A Proof that Manmade Emissions are Contributing to Global Warming

Abstract:
The scientific method cannot 'prove' a theory, only disprove it. Therefore, it is not possible to conclusively prove that anthropomorphic emissions are resulting in global warming. Instead, what we can do is show this theory passes all tests that the scientific method puts it to. That is being done here by addressing three questions: 1) Is the Earth warming?; 2) If so, is this warming at least partly due to the greenhouse effect or is it all due to other sources; and 3) If any of the warming is due to the greenhouse effect, are manmade emissions contributing to it? If, via the scientific method, we can show that the answer to these three questions is 'Yes', then it must be concluded that manmade emissions are contributing to global warming.

Hypothesis 2 can be rejected simply by examining reasonably expected costs and benefits of global warming. We can examine the anticipated costs and benefits of weather changes, changes in biodiversity, crops, diseases, and energy usage for both developed and undeveloped countries and make comparisons. If the anticipated costs incurred over the next 100 years as a result of global warming are greater than the anticipated benefits, hypothesis 2 must be rejected.

Introduction:
The question of whether or not manmade emissions are contributing to a rise in global temperatures can be answered by a systematic examination of three points:

1) Is the Earth warming?

If the Earth is not warming, then clearly the answer to the above question is that manmade emissions are not resulting in changes to the climate. This point is a necessary first step in answering the question.

2) If the Earth is indeed getting warmer, is this warming due to the greenhouse effect, or is it due to something else?

Again, it cannot be concluded that manmade emissions of greenhouse gases are resulting in global warming if the greenhouse effect is not the cause of the warming. This point is a necessary second point to answering the above question.

3) If the warming is actually due to the greenhouse effect, are manmade emissions causing or contributing to this effect?

If the answer to each of these points is 'yes', then it must be concluded that manmade emissions are resulting in an increase in global temperatures.

1. Is the Earth warming?
If the Earth is warming, the vast majority of the excess heat is expected to go toward warming the oceans. With over 1000 times the heat capacity of the atmospheres, the

oceans of the world are the largest repository for excess heating due to global warming (*Levitus et al.* 2005; *Hansen et al.* 2005). Changes in globally integrated upper ocean heat content anomaly (OHCA) therefore have very important implications for determining if any observed warming is real.

Because of their very large heat capacity, the oceans are very stable thermodynamically on the short-term and their overall temperature is not easily affected. Any changes would require a long-term, continuous effect. In comparison, temperatures of the land and air can be affected by short-term activity not associated with global warming. This volatility in temperature creates a great deal of 'noise' in the data that makes it more difficult to discern long-term patterns using land and air data. But, since the oceans are much less sensitive to short-term effects, this level of noise is greatly reduced in the ocean temperatures. Consequently, if we can detect that the oceans are warming over a period of years or decades, this would show there is a long term effect and serve as a positive indicator that the Earth is experiencing a warming trend.

Measurements of the ocean temperatures necessary for making such an evaluation have been recorded since 1955. Naturally, this database has become more extensive and more reliable as technology improves. All of the collected data shows the oceans to be warming over this period of time, with the greatest amount of warming occurring most recently. Some reported data was found to be suffering from artifact, but was then corrected. *Lyman and Johnson* (2008) examine the reliability of the data collected since 1955 and conclude that, when data bias and ocean variability is included in the analysis, the data produce a warming trend within the confidence intervals. And, *Levitus et al.* (2008) compare several independent data sets and find that these data sets show excellent agreement. Thus, examination shows that independent measurements of the world's oceans all show the ocean temperatures are rising and they all agree to the amount of the temperature rise.

Lyman et al. (2006) report a measured increase in the heat content of the upper 750 m of the world oceans by 8.1 (± 1.4) x 10^{22} J between 1993 to 2003, followed by a decrease of 3.2 (± 1.1) x 10^{22} J between 2003 and 2005. *Willis et al.* (2007) corrected this with the finding that the cooling was an artifact attributed to instrument bias. Incorporating this correction to their data they found the oceans experienced a warming between 1993 and 2005 that required an average rate of warming of 0.33 ± 0.23 W/m^2 over the Earth's total surface area. An important note is that while the cooling was attributable to an artifact, the measured heating of the ocean reported by *Lyman et al.* between 1993 and 2003 was real.

Consequently, we may conclude that the world's oceans are definitely warming and this warming trend has been in progress since at least 1955. And, we may safely conclude that the amount of heating that occurred between 1993 and 2003 was on the order of approximately 8.1 (± 1.4) x 10^{22} J.

Conclusion:

While it may be possible to dispute the precise numbers, the data clearly indicates that the oceans are warming up and have been doing so since at least 1955. Further, while there is a range in the numbers, the range is small and independent data bases show excellent agreement and even the lowest measurements show that the amount of heat absorbed by the oceans over recent decades is massive in scope. Since the oceans are in thermal contact with the rest of the world, this heating can occur if and only if the heat content of the world is going up. What cannot be debated is that the temperature of the oceans and, by direct contact, the temperature of the Earth is going up. Hence, the unequivocal answer to the first point is, 'Yes, the Earth is warming.'

2. If the Earth is indeed getting warmer, is this warming due to the greenhouse effect, or is it due to something else?

We have shown the Earth is getting warmer, but is this warming significant? Before examining the need for a source of heating, we need to determine if the amount of heat that has been added to the environment is significant enough to require a source other than something minor.

To put the observed heating into context, 8.1×10^{22} J is equal to the entire energy output of 20 million 1 MT nuclear bombs. One such bomb would have to be detonated every 16 seconds for 10 years and require 100% absorption of the released energy to achieve this level of warming. And, this amount of heating is only what was measured within the oceans and does not include any heating of the atmosphere or the land or energy radiated into space. Even using the lower ocean warming figure of 6.7×10^{22} J, we find this is still the equivalent of about 16.75 million 1 MT nuclear bombs. So, we can conclude that a significant amount of energy has been added to the Earth's environment and this heating would require some additional cause or source in addition to what was previously in place.

But, is this heating due to the greenhouse effect? Or, is it due to some other, unrelated, cause? To answer this, we can divide alternative warming sources into two categories: external sources and internal sources. Internal sources can be further divided into natural sources and manmade sources.

Naturally occurring internal sources would ultimately all require an increased level of warming within the Earth itself, the only true source of naturally occurring internal heating. All other sources of heating would be secondary effects of that one source. When we examine this issue, the first question that has to be answered is whether or not the Earth could experience a (geologically) sudden increase in internal heating.

Earth's internal heating is caused by radioactive decay of unstable isotopes. We can safely assume that these isotopes are not uniformly distributed within the Earth's interior and that they move around as internal convection occurs. Therefore, we can conclude there is a possibility that isolated concentrations of radioactive isotopes are brought together by this convective motion and this would lead to increased levels of radioactive decay. The probability of this happening cannot be accurately determined without knowing the distribution and size of isolated concentrations.

However, upon further examination it is clear that is not the case. The global warming effects we are witnessing have been widespread and have been occurring on a short time scale, even by human standards and certainly by geologic standards. This does not lend itself to the idea of a large amount of convective activity bringing isolated concentrations together within the Earth's interior, an activity that would require a timescale of hundreds of thousands to millions of years.

Even if this activity had occurred in the past such that the effects were now being witnessed, this effect would not be something that manifests itself suddenly or uniformly. Infrared measurements of the Earth's surface have not revealed widespread areas of unusual heating. There are isolated hotspots, such as Yellowstone National Park, but they are limited in scope, both in spatial dimensions and in temperature variations. Spots such as these do not produce enough heating to have resulted in the temperature increases we found in step 1, or to even produce anything other than a small fraction of a percentage of this observed heating. These hotspots have been active for millennia and are already included in the global heat budget, so they cannot be contributing to global warming. Additionally, the level of geologic activity on the continents does not show an increase in activity that could possibly account for the observed amount of increased heating.

Further, if global warming was a result of increased heating within the Earth, we would witness an inverse gradient to the temperature distribution within the oceans. The ocean floor is the thinnest crust on the planet and the majority of heating that would escape through the crust would occur there, either through geologic activity such as volcanic or seismic events or through direct conduction through the rock. However, the evidence shows conclusively that the temperature of the oceans drops dramatically and uniformly around the world as depth increases and is coldest at the deepest depths at the ocean floor. If a short term increase in interior heating was occurring, we would see exactly the opposite. Also, while it is conclusive that the upper portions of the ocean are warming, there is no evidence that the lower portions of the ocean have yet to experience any warming. This shows the oceans are warming from the top down, not from the bottom up.

When examining the speed and magnitude of the observed global warming it therefore must be concluded the heating of the Earth cannot be attributed to an increase in internal global heating. The evidence also shows that an increase of internal heating by the Earth cannot possibly be considered to be responsible for more than a small percentage of the observed global warming.

The only possible way that naturally occurring internal heating could result in any sizable increase in global temperatures would be if the internal sources produced a small increase in temperature over a period of many years and this heat was retained within the atmosphere in a cumulative effect. But, this would require the greenhouse effect or else this additional heating would have reached thermal equilibrium and the excess heat would be radiated out into space. And, this would prove an affirmative answer to our point 2 above.

This leaves the issue of manmade effects. Human activity has increased dramatically over the last few centuries due to an increase in population and industrial activity and this has led to an exponential increase in the amount of heat generated by humans. It is safe to assume that any heat released into the environment by man's activities would take some amount of time to radiate into space and that this heat would contribute to global warming. Could this released heat be trapped within the atmosphere at a rate that is naturally present within the atmosphere, and could this amount of heat be responsible for the observed global warming?

According to U.S. government statistics and reported by the Energy Information Administration (http://www.eia.doe.gov/emeu/international/energyproduction.html), world production of energy increased from 3.03×10^{20} J in 1980 to 4.85×10^{20} J in 2005. This gives an average of approximately 4×10^{20} J of energy that human activities release into the environment annually. Taken over 10 years, this comes out to be approximately 4×10^{21} J of energy. So, if 100% of global human energy production was retained in the atmosphere for 10 years, it still would amount to less than 5% of the observed global ocean heating of 8.1×10^{22} J over the period of 1993 – 2003 (and approximately 6% of the lower end of the ocean heating estimate). However, this conclusion is based on the idea that all of the heating is retained. This could occur only if the atmosphere had increased its efficiency in retaining heat at the same time, an event that would require an increase in the efficiency of the greenhouse effect. Also, this percentage of heating only reflects the heating of the oceans and does not include any heating of the atmosphere and land masses or heat radiated into space. Further, much of the energy included in the government figures includes energy that would be added to the environment even without man's activities, such as the energy generated through solar power, wind power, and hydroelectric power. All of these activities are directly the result of solar irradiance and would be present in the environment without mankind's activities. Therefore, we can conclude that, even with 100% absorption, energy released by human activities can be responsible for no more than very small percentage of the observed heating and the cause of observed global warming cannot be attributed to the amount of heat released by human activities.

We can safely conclude that global warming is not the result of internal heating, either manmade or naturally occurring. This leaves external heating as the only possible alternative source for the observed heating.

If we examine solar activity as a possible source, we find the observed increase could be achieved two ways: by an increase in the solar constant or by an increase in the absorption rate of the solar radiation. Since the second case proves the point in question, that is, the Earth is warming up via the greenhouse effect, we won't cover it here. The first case can be checked by examining satellite data for the period in question to see if there has been an increase in the solar constant.

However, measurements show that the solar irradiance has actually decreased over this period of time.

Dean Pesnell of the Goddard Space Flight Center stated, "There is also the matter of solar irradiance. Researchers are now seeing the dimmest sun in their records. The change is small, just a fraction of a percent, but significant. Questions about effects on climate are natural if the sun continues to dim." (Science@NASA, September 30, 2008)

The question of solar activity has been examined and reported on in depth. *Lockwood et al.* (1999), *Solanki and Krivova* (2003), *Lockwood and Fröhlich* (2007) and *Lockwood and Fröhlich* (2008) all examined this question and found that solar activity over the period of 1983 to 2003 actually decreased. *Lockwood and Fröhlich* (2008) conclude, "Hence, like many authors before us, we conclude there is no credible way that the recent rise in air surface temperature can be attributed to solar effects." Importantly, this conclusion was not reached by using complex models. They make another important note when they state:

"Contrary to the argument presented by Svensmark & Friis-Christensen (2007), this does not imply that [*Lockwood and Fröhlich* (2007)] argued that the mechanisms that caused any solar variability effects on climate have somehow ceased at some point in the twentieth century, rather [the 2007 paper] found that they have simply been swamped by other factors in recent years.

Solar forcing has declined over the past 20 years while surface air temperatures have continued to rise.

There is considerable evidence for solar influence on the Earth's pre-industrial climate and the Sun may well have been a factor in post-industrial climate change in the first half of the last century. Here we show that over the past 20 years, all the trends in the Sun that could have had an influence on the Earth's climate have been in the opposite direction to that required to explain the observed rise in global mean temperatures."

Lockwood and Fröhlich (2008)

The importance of this statement is that they are not denying that variation in solar activity is an important part of the global climate. Indeed, *Scafetta and West* (2007) estimate that solar input may be responsible for as much as 50% of the observed global warming. What *Lockwood and Fröhlich* are saying is that there are now other factors involved in the global climate that are so large they are overwhelming the effects of solar variability.

An additional theory concerning global warming and solar activity centers on what is known as the solar/cosmic ray theory. This theory says that cosmic rays create clouds which cool the Earth, but the magnitude of solar activity has increased over the 20th century, providing a better shield against the charged particles that make up cosmic rays, resulting in a decrease in cloud formation. With less cooling cloud cover, the Earth has experienced a resulting warming trend.

However, the data clearly shows that solar activity has actually decreased over the period of 1983 to 2003. The resulting increase in cosmic rays has been actually measured by the Ulysses spacecraft currently orbiting the Sun. So, by this theory, we should be actually experiencing global cooling, but the exact opposite is what has been observed.

As stated in *Lockwood and Fröhlich* (2007), "Our results show that the observed rapid rise in global mean temperatures seen after 1985 cannot be ascribed to solar variability, whichever of the mechanisms is invoked and no matter how much the solar variation is amplified."

Changes in Earth's orbit have also been cited as a reason for global warming. *Brook* (2008) relates how ice cores from Antarctica show that variations in atmospheric CO_2 levels over the past 800,000 years closely match changes in Earth's orbit. However, no such change in Earth's orbit is occurring and any such change would take thousands of years to manifest any changes in the environment, not a few decades. And, *Brook* states, "The fundamental conclusion that today's concentrations of these greenhouse gases have no past analogue in the ice-core record remains firm." It is a false argument to conclude that just because the climate changed naturally in the past over thousands of years, the changes we have observed over the last few decades can therefore be explained as a naturally occurring event.

We may conclude that external sources are not responsible for the observed global warming.

Conclusion:
We can conclude the observed global warming is not a result of an increase in internal geothermal heating or heat released by human activity, nor is it the result of external sources. Both internal and external alternative sources of heating have thus been eliminated. The only conclusion is that the observed increase in global temperature is the result of storing heat within the global environment over a period of years and decades, if not longer.

We must also take into consideration that any increase in heat input would result in an increase in heat radiated into space. This amount of heat is not included in our measurements of the warming oceans or into our calculations. Thus, the additional heating required to cause the observed global warming would have to be much larger than what we have considered here and no such additional heating has been detected. Even a combination of all possible additional heating sources would account for only a small percentage of the observed increase in heating.

The science of atmospheric gases shows very conclusively that increasing the amount of greenhouse gases in an atmosphere will increase the level of warming due to the greenhouse effect. See *Aubrecht* (1988), *Firor* (1994), *Barker and Ross* (1999), and *Knox* (1999) for just a few examples of a plethora of documents on this topic. Well documented measurements of greenhouse gases in the atmosphere have shown that it has been consistently rising over the entire period that measurements have been made.

But, the approach I took here was to eliminate other possible sources of the additional heat leading to global warming. What we have found is that the amount of energy coming in from outside Earth's environment is actually decreasing, while the amount of energy being released within Earth's environment is holding approximately steady. Even the combination of all of these factors cannot account for the additional amount of heat that is observed to have been added to Earth's environment over the last several decades and this combination of sources becomes credible only if we assume that the Earth has become more efficient at storing heat. This conclusion would require an increase in the greenhouse effect and would prove point number 2 above to the affirmative.

In other words, the Earth is not warming because of additional heat input, but because of more efficient retention of the heat that is present.

Since this is the definition of the greenhouse effect, we have shown that the second point is true. We have now proven that global warming is occurring and that this global warming is due to the greenhouse effect. We must now demonstrate that manmade emissions are a factor in this effect.

3. If the warming is actually due to the greenhouse effect, are manmade emissions causing or contributing to this effect?

It is important at this time to point out that hypothesis 1 in the challenge does not require the proof that anthropomorphic emissions are responsible for all of the observed global warming, or even most. It is only required to show that manmade emissions of greenhouse gases discernibly, significantly and predictably cause increases in global surface and troposphere temperatures. The exact percentage of warming due to man's emissions is not important to the task at hand.

What has been observed is that the amount of greenhouse gases in the atmosphere is increasing, and this increase has been going on for as long as we have been measuring the greenhouse gases in the atmosphere. These measurements have been made at Mauna Loa since the 1950s and have produced the famous 'sawtooth' plot of CO_2 concentrations (http://www.esrl.noaa.gov/gmd/ccgg/trends/). During this same period, man's emissions have also been increasing dramatically. This alone is sufficient to prove point 3 above. But, let's examine it more definitively.

A major argument used by global warming skeptics is that the amount of emissions produced by man's activities is negligible compared to naturally produced greenhouse gases. It may be a true statement that natural sources emit a much larger volume of greenhouse gases than manmade sources. But, these naturally occurring sources are balanced by naturally occurring sinks that absorb these gases. However, the issue is not whether or not mankind is producing more greenhouse gases than natural sources; the issue is whether or not manmade emissions are changing the environment. As an analogy, suppose we have a large balance scale and there is a great, but equal, amount of weight supported by either side. Since the two masses are equal, the scale is balanced. In this

scenario, a mass that is a small percentage of either mass could be added to one side or another and tip the scales. This is the situation concerning manmade emissions.

All natural sources of greenhouse gases are accounted for in nature and the production and absorption is equal. But, when manmade emissions are added, the absorption rate is insufficient to take all produced gases out of the system. Further, as temperatures increase, naturally occurring sinks, such as permafrost, and methane hydrates, will become sources as they melt and contribute to production levels while some sinks, such as the oceans, will absorb less and less. In this way, the significance of the effects of manmade emissions goes far beyond the percentage of manmade emissions in the total mix. Indeed, this is one of the greatest threats of global warming.

But, the argument that manmade emissions are small compared to natural emissions can also be disputed in specific instances. For instance, it is frequently stated that one large volcanic eruption will produce more CO_2 than all of the manmade emissions in a year/decade/century. You can pick your timeframe according to the source you are examining. In all cases it doesn't matter because the claim is not true. We can see this upon a simple examination of the graph of CO_2 content in the atmosphere. If large volcanic eruptions put that much CO_2 in the atmosphere, they would appear as spikes in this graph, but no such spikes exist.

Gerlach (1991) found that the annual CO_2 output of volcanoes is about 145-255 million tons. The annual output by humans is ~30 billion tons, more than 1000 times the emissions from volcanoes. Further, he found that the majority of volcanic CO_2 emissions occur during the quiescent phase of the volcanic eruption with the gas diffusing through the flanks of the volcanoes. This means the emissions of CO_2 by volcanoes is constant and approximately steady, a conclusion that is born out by the data. *Gerlach* further concludes, using conservative estimates, that human emissions are at least 150 times as large as the emissions from volcanic sources. In fact, the annual human rate of CO_2 production is the equivalent of 17,000 additional Kilauea volcanoes. See *Brantley and Koepenick* (1995), *Gerlach* (1991), *Gerlach* (1991b), *Gerlach* (1990) and references therein for supporting studies.

Studies have shown that approximately 45% of all anthropomorphic emissions are absorbed every year [*Barker and Ross* (1999)]. Using the 30 billion ton annual output cited above, this would result in approximately 16.5 billion tons of CO being added to the atmosphere every year by manmade sources. This would increase the amount of CO in the atmosphere by approximately 165 billion tons between 1993 and 2003. This would mean that during a ten-year period, manmade emissions have increased the amount of CO_2 in the atmosphere by an amount equal to the total amount of gases emitted by all volcanic sources over a period of more than 650 years.

Even if the levels of manmade versus naturally occurring emissions are not exactly correct, the point has been proven that manmade emissions are significant. We have demonstrated that global warming exists and that this warming is due to the greenhouse effect. We have further demonstrated that manmade emissions are significant enough to

change the naturally occurring balance of greenhouse gases in the atmosphere. We may, therefore, conclude that levels of manmade emissions will discernibly, significantly and predictably result in changes in the environment.

Conclusion:
It has been shown that the levels of greenhouse gases in the atmosphere are increasing. These measurements have shown these levels to be consistently increasing and are missing any sudden spikes that could be attributed to naturally occurring events, such as volcanic eruptions and this increase in greenhouse gases has occurred in sync with increased human emissions.

While we cannot conclude that manmade emissions are solely responsible for the observed global warming, we can conclude that manmade emissions are disproportionately responsible by way of changing the naturally occurring balance. We can conclude that manmade emissions are, at a minimum, responsible for a significant percentage of the observed greenhouse effect.

We have now proven that Earth is warming, that this global warming is due to the greenhouse effect, and that manmade emissions are discernibly, significantly and predictably contributing to the observed greenhouse effect.

4. Stratospheric cooling and reliability of models.
Using the scientific method, we have proposed a theory that the Earth is warming and manmade emissions are at least partly responsible for this warming via the greenhouse effect. Now, via the scientific method, this theory must be tested and evaluated.
If the Earth is warming due to an increase in the greenhouse effect, then we should see cooling of the upper levels of the atmosphere. This becomes obvious if we use an analogy of blankets on a person in bed. If the person has a blanket on them for a period of time, the heat exchange between the air above the blanket and the air beneath the blanket will stabilize. That is, the heat entering the blanket from the person's body will equal the heat being radiated out of the blanket and the air temperature over the blanket will stabilize. (Note that this balance does not require the temperatures in the two areas to be equal.) Then, if another blanket is added, the new blanket will absorb the energy radiating upwards from the first blanket, capturing it before allowing it to reradiate. In this manner, the second blanket reduces the amount of heat entering the air over the two blankets and the air temperature in that area will drop.

In the same manner, as the lower atmosphere becomes more efficient at trapping heat, the amount of heat being radiated outwards to warm the upper atmosphere will be reduced. This will result in a temporary cooling of the upper atmosphere while the lower atmosphere is warming. This condition is required if the atmosphere is retaining more energy and allowing less to radiate outwards. As the heat flux begins to return to equilibrium, heat will be radiated outwards in increasing amounts until heat output and heat input are again equal and this will result in the upper atmosphere being heated again.

This is exactly what has been observed. This is may not be the only cause, but it accounts for the much of the cooling of the stratosphere while the lower atmosphere is warming.

As for the question of modeling, examination of scientific papers shows that climate models are becoming more and more accurate. For example, Lyman and Johnson (2008) show that the climate models they were studying agree with *in situ* measurements within the 95% confidence level.

A false argument made concerning climate models is that because they are not completely accurate today, they are therefore as inaccurate as they were 20 years ago. Clearly, we are learning more and more as time progresses and we identify, and address, sources of error with greater certainty. Models today still have uncertainties, but the levels of those uncertainties are decreasing and it is reasonable to expect them to decrease in the future. As it is, climate models today are already producing accurate short-term predictions.

Climate modelers also have access to data that did not exist in the past. Satellites such as Aura, Terra and Aqua, and others, provide large amounts of data that were not available until recently. This amount of data from space is being replicated by a corresponding increase in data collected by ground stations. The data available for use in models is now larger, of better quality, and covers a greater time frame than it did 20 or 30 years ago. Models have increased in their reliability as a consequence. Future improvements in data will result in further improvements in the models.

Conclusion:
Using the scientific method, we have found that manmade emissions have discernibly, significantly and predictably caused increases in global surface and troposphere temperatures along with associated stratospheric cooling. Stratospheric cooling is a necessary consequence of global warming and is further proof that global warming is occurring as a consequence of the greenhouse effect.

Studies of scientific papers have shown that climate models are getting more and more accurate as the understanding of the climate improves and the amount and quality of data improves. Models have improved, and will continue to improve based on more reliable historical data.

We may conclude that UGWC Hypothesis 1 has been rejected.

5. Any benefits of this increase in global temperature, when considering all global social, economic and environmental effects, will not equal the costs and detrimental effects in the timeframe under consideration.
All developed countries will, at best, come out even. They are already prosperous and stability favors them. Any changes to the environmental status quo may result in some benefits that they would not have otherwise experienced, but they will also come at costs they would not otherwise have experienced. It is not reasonable to expect the U.S., Europe, and other well developed countries to experience such great benefits that we will be able to say, in 100 years time, that they are in better positions than they are today, due

to global warming. Any decrease in winter heating in some areas will be offset by increases in summer cooling. Any gain as a result in growing crops in different locales will be offset by losses of other crops that are currently being grown at those locales. Small increases are expected in the immediate future as a result of global warming, but yields are expected to drop dramatically as the temperature continues to rise.

What is more likely is that the well developed countries will suffer simply because the more you have, the more you have to lose. Global warming is resulting in more severe weather and it will become more severe as the warming progresses. The atmosphere, acting as a heat engine, will have more energy available to it to drive the weather systems. With increasing severity and frequency, storm damage will increase considerably. While winters will become shorter and milder, individual winter storms will become more severe. Diseases restricted to tropical areas will spread as the climate changes. This is also true of invasive species that are currently restricted from spreading by winter temperatures.

Any notable economic gains as a result of global warming would have to be observed in the less developed portions of the world in order to make the claim that we are better off as a result of global warming.

However, the data does not support the idea that third world countries will benefit. Global warming will result in the spread of disease, which the third world is woefully unprepared to deal with. This alone will result in massive amounts of human misery as a result of sick and dying people, but will also result in large economic costs as man-days are lost as a result of increased sickness and the caring for the sick. This situation will be further exacerbated if skilled workers are lost due to increased disease. Additionally, the spread of crop diseases will result in decreasing crop yields.

Rain bands will shift due to changing atmospheric dynamics, but also precipitation that has historically fallen in the mountains as snow will fall as rain. This shifting pattern will lead to routine droughts in that the snow and ice pack in the mountains provide a large reservoir of water that is slowly released over the spring and summer, providing a continuous supply of water for crops, livestock and populations. When the precipitation falls as rain, it immediately runs off and is not stored for later months. A slow runoff over several months will be replaced by large runoffs over a short period of time. Even developed nations will be at great risk from this, but it is likely to hit undeveloped nations hardest because they will not have the resources to deal with the changes. The developed countries will suffer damage while the developing countries will be handicapped in improving their situations.

Glaciers, in addition to snowfall, also serve as watersheds that provide water supplies during dry months as the snow and ice melt. With the melting and retreating of glaciers and by replacing snowfall with rain, the result is that this valuable watershed is reduced. Instead of melt water going long into the summer, there will be a greater flow of water in the winter time from runoff and a reduced supply of water in the dry months. This greatly

degrades the agricultural ability of many areas and will result in a reduced food supply in those areas.

Plants and animals in the tropics will suffer greatly and will have little corresponding environment to relocate to. Tropical rainforests take centuries to grow and warming regions will not have sufficient time to grow replacement rain forests. Polar environments will, of course, have no replacement at all. Both of these situations will result in great loss of species of both plants and animals. The resulting reduction in biodiversification will have untold negative effects, but cannot have any foreseeable beneficial effects.

Rises in the sea level and resulting loss of dry land are not even mentioned here. While this total loss worldwide will be large, it is possible that the effects only 100 years from now will not be burdensome. However, it is difficult to imagine how this would be of any benefit to humanity.

The idea that global warming will result in overall beneficial effects is analogous to not changing the oil in your car engine. There may be the short term benefit of saving money on oil changes, but the long term effects will greatly outweigh them. Likewise, there may be short term benefits from global warming, but the long term adverse effects will greatly outweigh them.

Conclusion:
We cannot justify global warming by examining just the beneficial changes. We must also consider the changes that are not beneficial. The climate is changing faster than the environment and humans can respond and will result in a situation that is unstable and full of turmoil.

There may be some beneficial effects from global warming such as reduced winter heating costs in some areas and longer growing seasons in some areas, but these will be outweighed by the costs. Increases in summer cooling will absorb any savings resulting in winter heating reductions. Increases in violent storms and increases in the magnitude, frequency and duration of droughts will result in reductions of harvests, not increases. The spread of diseases and the reduction in biodiversification will result in widespread human suffering. And, while it is relatively easy to protect against the cold, heat waves in recent years have resulted in tens of thousands of deaths. All of this is expected to worsen as global warming continues.

Humans will adapt and create innovative means to deal with the changing environment. But any benefits from these innovations will mostly work only to offset the negative effects until such a time as our efforts are directed at correcting the problem. Creating new industries that are sustainable and do not require the emission of greenhouse gases will provide opportunities for many and result in new jobs. The elimination of old jobs in the fossil-fuel dependent industries will not result in a reduction of overall employment. When presented with opportunities to develop new ways to overcome costly and inefficient industries, entrepreneurs will prevail. The social and economic cost of

changing to sustainable industries will be far less, over the next century, than the cost of doing nothing and then being forced to react.

We may conclude that UGWC Hypothesis 2 has been rejected.

The debate concerning global warming will not be settled here. The proper analogy for this debate is the debate in the 1960s to the 1990s concerning the harmful effects of cigarette smoking. Despite the enormous amount of evidence that smoking was harmful, a significant percentage of the population continued to believe otherwise. Individuals that did not want to believe the evidence would find some report and cite it as proof of their claim, even as they dismissed the preponderance of evidence. Then, it was found the cigarette manufactures were withholding information the whole time and knew all about the harmful effects. As it turns out, the isolated reports that went against the preponderance of evidence were in error.

Likewise, global warming skeptics have rejected the growing mountain of evidence that has been accumulating and, instead, focus on individual reports that fly in the face of all other evidence. This is much easier to do today due to the fact that the Internet allows not only a wide-ranging search, but also allows the posting of opinions and reports without any review for accuracy and validity.

In both of these cases, decisions are not made on the evidence, but are made despite the evidence. The belief of the skeptics in both of these instances is based on what the individuals want to hear and not based on what scientific research supports. While it is certainly possible that the majority of the scientific community is wrong and a small percentage of individuals could be right, it is not scientifically valid for someone to dismiss the preponderance of evidence simply because they have an emotional attachment to one conclusion over the other.

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