Testimony of
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Before the House Select Committee on Energy Independence and Global Warming
Hearing on Wildfires and the Climate Crisis
November 1, 2007

Chairman Markey, Ranking Member Sensenbrenner, and Members of this Select Committee, I thank you for the opportunity to testify on matters of wildfires and climate change today. My name is Steven W. Running, Professor of Ecology at the University of Montana in Missoula, MT. I have lived in Washington, Oregon, Colorado and Montana, so have high familiarity with forests of the West. My research for nearly forty years has been on forest stress, terrestrial carbon and water cycles, and satellite monitoring of global ecosystem health. Most important to this committee, I recently served as a Lead Author on the Intergovernmental Panel on Climate Change 4th Assessment that was co-recipient of the 2007 Nobel Peace Prize. My responsibility was in the Working Group II Chapter 14 on North American impacts, and my text specifically concerned trends in North American wildfire.

Executive Summary

The summary points of my testimony are:

1. Wildfire activity in the U.S. including Alaska, has increased dramatically in the last few decades, and correlates directly with recent warming and drying trends, and earlier mountain snowmelt.
2. Fuel accumulations due to past fire suppression and grazing control combine with climate trends to explain recent unprecedented wildfire intensities and patterns.
3. Global climate model runs used for the 4th IPCC Assessment predict even warmer and drier summers for the western U.S. in the next 50 years.
4. These climatic warming trends will exacerbate natural drought cycles, and stressed ecosystems will inevitably burn, human adaptation is essential.
5. Construction standards to encourage limited combustion building design and materials, fire defensible perimeters around structures, and zoning are necessary to cope with inevitable wildfires.
6. Fuel reduction efforts of removing small trees and surface fuels, processed to biomass for institutional heating, could both reduce wildfire risk and substitute for some fossil fuel consumption.

CURRENT WILDFIRE TRENDS

Let me first summarize, with text paraphrased directly from the IPCC report, WG II Chapter 14, what we know about current wildfire trends in North America.

Since 1980, an average of 22,000 km^2/yr has burned in U.S. wildfires, almost twice the 1920 to 1980 average of 13,000 km^2/yr (Schoennagel et al., 2004). The forested area burned in the western U.S. from 1987 to 2003 is 6.7 times the area burned from 1970 to 1986 (Westerling et al., 2006). In Canada, burned area has exceeded 60,000 km^2/yr three *times since 1990, twice the long-term average (Stocks et al., 2002). Wildfire-burned area in the North American boreal region increased from 6,500 km^2/yr in the 1960s to 29,700 km^2/yr in the 1990s (Kasischke and Turetsky, 2006). Human vulnerability to wildfires has also increased, with a rising population in the wildland-urban interface.*

And as of Oct 29, 8.7 million acres have now burned in 2007 (see Fig 1). Note that the graphics ended on October 5, because normally the fire season would be over. Yet California burned 380,000 acres last week. The 10-year annual average of 5.9 million acres burned has been exceeded six times since 2000.

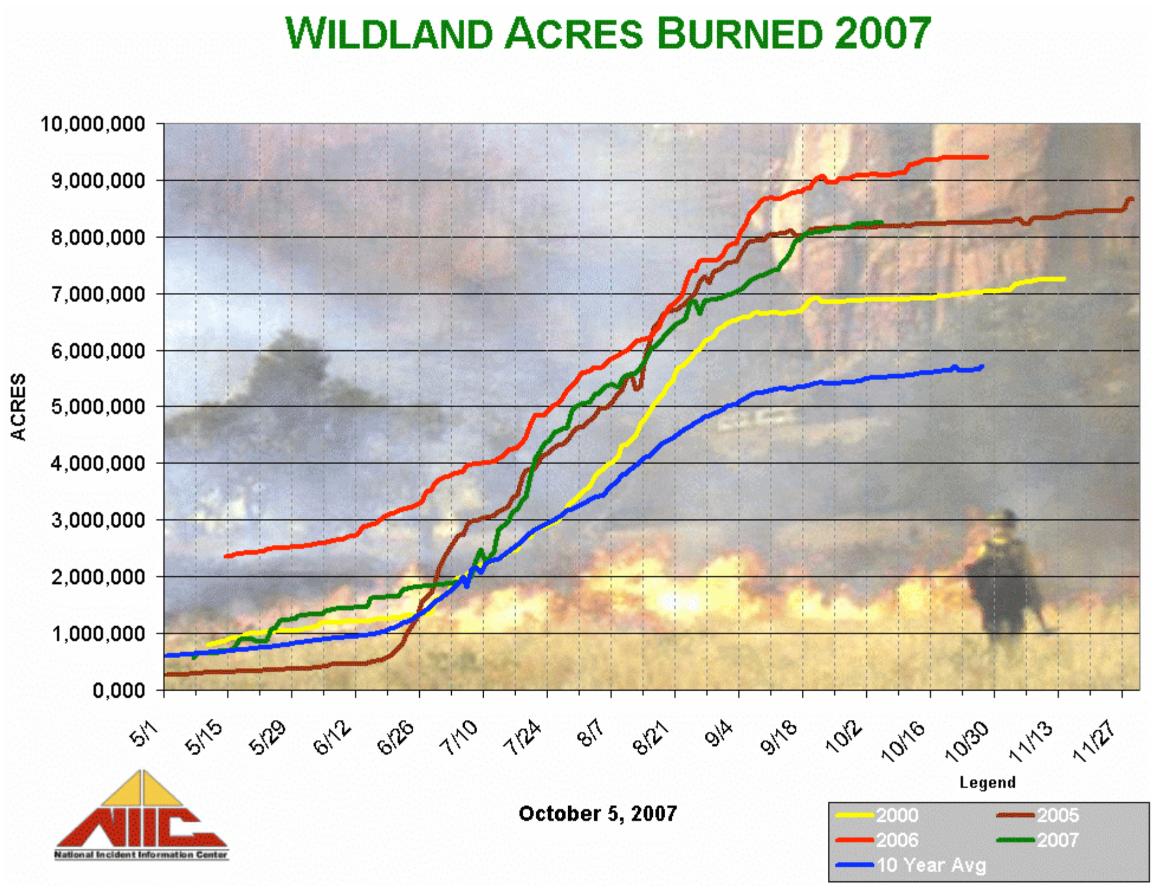

Figure 1: Seasonal trend of U.S. wildfire area. Note that when the graph starts, May 1, the SE fire season has often already burned a few hundred thousand acres in Spring fires.

THE CAUSES

In my view, ***four important trends*** have combined to bring us to the wildfire emergency we have today. ***First***, our western landscapes particularly are recovering from the stunning overexploitation of the 19th century, when unrestrained logging and overgrazing denuded much of the western landscape. Current forestland is much more extensive now than 100 years ago, and some invasive species like cheatgrass are highly ignitable when dry. Historical photographs illustrate rather denuded landscapes in the interior West around the turn of the 20th century that has recovered and regrown (Figure 2).

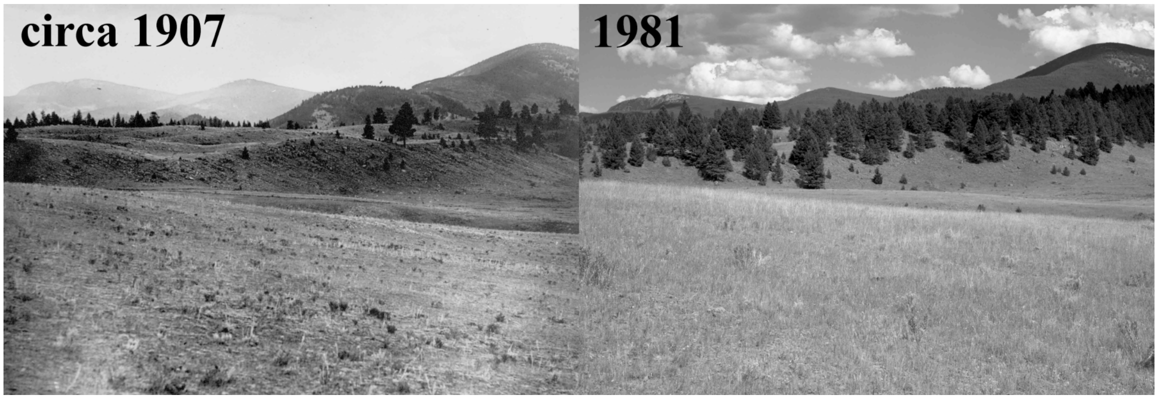

FIGURE 2. Flint Creek Range in western Montana

Second, wildfire suppression was organized nationally after the cataclysmic wildfires in 1910 that burned 2.6 million acres of national forest land in Idaho-Montana, including over 4700 square miles in 2 Days during the Big Blowup that killed 88 people. The Big Blowup was a "Perfect Storm" when all the weather and fuel wildfire ingredients merged with a massive 2 day windstorm on August 20-21, 1910, generating 80mph winds and blowing firebrands 10 miles ahead (Pyne 2001). These low probability, high impact events will always happen occasionally despite anything humans do. For the succeeding 100 years it was the goal of wildfire managers to suppress every fire before 10AM the following morning. In fact, wildland fire fighters now suppress successfully about 98% of all unplanned ignitions, a very high success rate! Unfortunately, the 2% that cannot be successfully suppressed occur under extreme conditions of fire growth brought on by extremely hot, dry weather, and in almost every case, wind velocities above 30mph. In these fire weather conditions, as we witnessed last week with the Santa Ana winds in California, a new fire can grow within hours to a level where no amount of manpower, equipment and money can stop it. These massive wildfires can have energy releases the equivalent of a Hiroshima atom bomb exploding every 10 minutes. Until the weather, particularly wind, subsides nothing can be done to stop these most dangerous fires except evacuate people.

The ***third*** important trend is the large number of dwellings and structures that have been built in forested area, particularly in the last 30 years. The wildland urban interface nationally now is an area larger than the size of California, and an estimated 8 million homes have been built in this interface since1970. In recent years many western states have experienced loss of hundreds of homes from wildfires, Colorado and Arizona in 2002, California in 2003, Texas in 2006. In addition, thousands of cabins, houses and ranches have been built in rural forested areas since the 1970s, typically as recreational second homes. A wildfire that might have burned harmlessly many miles from any human settlement now is threatening structures almost immediately. Wildfire suppression often must concentrate on public safety and structure protection, not putting out the fire.

Since 2000, the number of human-caused fires in the U.S. has ranged from 50 to 80 thousand per year, far outnumbering lightning caused fires at 8 – 16 thousand per year. Human caused fires occur from accidents, carelessness, and arson. Millions of Americans picnic and camp in the western forests every summer, so limiting these ignitions is challenging. However lightning-caused fires usually burn >60% of the annual total area, because fires in limited access areas are more difficult to attack, or may be allowed to burn to reintroduce natural fire cycles in remote areas where danger to the public is not great.

The ***fourth*** and final important trend is the changing climate. Again from the IPCC report, WGII, Chapter 14:
A warming climate encourages wildfires through a longer summer period that dries fuels, promoting easier ignition and faster spread (Running, 2006). Westerling et al. (2006) found that in the last three decades the wildfire season in the western U.S. has increased by 78 days, and burn durations of fires >1000 ha in area have increased from 7.5 to 37.1 days, in response to a spring-summer warming of 0.87°C. Earlier spring snowmelt has led to longer growing seasons and drought, especially at higher elevations, where the increase in wildfire activity has been greatest, see Fig 1 (Westerling et al., 2006). In Canada, warmer May to August temperatures of 0.8°C since 1970 are highly correlated with area burned (Gillett et al., 2004). In the south-western U.S., fire activity is correlated with El Niño-Southern Oscillation (ENSO) positive phases (Kitzberger et al., 2001; McKenzie et al., 2004), and higher Palmer Drought Severity Indices.

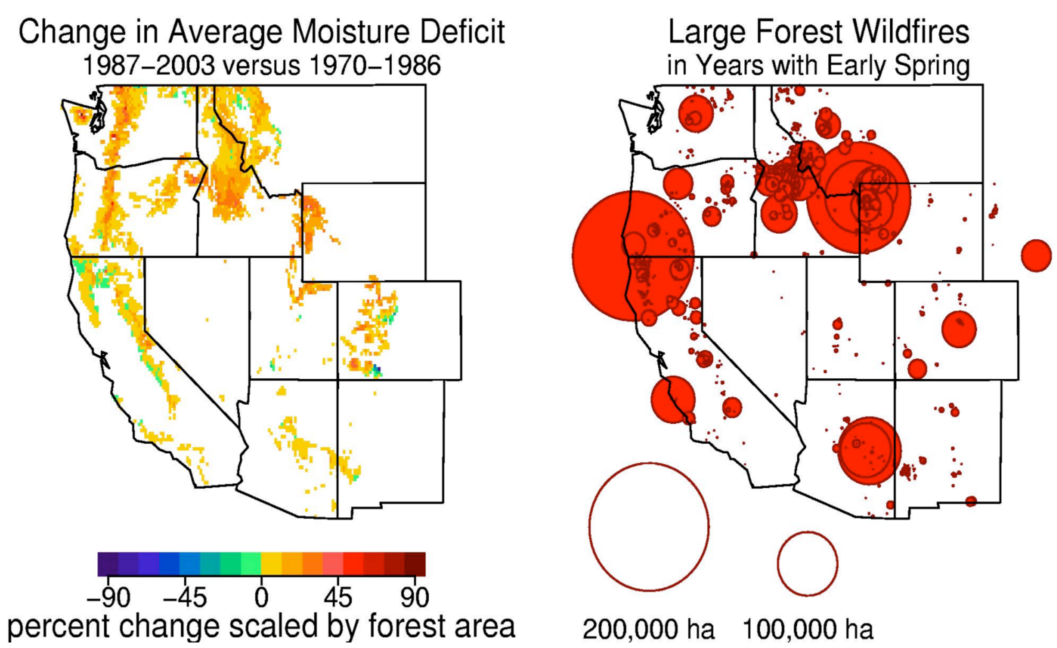

FIGURE 3. Between 1970 and 2003, spring-summer moisture availability declined in many forests in the western U. S. and most major wildfires exceeding 1000ha occurred in these same droughted areas. (From Running, 2006, Westerling et al 2006)

The mountains of the West carry most of the regional forest cover, as the valleys are often too dry or have been cleared for farming and ranching. These rather arid western forests rely predominantly on snowpack for their water supply for growth and survival, as summer rainfall is sporadic and re-evaporates quickly. Snowpack are now melting 2-4 weeks earlier throughout much of the West (Mote et al 2003), extending the summer dry period in time, *and* extending up in elevation the vulnerable dry forest area.

Ecosystems have a carrying capacity for vegetation, much like rangeland has a carrying capacity for cattle, or even an airplane for passengers. A parcel of land can only supply a finite amount of light, water and nutrients to the plants, yet many more plants germinate and compete for these resources than can permanently be sustained. When this climatic carrying capacity is exceeded, the vegetation, cattle or passengers don't immediately die, they initially become stressed, and more vulnerable to small, otherwise normal perturbations of their systems. Insects and diseases are a natural part of ecosystems. In forests, periodic insect epidemics kill stressed trees over large regions, providing dead, desiccated fuels for large wildfires (Logan et al., 2003). Ironically, fires have had the primary natural role of keeping ecosystems healthy in the arid western forests by cleaning out dead material and keeping the vegetation at or below the climatic carrying capacity of the landscape. During a hot, dry summer, when the carrying capacity of water to the ecosystem is reduced, fires react by reducing the vegetation cover. We now are entering an era where the ecosystem water supply may be permanently reduced, and ultimately the natural ecosystems will rebalance to this new climate. New ecosystems that grow back after fires may be different from the ecosystem that burned.

The Southeast U.S. is thought to be a mesic climate, yet because those ecosystems are accustomed to high normal rainfall, drought cycles rapidly deplete water availability. Spring is typically the most active fire season, before summer monsoon rains begin, and recent years have had major wildfires in Florida, Georgia and Texas.

Fires on Alaska's North Slope have been considered rare events. Only 134 fires north of 68º are recorded in fire history kept by the Alaska Fire Service since 1956. The 2007 Anaktuvuk River fire was an unprecedented event in that it burned in September, was so large (256,000 acres), and that it burned all the way from the coastal plain to the foothills of the Brooks Range.

FUTURE CLIMATE TRENDS

Our best look into the future climate is from analyzing the extensive computer model runs done for the 4th IPCC Assessment. Seven different global circulation models or GCMs from 6 countries were operated for three future emission scenarios, and selected for detailed regional analysis (Ruosteenoja et al 2003). A summary of these results for the western U.S. suggests that within 50 years the summer-time temperatures will be 3-4 deg C (5-7deg F) warmer, but with equal or even less precipitation than the present. Seaver et al (2007) analyzing 19 climate models for the IPCC report concluded that the Southwest U.S. may have a permanent Dust Bowl climate, which ironically would decrease fires in some areas due to lack of fuel.

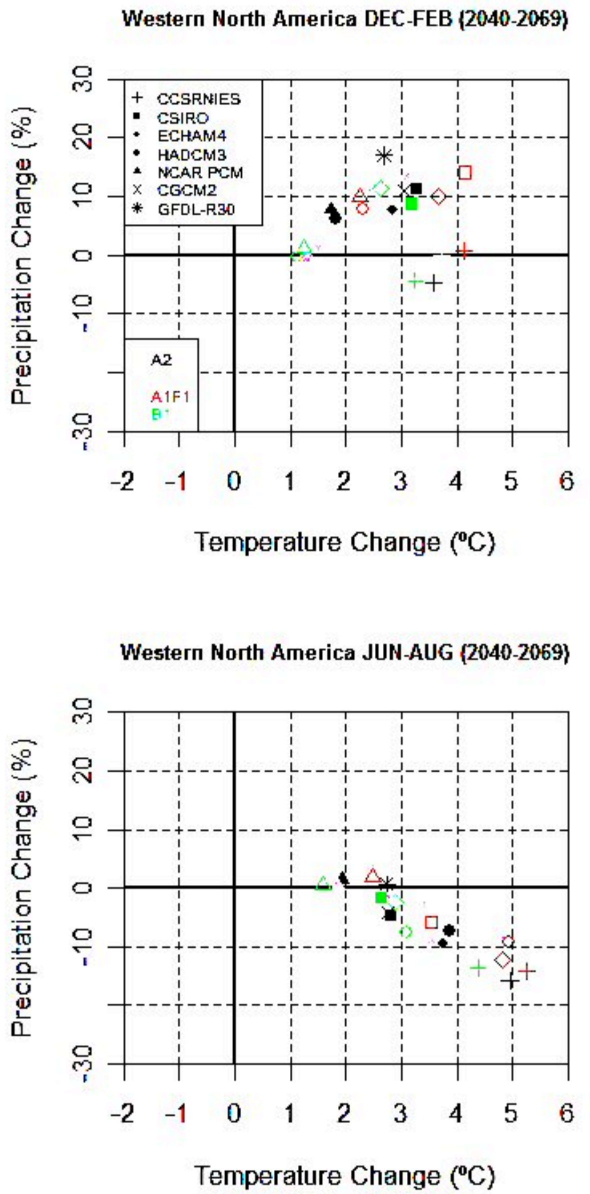

Figure 4: GCM runs done for the 4th IPCC Assessment report. These graphs isolate the western North America region, for the 2040-2069 time period, and show expected precipitation and temperature for the winter months (top) and summer months (bottom). Models included are the CCSRN (Japan), CSIRO (Australia), ECHAM (Germany), HADCM3 (United Kingdom), NCARPCM (U.S.A.), CGCM2 (Canada), GFDL-R30 (U.S.A.). A@, A1F1, B2 refer to IPCC Emission scenarios used for the 4th Assessment climate simulations. (from Ruosteenoja et al. 2003).

Implications for the future of wildfire in the West are clear. Warmer summer temperatures are projected to extend the annual window of high fire ignition risk by 10-30%, and could result in increased area burned of 74-118% in Canada by 2100 (Brown et al., 2004; Flannigan et al., 2004). The ecosystems that return after fire will not necessarily be the same that burned, but will be a more arid type. Closed canopy forests may be replaced with open savannahs. Analysis of recent satellite data by Wentz et al (2007), concludes that dry climates will get drier in the future, and the pattern is already emerging in current data.

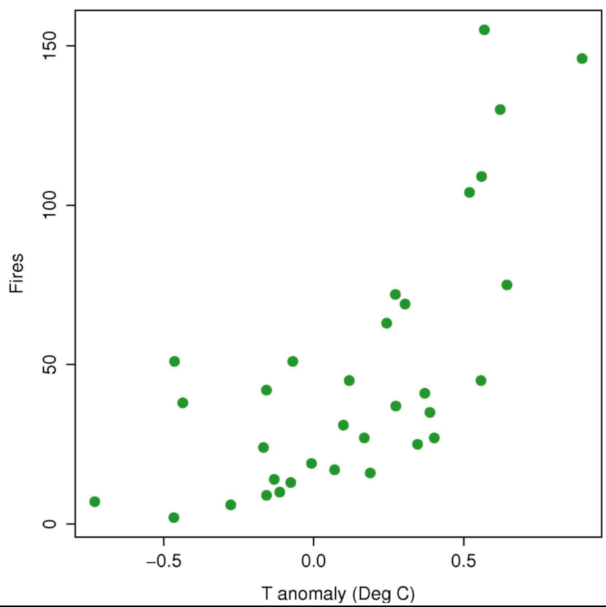

Figure 5:Large fires (>500acres) from 1972-2004 in the forested West related to March-August temperature anomaly. Note that these data only range to a temperature anomaly of 0.7deg, while Figure 4 projects temperature increases of 3-5 degrees by the 2050s. (from T. Westerling).

POTENTIAL SOLUTIONS

I defer detailed solutions to the land and fire management professionals also testifying today, but wish to make a few observations. When "Perfect Firestorm" conditions develop, as in California last week, the emphasis should of course be on human safety, and the public needs to understand that effective fire suppression must wait until the extreme weather conditions subside.

Combining the four trends identified earlier together, I can only conclude that the U.S. can expect more wildfire in coming decades. Consequently, I think building construction standards in fire prone areas need to emphasize fire resistance. Maintaining defensible space of 100ft around each home in fire risk localities needs to be a priority. There may need to be zoning regulations in some areas, focused on fire adaptation. Also, each homeowner in vulnerable areas has the responsibility to follow the well-publicized Fire Wise procedures for regularly minimizing combustion risk on their property. These may sound heavy-handed, but it is public funding that is used to fight these fires.

However, fire is not always the enemy. Fire has an important ecological role in keeping vegetation at the climatic carrying capacity of the land. Rather than waiting for hot, dry years to provide natural fires, it is safer to plan controlled prescribed fire where appropriate that can be accomplished during moderate, not extreme, weather conditions. In the arid West, where dead trees may not decompose for centuries, fire is an important natural recycling system for carbon. However, these fires emit around 5-10% of the CO_2 emitted by fossil fuel combustion in the U.S. (Sue Conard, U.S.F.S.). Policies that would encourage transforming these fire fuels instead to a biomass source for building heating or electrical generation could accomplish the dual objectives of reducing wildfire risk and reducing fossil fuel consumption.

Programs such as the USFS Fuels for Schools are a good example of pursueing the dual objectives of reducing fire fuels in the forest and replacing fossil fuels in town. This Forest Service program proposed to the Western Governors Association that by 2012 a goal of 70 institutional heating facilities be converted to biomass fuels. The program estimates that institutional and governmental buildings with available biomass sources within 60 miles could consume 800,000 tons of biomass per year, and save $90 million/year in fossil fuel costs by 2012 if outfitted with high-efficiency furnaces.

Members of the Association for Fire Ecology adopted ***The San Diego Declaration on Climate Change and Fire Management*** at the 3rd International Fire Ecology and Management Congress held in San Diego, California Nov. 13-17, 2006. The document was drafted by the AFE Board, submitted for peer review and group discussion, and individually endorsed by about 200 Congress participants. This ***Declaration*** states that future land management activities must consider climate change, and recommends a wide range of alternatives for planning and management to enhance ecosystem resiliency to wildland fire in a changing global climate. Recommendations include incorporating the likelihood of more severe fire weather, lengthened wildfire seasons, and larger-sized fire when planning and budgeting, expanding prescribed burning for fuel reduction, controlling highly flammable invasive species, and removing and utilizing small diameter forest products (engineered lumber, pulp, paper, and bio-fuels) and chipped fuels (for electrical energy generation) to reduce fire hazards in appropriate vegetation types. [http://www.fireecology.net/pdfs/san_diego_declaration_final_29_nov_2006.pdf].

SOME FINAL PHILOSOPHY, an essay based on my recent public speaking

The 5 Stages of Climate Grief

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The global warming topic seems to now be saturating the media. Newspapers, television, weekly magazines and endless Internet sites all have summaries of the science, and wide ranging discussions of what society should do next. The global warming trends and projections are sobering, even frightening, eliciting puzzling responses from the public.

As a professor and climate scientist at the University of Montana in the U.S.A., I have been giving public lectures on "The Inconvenient Truth for Montana" for at least 5 years, and these speaking engagements occur now almost every week. Also, as a lead author for Chapter 14 of the most recent Intergovernmental Panel on Climate Change (IPCC) WG II report, I wrote about both the level of scientific consensus and uncertainty, for global warming and impacts for North America. My speeches cover the newest evidence of increasing hurricane intensity, larger wildfires, melting glaciers, and sea level rise that are being implicated with climate change. Individual reactions to my presentations are wide-ranging, from anger to depression, and it has been difficult for me to understand this wide spectrum of emotions.

I recently took a fresh look at the widely recognized concepts on the "5 stages of grief" that Elizabeth Kubler-Ross defined back in the 1970s to summarize how people deal differentially with shocking news, such as being informed that they have terminal cancer. It seems that these stages of grief provide a very good analogy to how people are now reacting to the global warming topic, so I have formulated my "5 Stages of Climate Grief" as follows.

The first stage DENIAL, are the people that simply do not believe the science that the Earth is warming, or secondarily that humans are the cause. Despite seeing a 50 year record of global atmospheric CO_2 rising *every year* since 1957, and global air temperatures of the last dozen years in a row being the warmest in a millennium, they dismiss these trends as natural variability. These people see no reason to disturb the status quo. Most people rightfully started at this stage, until presented with convincing evidence. That convincing scientific evidence recently summarized in the 4^{th} IPCC report has, according to opinion polls, dramatically reduced the number of people in Stage 1.

Many people jump directly from DENIAL to Stage 4, but for others, the next Stage 2, is ANGER, and is manifested by wild comments like "I refuse to live in a tree house in the dark and eat nuts and berries". Because of my public speeches, I receive my share of hate mail, including being labeled a "bloviating idiot", from individuals that clearly are incensed at the thought of substantially altering their lifestyle. My local newspaper has frequent letters to the editor from people angry to the point of irrational statements hinting darkly about the potential end of modern civilization.

Stage 3 is BARGAINING. When they reach this stage many people (such as self-righteous radio talk show hosts), who used to be very public deniers of global warming, begin making statements that warming won't be all that bad, it might make a place like Montana "more comfortable". It is true that the building heating requirements for my hometown Missoula have decreased by about 9% since 1950 due to milder winters. At this stage people grasp for the positive news about climate change, such as longer growing seasons, and scrupulously ignore the negative news, more intense droughts and wildfires, and no glaciers in Glacier National Park by 2020. Most importantly, at this stage people are still *not* willing to change lifestyle, or explore energy solutions that are less carbon intensive. They seem willing to ride out this grand global experiment and cope with whatever happens.

Many people at my lectures have now moved to Stage 4, DEPRESSION. They consider the acceleration of annual greenhouse gas emissions, the unprecedented speed of warming, and the necessity for international cooperation for a solution, and see the task ahead to be impossible. On my tougher days I confess to sinking back to Stage 4 myself.

The final stage ACCEPTANCE, are people that acknowledge the scientific facts calmly, and are now exploring solutions to drive down greenhouse gas emissions dramatically, and find non-carbon intensive energy sources. Two factors are important in moving the public from DEPRESSION to this ACCEPTANCE stage. First are viable alternatives to show that reducing greenhouse gas emissions is possible without the end of modern civilization. It is very heartening to see wind turbines, LED lighting, thin film solar and hybrid cars on the market right now, not some vague future hope. Second is visionary national leadership, a "Marshall Plan" level of national focus and commitment, so everyone is contributing, and the lifestyle changes needed are broadly shared, in fact becoming a new norm. Progress on that front has not been good so far. An obvious flaw in this analogy is that many people are simply ignoring the global warming issue, a detachment they cannot achieve when they are personally facing cancer.

It is both welcome and important that some global leaders of the business community, from DuPont, General Electric and WalMart down to the smallest entrepreneurial startups are now strongly pursuing goals of de-carbonized energy, improved efficiency and conservation. Large social changes always unavoidably breed pain for some and new opportunity for others, depending much on how rapidly people react to new realities. We really need most of our political, business and intellectual leaders to reach Stage 5 ACCEPTANCE in order to move forward, as a nation, and as a global citizenry. There is no guarantee that we can successfully stop global warming, but doing nothing given our present knowledge is unconscionable. How otherwise can we look into our grandchildren's eyes?

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