Yes or no?

Mr. WASKOW. Yes.

Mr. DINGELL. Next witness please.

Mr. MONCKTON. Sir, if you must do anything, then adapt. That is what we have been doing since we were created. I am sure we will continue just fine, and we probably don't need Congress to help us.

Mr. DINGELL. Thank you. Sir?

Mr. BEISNER. Yes, adaptation is the natural human action and response to all changes around us. We have done that for thousands of years, and I think we will continue to do that very well with or without central planning.

Mr. DINGELL. Does that mean yes or no?

Mr. BEISNER. Yes.

Mr. DINGELL. Mr. Schweiger, I believe you've already been. Next witness?

Mr. STEPHENSON. Yes.

Mr. DINGELL. Final witness, sir?

Mr. KARL. Yes, and if I could just add, if I may, one of the real challenges for adaptation will be for us to be able to provide the kinds of climate-related information that will be necessary because the climate will be constantly evolving and changing. And developing those information transfers between what we understand the science and the engineering practices that are so important to put in place for adaptation, there will be a key linkage that I think we will have to ensure that we do a better job in developing.

Mr. DINGELL. Thank you. Now, I have another question here for you, sir. I am curious, and I want you with your expertise as a member of the GAO, how are we—we are going to generate enormous sums of money from the sale of these allowances.

How are we going to keep those sales honest? We are obviously going to have to have lots of inspector generals. We are obviously going to have lots and lots of responsibilities imposed upon these people. We are obviously going to have to have questions with regard to how we handle the accounting. Can you give me a quick and dirty answer as to how we are going to address this problem of keeping honest men, or maybe somewhat dishonest men, honest given the huge temptations we are going to lay before them?

Mr. STEPHENSON. Well, this is part of the details of a cap-and-trade program, and whether or not you use offsets or not as a cost containment mechanism. Both of those features require emissions, not certainty but certainly good estimating techniques and verification techniques to ensure that the baseline emissions are correct. Then we are proponents of an auction rather than allocation of the allowances to make sure that the price of carbon is set correctly.

We think carbon offsets is a form of cost containment, but it too has a lot of problems in verifying that the additional carbon offsets you would get would be additional. That means it would not have occurred anyway. So the devil is in the details for all of this legislation. There is much to do to determine what techniques should be used to estimate allowances, to verify allowances, and to manage a cap-and-trade program if that is the way we go.

Mr. DINGELL. Thank you, Mr. Chairman. You are very generous.

Mr. INSLEE. [presiding]. Mr. Barton from Texas.

Mr. BARTON. Thank you, Mr. Chairman. Again I want to thank all of our witnesses. I really appreciate you all being here. I am going to focus on two of our witnesses, Mr. Karl and Lord Monckton, on some of the science.

Mr. Karl, you are a climatologist. Is that not correct?

Mr. KARL. That is correct.

Mr. BARTON. And you are part of the scientific panel of the IPCC?

Mr. KARL. I was lead author and convening lead author on the first three IPCC reports and review editor on the last.

Mr. BARTON. So we could consider you an expert. You wouldn't disallow that descriptive?

Mr. KARL. You could consider me anything you would like, sir.

Mr. BARTON. Well, I think you are an expert. Now, Lord Monckton presented the committee three charts. One is a chart from the Hadley and NCDC monthly terrestrial global temperature data set and the RSS and UAH satellite lower-troposphere data sets that shows a global cooling over the last seven years of about, if I read it correctly, equivalent to 3.5 degrees Fahrenheit a century. Is he lying to us?

Mr. KARL. Well, that is a very unusual way of presenting data that has never, in the IPCC, been combined in that way. Let me give you an example why.

Mr. BARTON. But I mean is the data that he presents it factual?

Mr. KARL. I can't attest to the figure you showed on the figure so quickly. I looked at it for——

Mr. BARTON. Well, will do you that? Will you research it and send a report to the committee whether he is lying to us or telling us the truth?

Mr. KARL. I certainly will. I can tell you that when IPCC does detection attribution studies, one of the key issues that we look at is the change in the rate of temperature throughout the atmosphere, and that figure—actually average temperatures at the surface with temperatures throughout the troposphere, which is not the way we go about doing fingerprint attributions. So that was quite unusual, and I noticed that right off.

Mr. BARTON. Okay, but it is theoretically possible he is telling the truth or this chart is factually correct?

Mr. KARL. I will reserve judgment. When you send it to me, we will take a look at it.

Mr. BARTON. And give us an honest assessment?

Mr. KARL. Best we can do.

Mr. BARTON. Now, his other chart shows that—the headline is "The UN exaggerates the greenhouse effect by sevenfold." Are you familiar with that graph, and is that another case of creative graphing, or is that the truth?

Mr. KARL. If I remember, this is the figure that was showing the rates of carbon emissions? Is that——

Mr. BARTON. Fourteen years of model-predicted (black) and ERBE satellite-observed (red)——

Mr. KARL. Okay.

Mr. BARTON [continuing]. Change in outgoing long-wave radiation from the earth's surface.

Mr. KARL. Yeah, in fact, last week, Chairman Mullhan's committee had a hearing on climate data records, and that graph—one of the important aspects of when you show earth radiation budget data, you have to take into account the fact that these measurements are made from satellites that change their orbit over time and from different satellites. And one has to stitch together the climate record from those satellites.

Mr. BARTON. Can you look at this one also?

Mr. KARL. Yeah, it is incorrect. I can tell you off—right away.

Mr. BARTON. You just say this one is wrong?

Mr. KARL. I can—because I saw that immediately. That is incorrect because it has——

Mr. BARTON. And what about his last chart that shows CO_2 concentrations are rising below their prediction, that the IPCC keeps saying these huge increases are going to—in CO_2 and it just doesn't appear that factually that can be verified by actual data collection. What is the story about that?

Mr. KARL. Yeah, I was quite surprised to see that graph because right now, there is a unified synthesis product the Climate Change Science Program has put together, and it has just gone through its second round of public review comments. And we hope to have it cleared through the agencies, the Climate Change Science Program agencies in the next few months. But if you look at that document today, there is actually a graph in there showing the rates of the

missions over the past 15 years. If you look around, compare it to IPCC scenarios——

Mr. BARTON. I am about to run out of time, and I want to give Dr. Monckton—Lord Monckton a chance to——

Mr. KARL. The bottom line is what our concern is the rates of global emissions are faster than what some of the IPCC emission scenarios suggest today.

Mr. BARTON. Lord Monckton, he basically says you are a liar. What is your——

Mr. MONCKTON. If you concentrate on emissions, then he is right. Emissions are rising faster than the IPCC predicted because they didn't expect China to do what China said she would do and continued to build power stations at a rate of one a week burning coal. However, concentration remaining in the atmosphere has indeed fallen, and the reason why is—it hasn't fallen, but it has gone up much slower than the emissions have and much below what is forecast. And the reason why that is is that, as the UN itself admits in its documents, it is incapable of adding up what is called the carbon budget in and out of the atmosphere to within a factor of two of the right answer.

Mr. BARTON. Well, Lord, just as I have asked Mr. Karl to try to verify what he said for the committee's consideration, could you also attempt to give some supporting documentation to prove that your charts, sir, are accurate and factual?

Mr. MONCKTON. Certainly. I would be happy to supply a paper which is currently out for peer review, which explains exactly how these two graphs are compiled. The third graph is from a scientific paper, one of a series that has appeared in the literature on this question of the outgoing long-wave radiation not diminishing as fast as the UN's models predicted it would. And I will give you the references to various papers on that subject.

Mr. BARTON. Thank you, sir. Thank you, Lord. Thank you, Mr. Chairman.

Mr. INSLEE. The lady from California, Ms. Matsui.

Ms. MATSUI. Thank you, Mr. Chairman. I would like to shift a while here to get to—from a global level to so-called ground level in my community.

Millions of people in my state depend upon levees to protect them, and climate change will increase the state's flood risk by causing a shift toward more intense winter storms, which could produce higher peat flows. Flood systems throughout the state must be upgraded and managed to accommodate the higher variability of flood flows to protect public safety, the economy, and ecosystems. And this is not cheap.

In 2007, Sacramento property owners voted to assess themselves almost $300 million for their local match to help achieve 200-year flood protection in the Sacramento area. Shortly thereafter, the state legislature passed legislation authorizing the state to participate in the 200-year flood protection program and contribute 70 percent of the non-federal cost of the program.

In 2008, our flood control agency established a development fee program to add to local funding available for the 200-year program. Now, Mr. Schweiger, as you can see, my community has taken it upon themselves to be leaders in adaptation and water manage-

ment. However, Sacramento's risk of flooding remains high, and we need additional help. In your testimony, you reference a lot of communities and their efforts to adapt. What are other communities doing to help prevent flooding and how are they raising the necessary funding?

Mr. SCHWEIGER. A number of groups are working, and I will give you one example. In coastal Louisiana, to reestablish some of the damaged wetland systems in the North Orleans areas, because we believe that by building back this natural resistance, we will reduce the storm surges, and we will also provide protection for nearby communities. So we think that there is an important investment in that area.

I would also suggest that the Army Corps of Engineers needs to change the way they do their planning and look forward and not look backwards. You know we have been designing structures to look at the last hundred years, and I think it is important that Congress give the Corps direction to look forward and understand the modeling and how it might impact communities.

I think that there are many community risks involved in climate change, and there are also enormous wildlife risk. Some of your fishery resources, for example, in California are being lost as coastal areas are being lost due to sea level rise and port wetland systems are disappearing.

Ms. MATSUI. And in your opinion, what percentage should the federal government contribute to adaptation versus states and communities? And, you know, we are looking for financing. What are the types of financing we should look to in tough economic times?

Mr. SCHWEIGER. The Senate Environment Public Works Committee last year had identified a $7 billion annual average funding for the first two decades for the climate adaptation funding for wildlife. And if you look at that, that is about 1 percent of the economic benefits from outdoor recreation forest and wetland conservations.

So we think that is a reasonable starting point for those kinds of investments, and I should say that there is also a number of other important community investments that need to be made. And some of those are, in fact, overlapping because what benefits humans also benefit wildlife in certain cases.

Ms. MATSUI. Okay, thank you. Mr. Stephenson, I understand the GAO is still analyzing adaptation efforts as you complete your study this year. Based on what you have uncovered, have you seen examples of adaptation efforts relating to flood control?

Mr. STEPHENSON. Yeah, the one I mentioned in Maryland. We just visited the state of Maryland and are looking at their efforts to address sea level rise. And at this point, it is more one of providing information to counties subject to sea level rise and advising what they can do in their laws and their land management use plans to address those problems. They are going to have to make economic decisions in the future as to what kind of adaptive measures they may want to take.

Ms. MATSUI. What is the federal government doing to better understand the flood risk and hydrologic impacts of a changing planet?

Mr. STEPHENSON. Well, there are many research efforts both by the federal government and others, both in the U.S. and throughout the world on this issue. What we are suggesting is that there needs to be more regional and localized information so that individual communities and governments can make decisions on what they should or shouldn't do. We don't think the information is specific enough to the local level to be able to make those decisions.

Ms. MATSUI. And what should Congress specifically do to finance flood control efforts as they relate to climate change?

Mr. STEPHENSON. Well, we haven't really looked at that issue. We did look at the national federal flood insurance program, and we think it is interesting that there have been no portfolio adjustments on the federal government's part for the insurance industry, similar to what Swissree and some of the big reinsurers of the world have already done. They have already looked at climate change projections and adjusted their portfolios to minimize their risk. And we are suggesting that the federal government should do the same thing, both for crop insurance and flood insurance.

Ms. MATSUI. Okay. Thank you, Mr. Chairman.

Mr. INSLEE. Thank you. Mr. Pitts, Pennsylvania.

Mr. PITTS. Lord Monckton, you say the European try at cap-and-trade has failed. Would you elaborate? And why do you suggest the U.S. may go it alone?

Mr. MONCKTON. Certainly. You go it alone, I think, to answer that question first, because those who have tried cap-and-trade have found it doesn't work. Those who are thinking of trying it are, in the light of that, beginning to revise their opinions on whether they should. There are many problems with cap-and-trade, but to answer your question about the European experience in particular, the European Union, which is governed by effectively a bureaucratic centralist dictatorship in Brussels, decided to allocate to each member state a right to emit without payment, which exceeded each states total emissions.

Not surprisingly, therefore, the price of the rights to emit carbon per ton fell to the market clearing level of zero on the artificial carbon trading hot air markets—called the trading in hot air on the London market in recognition of its general uselessness.

So it failed, and they therefore decided they would issue an edict that each country was not allowed to give away as many free permits as before. However, the economic collapse then supervened, and when you have a declining economy, then what happens is whatever price you try to set for carbon will promptly fall on the open market and we are now once again trading carbon permits at dangerously close to zero. So for the second time, the European system has failed in much the same way as the New Zealand has also failed. And in Australia where they had been contemplating carbon trading, the Senate, much as here, has decided that it doesn't like the idea.

So if you do impose carbon trading, then you could be shooting yourselves uniquely in the foot because most other countries in the world are at present disinclined to follow you.

Mr. PITTS. And whom do you believe will be most affected by cap-and-trade or a carbon tax or any other method of increasing energy prices?

Mr. MONCKTON. That is an extremely good question, and the answer is unfortunately horrifyingly clear. It is the low-income families. It is the poor. Why? Because a larger proportion of their income is devoted to spending on energy than any other sector. Now, of course, there may or will indeed be elaborate attempts to make transfer payments to the poor to try to cushion them to some extent or even fully from the effects of this misguided type of taxation.

But unfortunately, that then leaves the cost of it falling disproportionately on the middle class because, as you may know, President Obama has recently given strong indications to the other people who are most heavily affected by cap-and-trade—that is very big, heavily emitting industries, of course, electricity generation, steel, concrete, construction, so forth. They would have suffered very badly by this, and President Obama has said that he is going to look favorably on exempting them to some degree.

If he does that, then the entire cost of a tax, which is supposed to bring in very nearly the equivalent of the entire federal budget on average for the last five years, and it will bring it in every year for the next eight years, $2 trillion a year. That is going to fall entirely on small businesses who are already disproportionately affected by the existing recession.

If that happens, there will be bankruptcies all round, and it is even possible that this scheme, as at present conceived—and I must make this point very clear to you—could bankrupt the United States government itself.

Mr. PITTS. Dr. Beisner, you criticize the promotion of solar panels and renewable energy in the developing world. Why do you believe this is not in the best interest of the poor?

Mr. BEISNER. Well, the developed world managed to do a great deal of its economic growth on the basis of the very inexpensive energy that was available to us by the development of grids and the like. Just recently, Abbot E. Shlaze's book, "The Forgotten Man" was published on the history of the Great Depression.

She discusses the competition between the idea that there should be small, local generating plants, indeed even possibly generators at every home, versus the idea of grids. And essentially what we are being asked to do when we say let us have the small alternative energy things for people's huts and so on in Africa is to choose what they figured out, even at the time of the 1920s and 1930s was not going to work here. It is a short-term, really elusory solution that has long-term costs by directing capital investment away from the types of generation and distribution of electricity that can reach the lowest cost per kilowatt-hour delivered in the longer term.

And so what we are actually doing is asking the poor to adapt fairly expensive short-term solutions in exchange for much cheaper long-term solutions for their energy needs.

Mr. PITTS. So what do we do? What is the best approach to help developing nations to help the world's poor and impoverished?

Mr. BEISNER. Well, as Bjorn Longbourg and the Copenhagen Consensus have pointed out, certainly one of the most important things that we can do is to promote the Doha Round and world trade generally because general world trade is the most important

thing for raising income levels. And as income levels rise, those can generate enough capital investment to support the provision of large-scale energy systems to electrify the homes of the roughly 2.6 billion people around the world who don't have them.

Rather than highly centralized governmental solutions, I think the market solutions are the best, and that is what we learn from the history of economics.

Mr. PITTS. My time is up. Thank you, Mr. Chairman.

Mr. INSLEE. Thank you. Ms. Capps, California.

Ms. CAPPS. Thank you, Mr. Chairman. I want to thank all of our witnesses. I agree with my colleague who said this is quite a stellar panel and very interesting. I thank all the witnesses, and I want to thank especially and associate myself with the remarks of Bishop Holloway, since you represent my faith tradition.

And I feel I must make a brief disclaimer to you, Lord Monckton. I am privileged to represent a congressional district in California which stretches a bit over 200 miles of coastline, and I want to reassure you that my neighbors and I have no intention of packing up and leaving anytime soon.

Mr. MONCKTON. I am delighted.

Ms. CAPPS. Thank you. Mr. Schweiger, as I mentioned, my congressional district lies entirely within California's coastal zone. We must plan for sea rise, and then in that regard, I suppose I could represent any community along the coastal areas of our nation and perhaps indeed of the world. It has been said in my area if we bury our heads in the sand on the issue of sea rising, we may drown.

Could you give some specific strategies that managers federally, locally, and other kinds of interveners could manage to help our communities to be more resilient in the face of climate change? How might we or should we change some of our approaches to the management of coastal areas?

Mr. SCHWEIGER. Well, thank you for the opportunity to respond. I think the first thing we need to do is actually to cap pollution because the most important thing we can do is quit feeding the beast that is raising the sea levels and warming our planet. Secondly, I think it is important for us to do really good downscaling of the models that are currently being used to assess the condition of our planet. And I would say the greater granularity we can get into those models, the more we can know exactly what we are dealing with locally.

And I think it is important, as we plan those futures, that we anticipate the range of sea level rise, and that goes for water supplies, sewage and storm water management. I think it also speaks to the design of culverts and all the other things that we do in a community. We need to understand that we are going to have more vigorous rainstorms. Coastal flooding is going to be more intense in many places.

But I think it is so important to get that downscaling right so that we know precisely the kind of choices we need to make for both humans and nature.

Ms. CAPPS. Thank you. And, Mr. Karl, this is what your agency does. I don't have time to ask you, but I am certainly very interested in working with NOAA as we design this granularity to be

specific to our communities. And you have people in my district that I am very grateful for, and I look forward to that partnership.

I want to turn the rest of my time to the comments that were made by Mr. Waskow and Bishop Holloway. You made the statement, Mr. Waskow, that it probably will cost upwards of $50 billion to address adaptation needs. And it has been alluded to that, like the wildlife and the marine life, whose creatures are most impacted by a climate change and are not really responsible for it nor in the position to really adapt a lot. The poorest of the poor, as the bishop described, are often living in coastal areas. Again didn't contribute very much to this and will certainly be at the mercy.

And there is a moral compulsion, which I hope each of you will address. But there is also a piece of it that I want to get on the record. That it would be in our interest. It is an investment really that could be made to assist these communities in adaptation to climate change because it can provide their self-empowerment and their ability to decrease their dependency and to increase their self-sufficiency.

And I don't have much time, but maybe if each of you could say a word to this.

Mr. WASKOW. Absolutely, and I would fundamentally agree that it is in our national interest to address adaptation needs around the world for several reasons. One is the security dimension that has been alluded to already. The second has to do with costs that we would face from responding to disasters. So for example, helping provide irrigation equipment, improve agricultural practices, drought, and water resistant seeds. Those kind of things help in reducing the risk of famine or other food crises.

Similarly, helping communities improve and strengthen their infrastructure, their roads, their bridges, their schools, their clinics, helps in reducing potential disaster response costs down the road. And——

Ms. CAPPS. I know you could say more, but I want to ask the chairman's indulgence if I could ask my bishop to make one word on this.

Mr. INSLEE. Go ahead.

Ms. CAPPS. Thank you.

Bishop HOLLOWAY. I look at this in a three-tiered way. That in our work of dealing with the issues and problems of many different people around the world, I see that one pillar must be emergency and immediate aid. That is incumbent upon us. The other is where we can to work in an accompaniment model. Rather than telling folks what to do, we work with them to see what we can jointly discover as the best way to build capacity, the capacity that might lead toward self-sufficiency.

And the third thing is advocacy for those who do not have a voice but who have just as much at stake in the quality of life as anyone else. So these are the three areas, I think, that we are most effective, and look for legislation here since we are the, for lack of a better term, the biggest dog in the pounds.

Ms. CAPPS. Thank you very much.

Bishop HOLLOWAY. So we have a higher responsibility since we have higher resource.

Mr. INSLEE. Thank you.

Ms. CAPPS. Thank you.

Mr. INSLEE. Mr. Shimkus of Illinois.

Mr. SHIMKUS. Thank you, Mr. Chairman. Great to have the panel. I apologize for being in and out. That is kind of our line of work. Let me ask a question. When we have had these debates in the previous year, we used to talk about the off ramp. It is not being talked about very much now, and the basic premise was if China and India do nothing, all our pain and agony is for no results.

Should there be an off ramp in the legislation on climate change? And just say kind of yes or no, maybe a little phrase so I can get my time in. Bishop Holloway.

Bishop HOLLOWAY. I don't believe so, sir.

Mr. SHIMKUS. Okay.

Bishop HOLLOWAY. And——

Mr. SHIMKUS. If it can be quickly.

Bishop HOLLOWAY. Okay, yes. That is impossible.

Mr. SHIMKUS. Why is it impossible?

Bishop HOLLOWAY. Because ministers cannot speak briefly.

Mr. SHIMKUS. I thought it was impossible because China and India will never agree to any cap on carbon, and so to assume that China and India will be involved in any regime to control climate, that is the impossibility. Mr. Waskow.

Mr. WASKOW. We have the greatest historical responsibility for emissions. We have to take the lead, and I think that by taking the lead, we will be most able to bring others like China and India along.

Mr. SHIMKUS. Okay. Lord Monckton.

Mr. MONCKTON. None of the disasters imagined by this committee will happen. Sea level, in particular, is not about to rise by more than around eight inches to a foot this century. Even the UN says only 1.5 foot, maximum 2. That is not going to do any damage except in places where the land is subsiding from non-climate change reasons.

Mr. SHIMKUS. Okay.

Mr. MONCKTON. The Chinese and the Indians are perfectly aware of this. They have declared over and over again that——

Mr. SHIMKUS. All right.

Mr. MONCKTON [continuing]. And rightly that they are not going to do this. And therefore, you should indeed have an off ramp. Thank you.

Mr. SHIMKUS. Thank you. Dr. Beisner.

Mr. BEISNER. Yes, we should have an off ramp for precisely that sort of reason, but also simply because the assumption behind all of this is that the climate change that we are seeing has been human driven. Climate change and human driven climate change are not the same thing. And the increasing tendency of the most recent scientific publications has been to magnify the apparent natural contribution and minimize the——

Mr. SHIMKUS. Quicker please. Mr. Schweiger.

Mr. SCHWEIGER. I believe that the Himalayas are at great risk. The Chinese and Indian governments are well aware of those risks, and I——

Mr. SHIMKUS. Should there be an off ramp?

Mr. SCHWEIGER. I believe what we ought to do is work closely with China particularly to find common ground to make the——

Mr. SHIMKUS. Should there be an off ramp?

Mr. SCHWEIGER. I do not believe that we should back away from our responsibilities.

Mr. SHIMKUS. Should there be an off ramp?

Mr. SCHWEIGER. No.

Mr. SHIMKUS. Thank you. Mr. Stephenson.

Mr. STEPHENSON. We can't control what China does. We have to take action irregardless of what they do. So there should not be an off ramp.

Mr. SHIMKUS. Thank you. Mr. Karl.

Mr. KARL. Our agency works to provide the science to help provide that.

Mr. SHIMKUS. You are right. Very good. We had testimony here—I want to talk to the impact on the middle class and the poor. My district represents 30 counties in rural southern Illinois, stretching from the state capital of Springfield down to the Paducah, Kentucky, Indiana line. This is a mine, as I said in opening statement. 1,200 miners lost their jobs.

I now know through additional research further mines closed primarily because of the Clean Air Act amendments. The economy of southern Illinois has been devastated through the mine closures. The Coal Association of Ohio testified just last week 36,000 mine workers lost their jobs.

This is an incredible impact on the livelihood, and it does fall disproportionately on the poor. They will pay the burden of this through job loss, through long distances, through travels.

Lord Monckton, talk to me about this debate on are we a carbon-starved planet.

Mr. MONCKTON. Well, Will Happer testified—he is from Princeton—testified in front of the Senate committee with Dr. Patrari on this recently. In Will Happer's view yes, we are carbon-starved. If we go back to the Cambrian Era, 7,000 parts per million to compare with less than 400 parts per million today. Go back to the Triassic Era, 175 million years ago. At the time when the Aragonite corals, the most fragile of all the corals, came into being by algosymbiosis for the first time. Again around 6,500 to 7,000 parts per million of carbon dioxide.

Carbon dioxide is a plant food. It is necessary.

Mr. SHIMKUS. Say that again. Carbon dioxide is what?

Mr. MONCKTON. Is plant food.

Mr. SHIMKUS. It is plant food?

Mr. MONCKTON. Yeah, without it, all plant life and therefore all life that depends on plant life——

Mr. SHIMKUS. So if we were to decrease the use of carbon dioxide, are we not taking away plant food from the atmosphere?

Mr. MONCKTON. Yes, indeed you are. The U.S. Forest Service has very good figures, showing the enormous growth in the cubic——

Mr. SHIMKUS. So all our good intentions could be for vain? In fact, we could be doing just the opposite of what the people who want to save the world are saying?

Mr. MONCKTON. You could indeed. You are quite right.

Mr. SHIMKUS. The basic finish with this comment is the earth will not be destroyed by a flood. And I yield back my time.

Mr. INSLEE. Thank you. We have, I believe four, maybe five more members. We could go with a lightning round of 2 minutes apiece and vote, or we could continue and then come back. The chair would suggest we do a lightning round of 2 minutes apiece, and I just wonder if anyone would have objections to that. Vote is going to start just briefly. I would suggest—the Chair is sacrificing his time in order to move forward. If there is no objection to that, let me suggest that we do that.

Mr. SHIMKUS. I would object and just make that decision once the time comes for the call of vote.

Mr. INSLEE. We will always respect Mr. Shimkus's views, at least on this very small issue. Mr. McNerney.

Mr. MCNERNEY. Thank you, Mr. Chairman. I want to thank the panel for coming here. I think—good call—your testimony is excellent, and I want to congratulate Chairman Markey for pulling together this hearing.

You know when we discuss adaptation, I can't help thinking about my home district in California for two reasons. One is by analogy to climate change, and the other by an already in progress impact of climate change.

The first that I want to discuss is earthquakes. California is earthquake country, and we have learned a lot about how to adapt to earthquakes. We build our buildings better, and the results are pretty dramatic; although we still have a lot to learn and a lot to do to make our city safer.

The second is water. You know many glaciers are receding around the world, and California depends on its snow packs. So we are deeply engaged in planning and preparing for this, and I think that is an adaptation to global warming. So building buildings better and more resilient and building better waterways is good sense. The threat of global warming just adds urgency to this whole issue.

So, Mr. Monckton, I have a question. Do you think we should stop planning for earthquakes and stop adapting for water changes, or what should we do in this case?

Mr. MONCKTON. Sir, as far as earthquakes are concerned, there is no connection between earthquakes and global warming.

Mr. MCNERNEY. No, but it is adapting to——

Mr. MONCKTON. Yes, of course, you should always adapt to natural change.

Mr. MCNERNEY. So should we adapt to water coming down from the Sierras?

Mr. MONCKTON. If, as California is a very heavy user of water, you will need to make sure there are continuing water supplies.

Mr. MCNERNEY. So adapting——

Mr. MONCKTON. However——

Mr. MCNERNEY [continuing]. To change in progress is a good idea?

Mr. MONCKTON. So of course adaptation to natural changes that occur is very sensible.

Mr. MCNERNEY. Thank you.

Mr. MONCKTON. If there were any——

Mr. MCNERNEY. Mr. Karl. May I ask you, Mr. Karl, could you just give me a little bit of detail about some of the models of the resolution that you have, the accuracy that you have? I am a scientist, a mathematician, and I did spend my career in modeling, so I am interested technically in where we are with this stuff.

Mr. KARL. Yeah, one of the things we can tell you is that the models today are good enough to be able to identify some of the causes for some of the water issues out west with respect to changes in the snow melt season. Snow melt, from the observations we already see, it is melting earlier, more frequently, that runoff occurs more earlier. It means there is less water available later in the summer for use. That kind of an activity—that kind of process is expected to continue and accelerate as global warming continues on into the future. So that is one example from the point of water.

Another one has to do with changes in heavy precipitation events. We are seeing a change in the frequency of heavy precipitation.

Mr. MCNERNEY. So you have confidence in the resolution of these models and the accuracy of these models?

Mr. KARL. Yes.

Mr. MCNERNEY. In sort of an average sense?

Mr. KARL. In a broad sense, yes.

Mr. MCNERNEY. Okay, we will have to talk more about that at a different time. I am going to yield back to my courteous, to my other——

Mr. INSLEE. Thank you. I appreciate that. Mr. Burgess.

Mr. BURGESS. Thank you, Mr. Chairman. Mr. Karl, in a way, your federal agency is an adaptation, is it not? Isaac Klein, the famed meteorologist in Galveston with the storm that Gene Green mentioned of 106 or 107 years ago. I mean your federal agency came into existence as a consequence of the troubles that Mr. Klein encountered at that point with not being able to predict what was fixing to happen to them. And, of course, the large loss of life that then ensued.

So in many ways, what we are seeing today with your federal agency is an adaptation to the fact that if you develop coastal areas from time to time, you will be visited by hurricanes. Is that not correct?

Mr. KARL. There is no question.

Mr. BURGESS. Now, on the issue of hurricanes—I apologize for not having the data in front of me, but it seems like in a newspaper report from just a few days ago, we are—we have entered into a period of a relative lull in hurricanes. Am I correct in that?

Mr. KARL. All I can tell you is that we have, over the past several decades, seen an increase in hurricane activity. And in fact, the most recent paper, looking at the—all the global oceans have identified fairly conclusively that since the early '80s, the intensity of the strongest storms has actually increased.

Now, one has to recognize when we get down to smaller and smaller scales, because we have fewer hurricanes, it is more difficult to say, for example, yes we are seeing a change in intensity of storms——

Mr. BURGESS. Well——

Mr. KARL [continuing]. Affecting a particular part of the coastline.

Mr. BURGESS. And I don't mean to be disrespectful, but the chairman has limited my time. We see cycles. We are in a bad recession right now. We are told that it is equivalent to the Great Depression of the 1930s, but we don't have the adverse weather phenomena that they encountered in the 1930s in the form of the Dust Bowl.

But having moved to the state of Texas as a very, very young child back in the early '50s, I remember very well the seven years that it didn't rain. As I recall, the newspapers attributed that to the fact that the Russians were testing nuclear weapons in the atmosphere and it was the Russian fallout that was responsible for no rain. I guess our fallout was exempt.

But nevertheless, there always seems to be a reason that we will look for when we encounter these odd weather cycles. So how do we know, as we are sitting here and we are going to make policy, significant policy that is going to affect the next three generations of Americans, how do we know that we are just simply sitting here observing what our naturally occurring cycles in our climate, what would be the fingerprint? What would be the signature for evidence that this is a manmade phenomenon?

Mr. KARL. That is an excellent question, and I can tell you what NOAA is doing is what we actually do is go back in time and actually simulate in our computers the kinds of conditions that have occurred that actually led to various intensities and frequencies of hurricanes each season. And one of the things I can say with the American Recovery Act, we actually now will have access to supercomputing pedaflops that our computers will be running these models in much higher resolution mode to be able to pinpoint with greater accuracy and greater understanding.

Mr. BURGESS. So right now, we just simply do not know. We don't have the data that we are required to have.

Mr. KARL. We want now. Right now, our——

Mr. BURGESS. And I don't disagree, and I don't mean to be disrespectful. I only have a limited amount of time and Lord Monckton.

Mr. KARL. All I can tell you is that the projections in the future of the models show more intense hurricanes. Right now, the linkage in terms of a specific attribution between what we have seen and intense hurricanes still awaits more scientific study.

Mr. BURGESS. Lord Monckton, you were wanting to tell me something.

Mr. MONCKTON. Yes, sir. You wanted to know what the current state of play is about hurricanes. Over the last 30 years, satellites have been monitoring the frequency and intensity of hurricanes and accumulated cyclone energy index is compiled, which is a two-year running sum of the frequency and intensity of all hurricanes, tropical storms around the equator, and the current value of that accumulated cyclone energy index is the lowest it has been in the 30 years globally that has been recorded. So you are quite right.

Mr. BURGESS. So you will make that data available to Mr. Karl to plug into the supercomputer?

Mr. MONCKTON. I will give him the graph. It has been published recently.

Mr. BURGESS. Wonderful. Look forward to that. Mr. Chairman, I am going to yield back in the interest of time.

Mr. INSLEE. Thank you. Appreciate that. Mr. Welch.

Mr. WELCH. Thank you, Mr. Chairman. Dr. Karl, you are having this debate here about CO_2 concentrations in the atmosphere, a lot of evidence that they are actually rising, and whether they are doing so in line with the projections of the Intergovernmental Panel on Climate Change. My question is, is the level of CO_2 in the atmosphere easily determined? I mean is that really a scientific debate about whether we can measure it? And is it not the case that the level, in fact, is higher than in the past IPCC projections?

Mr. KARL. To answer your question, it is probably the most confident measurement we can make, and that is the level of carbon dioxide in the atmosphere. And indeed it is increasing, and it is due to human causes.

In relation to comparison to IPCC, again what IPCC uses are scenarios, and there are a number of scenarios they use in terms of how carbon dioxide concentrations would change in the future without any policy options but with considerations of economic growth, technology intervention. And if you look at those scenarios, the current levels of carbon dioxide concentration are very consistent with those models, in some respects, might even be a little bit low.

Mr. WELCH. Thank you. I yield back, Mr. Chairman.

Mr. INSLEE. Thank you. At this time, the committee will be in recess. I think about 12:30. Can the panel all stay with us? Is that acceptable? Thank you for your courtesy. Mr. Schweiger may not be able to, but we appreciate it, and we will be back by about 12:30. Thank you.

[Recess.]

Mr. INSLEE. The hearing will convene, and we will hear from Mr. Stearns—excuse me, Mr. Scalise.

Mr. SCALISE. Thank you, Mr. Chair. Looks like Mr. Schweiger has left. Is this gentleman Mr. Kostyack? Can you answer questions on—there was part of Mr. Schweiger's written testimony that I have a big issue with is in relation to his claim that the deaths attributed to Hurricane Katrina are—well the deaths from Hurricane Katrina are attributed to global warming. He actually attributes 1,800 deaths from Katrina to global warming, and I understand that he has left. I am sorry that he has left because I represent a district that includes many of those areas that were hit by Hurricane Katrina and in fact incurred some of those deaths. And I take strong issue with the fact that he would attribute those deaths to global warming when, in fact, there is substantial record of documentation that both points out that global warming had nothing to do with Katrina's deaths but, in fact, it was the failure of federal levees as well as the problems caused from coastal erosion.

Now, what documentation, if you can speak for Mr. Schweiger, what documentation did he base his assertion on?

Mr. KOSTYACK. I would be happy to speak for Mr. Schweiger. We didn't, in our testimony, state that global warming was directly responsible for that particular——

Mr. SCALISE. In written testimony—it is in his written testimony that he submitted right here on page 9.

Mr. KOSTYACK. There is certainly, and we made the link in the testimony between global warming and that storm because of the fact that there is extensive scientific data showing a linkage between the intensification of coastal storms and global warming. And so, although you can never pinpoint one particular storm in saying that storm was caused by global warming, you could certainly say, as we did in the testimony, that a storm of that nature is becoming more prevalent in this era of warming. And I would defer to my colleague from NOAA to give you the citations to the papers. But there is extensive literature in this area.

Mr. SCALISE. And I will read his quote. "Increases in weather-related disasters associated with global warming carry more than an economic cost. The perils of weather-related disasters are exemplified by Hurricane Katrina, which caused one million evacuees to flee and more than 1,800 deaths."

Now, I would urge you to go and read the report by the Army Corps of Engineers who acknowledges that the failure of federal levees is what lead to the deaths from Hurricane Katrina as well as the increased damage done by storms over the years due to coastal erosion, which at the state level, the state is working on restoring the coast, which is a very important issue for blocking future storms.

But I would just urge you to spread that word back to Mr. Schweiger that I think it diminishes his credibility when he makes statements attributing deaths from Katrina to global warming to try to further his cause because that had nothing to do with it. And if he has some proof that carbon emissions had anything to do with the failure of those levees, tell him to get that information to the Corps of Engineers because no one has ever asserted that up until this point.

I see Lord Monckton nodding. If you had anything you wanted to add to that, Lord Monckton.

Mr. MONCKTON. Certainly, sir, with pleasure. Mr. Justice Burton in the high court considered this matter because, of course, Al Gore has also in his sci-fi comedy horror movie attributed the Hurricane Katrina to global warming. And Mr. Justice Burton, after hearing very careful evidence from both sides, including our own meteorological office, which tends to share the views of your NOAA over here, came to the very firm conclusion that that link cannot be established.

And it is also worth recording that Hurricane Katrina was only a category three at the point where it made landfall. And as you have rightly said, sir, the real failure here was the failure of the local administration—I cannot for the moment remember which party it is—to make sure that the levees were adequately maintained.

Mr. SCALISE. The Army Corps of Engineers, which actually issued a report acknowledging that those levees failed in a way that they should not have failed for a category three.

Following up on a point you made about Al Gore, because Al Gore has said on record that the UN is wrong and sea levels may

rise upwards of 20 feet by the end of the 20th Century. Do you prescribe to that view that Al Gore has——

Mr. MONCKTON. I have recently consulted the world's foremost expert on sea level, Professor Neals Axcel Murner, who has written 520 papers on the subject. He tells me that sea level in the last century rose eight inches compared with an average centennial rate of rise over the past 10,000 years of four feet per century. And his best estimate is that it will be another eight inches. Now, the UN says perhaps 1.5 as its central estimate in the whole of the next century.

Mr. SCALISE. And I am about to run out of time. One last question, Lord Monckton. Over the past decade or so, have temperature observations verified the model predictions that we keep hearing about?

Mr. MONCKTON. No.

Mr. SCALISE. Thank you. I yield back.

Mr. INSLEE. Thank you. Chair will recognize myself. Mr. Karl, the Right Honorable Lord Third Viscount Monckton of Brenchley had told us that the earth is cooling, which is an extraordinary statement giving the unprecedented amount of scientific consensus to the contrary.

I want to refer you to a slide showing five-year averages. The NIS GISS data and CRU Hadley data. You have to look behind you to see it. I am sorry, Mr. Karl. It is over to your right. These are five-year averages that basically show temperature in five-year periods. Is it helpful to look at five-year averages when we are looking at climate trends?

Mr. KARL. It is certainly helpful to average over longer periods than a few years. And in fact, I just want to point out that in the IPCC report, the reference to linkage between human contributions to changes in atmosphere composition and global warming was over the last 50 years. And there is a lot of danger in taking that record and looking at year-to-year variations and talking about cooling or warming.

Mr. INSLEE. Thank you. And my next chart, if we can put the next chart up, I think shows the wisdom of that, that basically shows annual temperatures which does show the temperatures in '08 somewhat less than '04. But the trends are obviously disturbing. And I would trust the 2000 IPCC scientists.

The next slide please showing observed monthly carbon dioxide trends as measured at Mauna Loa since 1973 compared with the emissions scenarios of the IPCC. Will show that in fact the emissions, actually the concentrations in the last several years have been higher actually than even the models. Is that correct?

Mr. KARL. Yes.

Mr. INSLEE. Okay, next slide please. You can help me. The other slide, it was the first slide of Lord Viscount Monckton. Yes, I was looking at this. I was intrigued by your testimony, Lord Monckton, and I was just wondering what this graph was.

Mr. MONCKTON. That is merely the header sheet so I know that the slides are up there. In fact, it is the view from my library in Renneck.

Mr. INSLEE. Is this a coat of arms? Is that what they call this in England or——

Mr. MONCKTON. No, sir, that is the four colors, which is the symbol of the House of Lords, and superimpressed upon it is the Visacomital Coronet.

Mr. INSLEE. Thank you. I appreciate that. Lord Monckton, how much have the seas acidified since industrial times? By what percentage are there higher concentrations of the ions contributing to acidic oceans compared to pre-industrial times? I will just take a number if you can give it to me.

Mr. MONCKTON. Certainly. There has been no satisfactory measurement to establish it, but modeling suggests—and I don't know how reliable the modeling is—that the pH has reduced by 0.1.

Mr. INSLEE. And what percentage increase in ions—the scientists tell me that is a 30 percent increase in the ions concentration compared to pre-industrial times. And I am a little stunned by your statement that there is no evidence in this. In fact, there is overwhelming evidence from multiple sources that our oceans are becoming more acidic. Most recently off the coast of Washington State and Tatoosh Island, which showed the acidification caused by anthropomorphic, meaning us putting carbon dioxide in the atmosphere, going into solution and then making the oceans more acidic is actually accelerating even beyond the models that it clearly is at extraordinarily high levels compared to pre-industrial times.

Now, do you think that given the value set that you bring to this testimony, considering that that can adversely impact living creatures including coral and phytoplankton at certain levels, that that is something that we should make an effort to arrest?

Mr. MONCKTON. No, sir, I don't think you need to because if we go back a little bit further than the period you are looking at, and we go back to the Triassic Era where the most fragile of the corals first evolved, they were the Aragonite corals, at that time there 6,500 parts per million of CO_2 in the atmosphere. One can presume therefore that there would be more CO_2 in the oceans at that time as well. And the corals did just find. Indeed, that is when they evolved. So we know from these geological records that the fears over ocean acidification have been much exaggerated.

Mr. INSLEE. Well, your testimony is in stark contrast with the entire rest of the biological and botanical testimony because you are talking about corals that were adapted to those conditions. We are talking about corals that are adapted to our conditions of acidity in the ocean. They are entirely different species.

In fact, it is shown by new research, so when you go back home, you can notify them in your country of what we found in this country, which is acidification at certain levels, which we will approach in this century, retards the calcification and the deposition of calcium carbonate. That is a message from America just so you will know, and we have lots of literature about this I would be happy to provide you. Thank you.

Mr. MONCKTON. Without objection, sir, may I introduce into the record a recent book on the subject by Dr. Craig Itso, which is a comprehensive review of literature on precisely this subject? And I think you will find that it does show a rather different picture.

Mr. INSLEE. Thank you. We enjoyed——

Mr. MONCKTON. Thank you, sir.

Mr. INSLEE. Sure, we will insert that in the record. Mr. Karl, do you have any comments on ocean acidification, what NOAA's findings have been?

Mr. KARL. It is a very important issue that our agency is looking at, and I am happy to report that we have some leading researchers in the world. Dr. Richard Feely, who just recently published a paper pointing out some of the observations that indicate that the oceans indeed are acidifying and the projections with continued increase in carbon dioxide in the atmosphere are for those increases to have gone up about a tenth in pH, another—not a tenth, a tenth of a unit. Another one-tenth to two-tenths of a units with the kinds of concentrations as projected by IPCC.

Mr. INSLEE. Thank you. Well, I turn to Mr. Stearns of Florida.

Mr. STEARNS. Thank you, Mr. Chairman. Lord Monckton, let me just give you a hypothetical question here that you might help me with. In mitigation that is the elimination of CO_2, let us say, for example, the United States adopted cap-and-trade as well as all the other methods to totally eliminate energy-producing components that have CO_2 emissions in this country. We totally eliminate it. How long would it take theoretically to bring back the level of CO_2 that we have in this country today if we were successful in eliminating it? Is there any studies, or anybody that has done state-by-state in the United States, for example, my home state? Or is there any way to evaluate what the repercussions would be?

Mr. MONCKTON. Let me start state by state. Yes, sir. The Science and Public Policy Institute publishes state-by-state surveys of what would happen to global temperatures if that state were to close down its emissions all together and go back to the Stone Age without even the right to light a fire in your caves. And the effect on temperatures is fair to say on an individual state-by-state basis is negligible.

If you were to close down the entire United States economy and go back to the Stone Age, then what would happen is that is going to take you a certain amount of time to do. As you reduce your production here, since your citizens will still require much the same in the way of goods and services they had before, they will have to get them from overseas, from places like China and India where, alas, the emissions per unit of production are considerable higher, in some cases three or four times higher, than they are here.

And therefore the net effect of the United States shutting down her economy would be to increase carbon emissions worldwide, achieving the very reverse of the objective which was however piously intended.

Mr. STEARNS. Are there any timeframes you could say this study was done on so you could say theoretically if we shut down like say over the next seven years before we would see the CO_2 emissions come up to what they are?

Mr. MONCKTON. You would see virtually no decline at all because so quickly would other countries take up the production that you forego. If you transfer your jobs and your industries and your wealth to other countries and get them to do the work that was once done here, then the uptake, and therefore the increase in CO_2 emissions, will be more or less immediate.

All you will be doing is shooting yourselves economically in the foot. Not only for no climatic benefit whatsoever, but actually you would end up making things worse. And you would end up making things worse more or less immediately.

Mr. STEARNS. You have used that term shooting ourselves in the foot. I think I will use one of your assistance, sort of call this kneecap-and-tax which would be shooting ourselves in the kneecap and then coming back in taxes and putting us in perilous condition.

Mr. Waskow, I have an article here that says "Biofuels pushing up food prices and poverty" Oxfam that indicates. And so, you know, we had these well-intended mandates from ethanol. They were enacted supposedly to help the environment, and yet there seems to be consequences reading this article. Shouldn't we be cautious in implementing any new policy which would have far-reaching effects, such as a policy that would change the entire energy base of our country like kneecap-and-tax.

Mr. WASKOW. Well, I would say that it is absolutely the case that we need to be careful in designing a policy of this magnitude. I think that the consequences of climate charge are so grave, particularly for poor people around the world and also in this country, that a lot of the care that must go into it is, in fact, making sure that emissions do not continue rising in a way that is going to lead to even greater harm down the road.

And in the near term, since this hearing is focused on adaptation, I would just note that part of the care that we must take in designing climate policy is, in fact, to make sure that those who are being affected now by the current impacts of climate change are, in fact, having their needs met and that the adaptation responses and resilience responses that are necessary are, in fact, being put in place.

Mr. STEARNS. Would you state then that you think that we should scrap all biofuel targets in the world?

Mr. WASKOW. Well, I mean if the question goes to whether to entirely remove any policy supporting any kind of biofuels, that would not be our position. However, we do think that in the case of biofuels, because of the food consequences, that targets need to be looked at very closely in terms of how they may affect food supplies.

And so corn ethanol is an excellent example where we have serious concerns about what it means to ramp up production of that because of the food consequences worldwide.

Mr. STEARNS. Do you have any percentages that you could use it ramped it up by? In other words, you talk about these biofuel mandates. Have they increased global food prices by any percentage?

Mr. WASKOW. I am not aware that we have a specific number that one can attribute to the increase but——

Mr. STEARNS. The article says biofuels are responsible for 30 percent of the increase in global food prices, pushing 30 million people worldwide into poverty, the aid agency Oxfam said in a report Wednesday.

Mr. WASKOW. Yeah, I believe that that is—I will check and happy to get back to you in writing. I believe that that data reflects World Bank analysis of—in their annual economic report last year.

Mr. STEARNS. All right. Thank you, Mr. Chairman.

Mr. INSLEE. Thank you. Mr. Walden of Oregon.

Mr. WALDEN. Thank you, Mr. Chairman. Mr. Kostyack, your predecessor at the hearing, Mr. Schweiger, made a comment that the Boreal Forests are either now or soon to be giving off more carbon than they are sequestering. And I wonder if you could speak to why that is.

Mr. KOSTYACK. We are currently seeing a die-off of forests all around the globe, and it is due to the increased stress, rising of average surface temperatures around the globe.

Mr. WALDEN. And would part of the effect of that be then additional drought conditions and stress on the trees themselves?

Mr. KOSTYACK. That is correct.

Mr. WALDEN. And so what is the proper intervention, if you are a forester, to help ameliorate that problem?

Mr. KOSTYACK. Well, a number of ideas have been suggested. There is no easy answer. Much more research will be needed to manage our way through this problem. Obviously the first step is we need to cut global carbon emissions because we are not going to be able to adapt our way out of this problem.

Mr. WALDEN. So you don't think managing the forests back to a more balanced system is an answer?

Mr. KOSTYACK. No, that is where I was heading next. My point is——

Mr. WALDEN. I am sorry.

Mr. KOSTYACK [continuing]. That forest management by itself will not solve this problem. That the first step will be to cut carbon emissions. We will not be able to address massive die-offs of forests we are seeing around the globe, unless we start there.

The second will be to look at natural resources adaptation efforts, and that involves more scientific research. It involves storing as much ground water as possible. It means forest management to reduce some of the fuel load to avoid unnecessary catastrophic fires.

Mr. WALDEN. I appreciate especially that last point. I represent a district of 70,000 square miles, 10 or 11 national forests. We have forests there that are completely overstressed right now today. 500 of the Wynema National Forest. There is about 500 square miles the bugs have been eating away at for a decade. It is ready to explode, and yet there are many organizations who care passionately about global climate change and CO_2 emission reductions that consistently, repeatedly, and aggressively appeal every proposal to go in and do thinning operations on these forests to get them back into balance with nature frankly because they—you can let them get back in balance a couple ways.

You can let catastrophic fire just wipe out the stand. Or we can go in and using—and I think there is a pretty good basis of scientific knowledge on the number of trees per acre that would be historically correct. And yet the same organizations are opposing it. So I guess my question is—and, Mr. Monckton, maybe you want to—Lord Monckton, I am sorry. Maybe you want to speak to this as well.

I know we sort of have this existing exchange policy in the world where we don't manage our federal forests in America. We would rather rape and pillage forests around the globe for our wood. And

I am not exaggerating here. I mean 60 percent, I think, of Oregon's forest land is federal, and it represents 6 percent of the trees that are actually harvested.

I have counties that are at 19.7 percent unemployment. These folks—I was just out there. They don't understand why the forests are allowed to burn up around them, and they can't even cut burned dead trees while they still have value.

And what they further don't understand is that their heating bills are going to go up dramatically under cap-and-trade. And the one manufacturer that is kind of left in eastern Oregon makes cement, the Ashcome Cement Plant, and they figure they will probably have to close. Now, I don't know how this helps people in poverty.

Mr. MONCKTON. Sir, I sympathize with you entirely. The one thing you don't want to do in the present economic circumstances is start closing down the few industries that still remain in the name of the Chimera of global warming, which visibly hasn't been happening for the last seven years, though it has been happening for the last 300. During at least 270, we could not have had anything to do about it.

As for the management of trees, you are quite right. It is essential that proper fire breaks be cleared and maintained so as to prevent forest fires. Forest fires are not new. They are not a consequence of global warming. They occur naturally. They are, in fact, a part of the natural process by which forest manage themselves. But if one wishes to minimize that, you must have fire breaks. And that is what we do in the U.K.

Mr. WALDEN. Plus we are finding that even the old growth trees now are getting stressed because some years of drought. When they get stressed, then they bugs come in, and they kill the old growth trees, which many people would like to preserve. So it really is a problem.

Let me shift gears because I only have 30 seconds left. My district also is home to some of the most active wind energy development out there, and our grid in the Northwest will soon have more wind on it than any other grid by percentage in the country.

The question has recently come up by some groups that—and I thought this had been resolved—that wind energy and the wind turbines are killing raptors and birds. And so I would go to the Wildlife Federation. Is that the view of your organization that the wind energy we are putting in is—I thought they had designed around this problem.

Mr. KOSTYACK. There are some negative impacts on wildlife from wind energy development. That being said, these problems can be worked out. There are technical solutions. I mean let us recognize, first of all, just installing the wind power by itself will take out some habitat. And then there are some collisions we would need to address both with birds and bats.

We are very much supportive of building out a massive wind energy——

Mr. WALDEN. That is what I thought.

Mr. KOSTYACK. And it is fundamental to the solution of global warming. This goes through our overall message here today. We are going to need to have a major investment in natural resources

adaptation. And that means a lot of public outreach for people to understand some of these tradeoffs. There is no free energy source, and so we are going to have to find ways to minimize wind impacts. There are ways to place these renewable energy systems in the most degraded areas or areas where there is also essentially a human footprint and trying to protect those pristine areas.

But at the same time, we have to get this wind energy complex built.

Mr. WALDEN. But at the end of the day, you kind of have to put it where the wind is.

Mr. KOSTYACK. That is one of the key factors to look at, yes.

Mr. WALDEN. Yeah, all right. Thank you. My time has run out, Mr. Chairman. Thank you all. I appreciate your testimony from all of you.

Mr. INSLEE. Thank you. With unanimous consent, the chair will put into the record a letter dated March 24, 2009 from the Outdoor Industry Association and another one from a group of organizations including the League of Women Voters, dated March 25, 2009.

[The information appears at the conclusion of the hearing.]

I would extend an opportunity to any of you who feel a burning passion to make another one-minute statement on anything you didn't have a chance to say. We want to make sure the witnesses have a chance to respond to any of the questions you asked. If any of you would like to take a minute to extend your comments, feel free to do so. Mr. Karl, if you would like to. Don't feel compelled by the way.

Mr. KARL. No, I don't. I just want to——

Mr. SHIMKUS. Mr. Chairman, may I ask a question?

Mr. INSLEE. Certainly.

Mr. SHIMKUS. Does that mean we get a chance for a 1-minute response to their 1-minute question?

Mr. INSLEE. If Mr. Shimkus would like, I would certainly—

Mr. SHIMKUS. I mean I am just trying to find out the rules here.

Mr. INSLEE. I would be happy to extend a minute to Mr. Shimkus for sure if that is so ordered by the two consensus builders of Shimkus and Inslee. Mr. Karl.

Mr. KARL. Yeah, I just wanted to thank the committee for addressing this extremely important issue and note that there is enormous amount of climate change science that is available today. The major challenge for our agency, which we hope to be able to address in the short few years ahead is to take that science and be—make it available to help make decisions, practical decisions, that are required from a local scale all the way up to national and international scales. Thanks.

Mr. INSLEE. Thank you. Mr. Stephenson.

Mr. STEPHENSON. I would parrot that, but I think we have an information shortage here, especially at the local level such that we are not prepared to make economic decisions yet. We need the data first before we can do the cost/benefit tradeoffs on what is going to be worth the investment and what is not.

And the same is true with the cap-and-trade bill, from the way you design it, how expensive or not it is going to be and whether the benefits are worth the cost. So I just don't think we are there yet. I think we need to negotiate the specific details of any legisla-

tion and see what that means before we can say universally that it is going to cost jobs and tank the economy.

Mr. INSLEE. Mr. Waskow.

Mr. KOSTYACK. Mr. Inslee, thank you, Chairman, for the opportunity. Very much want to associate myself with my colleague's remarks about the need for more additional scientific research. If you look at the overall agenda for natural resources adaptation, we have to recognize, first of all, we are playing major catch-up on the scientific research here.

There have been a lot of investment on the mitigation side. We are really just getting going on adaptation. That being said, there are many, many things that the scientists already agree on that are essentially no-regrets strategies for making our natural systems more resilient to harmful impacts of climate change. And we have heard some of them today, whether it is buffering people and wildlife from coastal storms by rebuilding wetlands complex, we should be doing those now. The longer we wait, the more difficult and expensive it gets.

And so when we came here today and advocated for a very substantial large-scale investment in natural resources adaptation as part of climate change, this is something we can demonstrate today has far greater economic benefits than the cost. And there is no reason to hesitate.

Mr. INSLEE. Thank you. Dr. Beisner.

Mr. BEISNER. I would just simply ask the members of the committee to study very carefully the results of the findings of the Copenhagen consensus, which attempts to rank a variety of different responses to climate change, assuming the IPCC's scenarios to be accurate, ranks the variety of different responses, and responses to other problems pressing upon mankind.

We don't have infinite resources. There are opportunity costs, and I think there are things that need to take much higher priority than anything we can do in either mitigation or adaptation in response to climate.

Mr. INSLEE. Lord Monckton.

Mr. MONCKTON. Thank you, sir. Don't do cap-and-trade. Remember the poor. Remember your taxpayers. Beware rent seekers, particularly from the scientific community. Remember the warning of Eisenhower against the technocrats who would eventually take over and try to push you in various directions. Pay no attention. Keep your spending down as a state and as a nation, and God bless you all.

Mr. INSLEE. Mr. Waskow.

Mr. WASKOW. Thank you, Mr. Chairman. I would like to address two things quickly. First of all on the Katrina issue. I would agree that there was a massive failure of the levees. There was also a failure of the emergency response system, but I think the lesson that we should draw from this is what is necessary in the context of increasing risk from climate change. And as we have increasing risk on the one hand, we also have to have resilience and adaptive strategies on the other hand going together.

And so dealing with the levees is not—or our emergency response system is not something separate and apart from addressing cli-

mate change. It should be integrated and should be integrated as well with a dramatic reduction in emissions.

The second thing I just wanted to quickly address is the question of renewable energy in developing countries. And without getting into detail, just to say that our view is that renewable energy does, in fact, have many benefits in the development context. And often, in fact, renewable energy is what is going to be necessary for the poorest around the world to be able to have access to modern energy sources.

Mr. INSLEE. Thank you. Bishop.

Bishop HOLLOWAY. Thank you very much. I thought it was very aptly put earlier by Mr. Shimkus that God has no intention of destroying what He has created. He has placed upon us, in addition to that, a covenant that we must honor with Him, but also with one another in the care of the earth. This is part of our responsibility as good stewards.

It is also part of our responsibility to care for one another as we do this. There are others who are affected by what is going on with the changes in the climate and have no way of dealing with it in a way that is life sustaining or capacity building.

We are committed to do that and continuing that work and call upon Congress at this time, not only to carry out its traditional responsibilities as well as it has in the past, but also to take leadership in thinking for those of us and to advocate for those of us who cannot speak for ourselves. Thank you very much.

Mr. INSLEE. Thank you. Mr. Shimkus, would you like to make a comment?

Mr. SHIMKUS. Yeah. Thank you, Mr. Chairman. You know to assume that man can control the world's climate is a very dangerous and a very arrogant position. It reminds me of the biblical story of the Tower of Babel when man thought they could build a tower to reach God. It was in their arrogance that they thought they could do things that only God can do.

What hasn't been talked about a lot—I think the impact on the poor has been talked about, the rural areas, the job dislocation. I think we have ferreted that out. What I would ask you all to look at is especially the climate cap-and-trade, cap and tax, this trading floor. Numerous times, my colleagues on the other side have attacked the New York Mercantile Exchange. Farmers have always attacked the Chicago Board of Trade because big money interests go into these, and it is an area for big money to make big money by setting the price for carbon on a trading floor. They will be held accountable when they attack the trading floor venue, as they always do, in this failed policy. Thank you, Mr. Chairman.

Mr. INSLEE. Thank you. Mr. Scalise, would you like to make a comment?

Mr. SCALISE. Thank you, Mr. Chairman. I would point out that the National Hurricane Center actually tracks hurricanes over the last 150 or so years, and you might not be able to see this where you are sitting, but there have actually been periods going back over 100 years where there were higher numbers of hurricanes and bigger hurricanes than Hurricane Katrina. But clearly the devastation that was caused from Katrina and the deaths related to it were caused by, number one, failure of federal levees, but also the

erosion of the coast, none of which has anything to do with changing and climate temperatures.

And clearly I think the science on global change is not settled. One thing that is settled is the cost, the cost to this country. Peter Orszag, President Obama's own budget director stated before this committee that this type of policy, cap-and-trade policy and energy tax, would actually cost every American family over $1,300 a year in increased energy costs that they would be paying.

For those people that think people making below $250,000 a year won't pay a dime, you give them that $1,300 bill, you are going to have a hard time explaining it to them. That one area is settled as a result of this policy that we should defeat, and I yield back.

Mr. INSLEE. Thank you. I just would like to point out we have one of our witnesses from the Cornwall Alliance for the Stewardship of Creation, and I would just suggest that fulfilling our stewardship responsibility does not involve destroying all creatures great and small, the Lord God made them all. And in fact, that is what is going on right now.

And I don't think we can help the polar bear adopt. They are gone unless something changes in our climate policy. I don't think the people of Shishmaref are going to have a problem there. Their city in Alaska is melting in the sea. We can't just tell them they are just going to have to pick up and move to Florida. It is just not their cup of tea, and it is not all right to make them move.

And I would suggest that we appreciate wisdom from all over the country, but the Englishman I will be listening to is Sir Isaac Newton, whose physical laws are quite well accepted as is the science on everything we have been talking about here today. Thank you very much.

Mr. MONCKTON. Until Einstein.

[Whereupon, at 1:10 p.m., the subcommittee was adjourned.]

[Material submitted for inclusion in the record follows:]

OUTDOOR ALLIANCE

March 24, 2009

Honorable Jay Inslee
United States House of Representatives
403 Cannon House Office Building
Washington, DC 20515

Dear Congressman Inslee:

Together, Outdoor Industry Association and Outdoor Alliance represent the vast majority of the recreation industry and active outdoor recreation community in America.[1] We understand that the Energy and Commerce Committee's Energy and Environment Subcommittee plans to hold a hearing tomorrow morning regarding climate protection legislation adaptation policy. We write this letter to share our perspectives on the matter.

Not unlike indicator species, human-powered outdoor pursuits can be seen as "indicator activities" with respect to climate change because we are some of the first people to experience the impacts of climate change on our public lands. Declining snowpack shortens ski and snowshoe seasons, makes alpine climbing more dangerous and can eliminate ice climbing altogether. Less snowpack also means less water in our creeks, rivers and lakes for paddling. Higher temperatures and prolonged droughts create severe imbalances in forest, alpine, desert, and river ecosystems that stress native species and degrade the quality of the outdoor recreation.

The outdoor community's interest in climate protection and ecosystem adaptation is axiomatic – the places where we conduct our outdoor pursuits and that support the $730

[1] Outdoor Alliance is a coalition of six national, member-based organizations devoted to conservation and stewardship of our nation's public lands and waters through responsible human-powered outdoor recreation. Outdoor Alliance includes: Access Fund, American Canoe Association, American Hiking Society, American Whitewater, International Mountain Bicycling Association, and Winter Wildlands Alliance, and represents the interests of millions Americans who hike, paddle, climb, mountain bike, ski and snow shoe on our nations public lands and waters.

Founded in 1989, Outdoor Industry Association (OIA) is the premier trade association for companies in the active outdoor recreation business. OIA member companies include manufacturers and retailers such as The North Face, Patagonia, L.L. Bean, Jansport, Eagle Creek, VF Outdoor, Coleman, REI, Timberland and Columbia Sportswear. OIA provides trade services for over 4000 manufacturers, distributors, suppliers, sales representatives and retailers in the outdoor industry and is the title sponsor of Outdoor Retailer, the world's largest outdoor products tradeshow.

billion annual outdoor recreation economy[2] are imperiled by a warming climate. Outdoor Alliance and Outdoor Industry Association believe that a critical element of climate protection legislation must be a robust ecosystem adaptation policy that not only protects flora and fauna, but also takes into account the human aspects of our lands and waters.

The Human Aspect of Ecosystem Adaptation Policy

Adaptation policy should include preserving large tracts of open space through a pragmatic approach ranging from protective federal designation to voluntary conservation easements. Adaptation must also include physical structures and land management techniques to facilitate migration and land use planning that puts a premium on contiguous open space. Our National Trail System, including the Appalachian, Continental Divide, and Pacific Crest Trails, and the critical open space they connect, is a model of how this can be achieved.

A universal aspect of human-powered outdoor pursuits is that they take place outdoors in a context that includes not only the topography and gradient of a given place, but the flora and fauna as well. The ecosystem is not merely the setting for our pursuits; it is the very substrate. Taking care of the ecosystem must take precedence over how we enjoy and profit from it. We say this without qualification given the longstanding conservation and stewardship ethic in the outdoor community. This said, we also think there is an argument for conceptualizing adaptation goals and policies a little more broadly.

Long before people recognized the idea of an ecosystem, individual parts were honored through everything from creation myths and totem poles to the landscapes of the Hudson River School artists and our government's foresight in creating a National Park System almost 100 years ago. In addition to being the home to plants and animals, ecosystems and landscapes mean something to people, particularly to Americans. We suggest that as adaptation policy is developed and implemented, some consideration is given to how climate change will impact federal lands, waters and snowscapes as they relate to sustainable human uses. Consideration should include not only human-powered recreation uses, but also the associated economic impacts to the outdoor recreation economy and other traditional uses such as hunting, fishing and wildlife enjoyment.

Though not directly addressed, we feel that the idea of more broadly conceptualizing ecosystem adaptation is consistent with a leading effort to deal with climate protection from last Congress -- The Safe Climate Act of 2007, H.R. 1590.[3] As we understand it, the bill contemplated a carbon auction with proceeds to be used for a variety of purposes, including a series of "Supporting Activities" listed in Section 704(e)(7). These Supporting Activities provided support to states to protect and mitigate the impacts of

[2] The Active Outdoor Recreation Economy, Outdoor Industry Foundation, Fall 2006.

[3] This concept was also explored last Congress in the Leiberman-Warner Climate Security Act of 2008, S. 3036, where a provision specifically directed the Secretaries of the Interior and Agriculture to take into account "the potential to provide enhanced access to land and waters for fishing, hunting, and other public recreational uses" when making spending decisions for adaptation purposes. S. 3036, 110th Cong. §4702(c)(4) (2008).

climate change, including the depletion of snowpack and water supplies, increased wildfires, damage to fish and wildlife habitat and associated commercial harms. While this is a very comprehensive list, we believe that should a new version be developed, it could include a provision that acknowledges the impact of climate change on the human aspects of the landscape and the necessity to take steps to preserve and protect the same.

Diversified Funding for Ecosystem Adaptation

More than forty years ago, Congress created the Land and Water Conservation Fund. The underlying concept is well known and straight forward – authorize some of the revenues generated in the process of recovering our nation's offshore energy wealth to be spent on preserving and protecting open space for habitat and recreation across the country on both federal and state lands. This core concept is even more relevant these days as the nation takes another long, hard look at our federal lands and the energy potential that they contain.

Thus, in addition to potential revenues generated by market-based cap on carbon emissions, to the extent that the United States aggressively develops renewable energy on our public lands and waters, and such development creates new royalty income, spending some of this potential royalty income on ecosystem adaptation and the preservation of open space should be explored with vigor.

Conclusion

In addition to enabling us to better protect our lands and waters and the flora and fauna contained therein, a broadly conceptualized, properly funded ecosystem adaptation policy will create a tangible benefit to the American public. Healthy open space provides citizens with the opportunity to view wildlife, play in the rivers and snow, test one's skills on a steep rock or a single track, and experience first-hand the natural world – these places enable Americans to stay connected to the natural world, and contribute hundreds of billions of dollars annually to our economy. We believe that this connection will enhance our citizen's commitment and collective endurance to achieve the goal of stabilizing our climate.

Sincerely,

Frank Hugelmeyer
President
Outdoor Industry Association

Mark Singleton
Chairman
Outdoor Alliance

cc: The Honorable Henry A. Waxman
The Honorable Edward J. Markey
The Honorable Raúl Grijalva

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