

A View Toward Sound Policy Initiatives Regarding Agricultural Alternative Fuels

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Abstract

Scientific understanding regarding causes of climate change is maturing. Earlier indications that atmospheric CO₂ is the primary cause have been challenged by recent studies. Evidence against anthropogenic global warming is mounting. Subsidized alternative fuel initiatives may run out of support once political opinion aligns with scientific realities. First steps toward policy statements within professional organizations that reflect our current understanding of forces driving climate change are called for. We as farm or timberland managers, investors, lenders, appraisers or consultants in these fields should update our understanding. Agriculture's potential contribution toward cost effective alternative fuel sources and energy independence is discussed.

Introduction

This paper focuses on scientific studies related to the subject of anthropogenic global warming, and the potential implications of government policies which have been implemented, or are being considered for implementation. It covers several general areas including recent related policy decisions of the current and previous administrations in the United States (U.S.). It focuses in detail on the latest understanding regarding the affect of rising levels of atmospheric CO₂ and other related studies. The reason for focusing on certain scientific studies and the principals that were discovered through them is that, unless we in the profession have as thorough an understanding as possible of the fundamentals, there is little chance of advancing sound policy initiatives.

The discussion then turns toward the responsibility we have as natural resource professionals when it comes to being the beneficiaries of government subsidies which are largely based on proclamations about atmospheric CO₂ of which many of us are growing increasingly skeptical. Many of us have come to this conclusion through knowledge of studies which draw precisely opposite conclusions, and of which the public is generally not aware. The point is that the information which is presented here will eventually be known by an inquiring public. Therefore, it may be in our best interest to make our awareness of these issues known now through our various professional organizations so that we are not one day seen as silent collaborators on the receiving end of government subsidies that we knew to be based on premature conclusions regarding elevated levels of atmospheric CO₂.



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Some Common Misunderstandings

The general public's understanding regarding global warming can be summarized as follows:

1. Global warming is occurring at an alarming rate.
2. Rising levels of atmospheric CO₂ are the primary cause of global warming.
3. Human beings, through their use of fossil fuels which emit CO₂ into the atmosphere, are therefore the primary cause of global warming.
4. Global warming is a bad thing and unchecked, it will lead to an irreversible environmental catastrophe for human beings and other species.

The author postulates that while these are not universally held views, they are at least very widely held views, and have been driving political and scientific debate and government policy issues for many years.

The research conducted in preparation for this paper uncovered numerous studies which the author believes cumulatively challenges all of these widely held beliefs. New studies and articles are coming out almost daily which also seriously challenge these types of beliefs.

US Government Policies on Environmental and Economic Issues

General examples of policies and legislative initiatives which have been implemented with respect to this issue are as follows:

- Mandating standards to the U.S. auto industry.
- Limiting access to reserves of U.S. fossil fuels.
- Favoring alternative energy industries, including ethanol & biofuels
- Punishing or limiting industries which use fossil fuels via
 - Proposed cap and trade legislation (CAT)
 - Denying permits for new oil refineries or nuclear power plants (Loris and Lieberman)

Paradigms Behind The Policies

These policies are mostly driven by the belief that we will soon run out of fossil fuels, and that CO₂ is the primary cause of so called anthropogenic global warming. There are likely to be other reasons driving these policies, but these are primary. The first of these stated reasons has been around for decades. In the 1970's, the prediction was made that we would run out of oil and natural gas within about 20 years. This sentiment was chronicled and challenged by one fairly recent publication as follows:

"In 1947, the world's proven reserves of crude oil totaled only 68 billion barrels. Over the next 50 years, we consumed 783 billion barrels – and at the end of 1998 still had proven reserves of 1,050 billion barrels! Back in 1966, the world had proven natural gas reserves of just 1,040 trillion cubic feet (tcf). By the end of 1998, we had used up 1,880 tcf – and still had untapped reserves of 5,145 tcf!"

"At 1998 consumption rates, today's proven reserves are equal to 43 years of oil and 62 years of natural gas – and crews are still finding new deposits all over the world. In fact, vast areas of our planet remain unexplored, due to technological, terrain, weather, political and other factors." (Driessen, 94)

The reader should note that this statement was made prior to the confirmation of oil reserves in the Green River Formation in Colorado, Utah, and Wyoming during the last few years. This single new source is approximately equivalent to all proven reserves quoted above.

Potential Effect of Climate Policy Implementation

The author has come to the conclusion, as have many others, that full implementation of climate policy initiatives currently under consideration will probably have disastrous effects for the US economy. The following points are offered for consideration.

1. Forcing the U.S. to pay for more expensive energy sources will drive up the cost of production for virtually everything, and thus lower standards of living. (Lieberman)
2. Denying access to deposits of U.S. domestic oil and coal decreases world supply making energy more expensive and complicates US foreign policy.
3. Forcing people to drive smaller vehicles will likely increase auto fatalities as have previous initiatives. (Over 2,900 additional auto fatalities in the U.S. annually since 1975 attributable to government mandates regarding fuel efficiencies.) (Roth)
4. Taxing industries which emit CO₂ will increase energy costs for everyone.
5. Studies by the Heritage Foundation suggest a 50 percent increase in energy costs over the next eight years as a result of CAT. (Istook)
6. CAT was initiated in Europe in 2005. (Lieberman) However...
 - CO₂ emissions in some countries are still higher than in the U.S.
 - No country has yet met its target.

- Accusations of fraud and unfairness plague the system.
 - In the U.S., the media has already reported that some have charged that the initial allocations of carbon credits have been made mostly on the basis of political favoritism, and not into a competitive market pool.
7. The US is moving toward CAT type policies while much of the rest of the world is moving away. A Wall Street Journal article appearing on June 26, 2009 reported the following. (Strassel)
- “Australia is delaying implementation of its emissions reduction scheme and the Parliament may be moving to kill it all together due to the lack of scientific evidence in support of anthropogenic global warming.”*
- “France, the Czech Republic and New Zealand are all reconsidering or have abandoned cap and trade programs.”*
- “Joanne Simpson, the world’s first woman to receive a Ph.D. in meteorology reportedly expressed relief upon her retirement (from the U.N.) last year that she was finally able to speak ‘frankly’ of her non-belief.”*
- “Dr. Kiminori Itoh, a Japanese environmental physical chemist who contributed to the U.N. Climate Report, dubs man-made global warming “the worst scientific scandal in history.”*
- “Norway’s Ivar Giaever, Nobel Prize winner for Physics, decries it as the “new religion.”*
- “A group of 54 noted physicists led by Princeton’s Will Harper, is demanding that the American Physical Society revise its position that the science is settled. (Yet Nature and Science magazines have refused to run the open letter from these physicists.)”*

The tide appears to be turning.

Which Forms of Energy Should Be Developed?

During the 2nd half of 2008 when gas prices in the U.S. hovered around \$4 per gallon, there was some movement in public opinion and political will in favor of developing more fossil fuels domestically.

The Green River Formation (GRF) in the western U.S., the Alaskan National Wildlife Reserve (ANWAR) and U.S. off-shore oil reserves represent significant quantities of untapped domestic fossil fuels. Here are some facts regarding the GRF and the off shore reserves which provide estimates of availability. (Loris and Lieberman)

The Green River Formation (GRF)

1. Oil shale deposits in parts of Wyoming, Utah, and Colorado are conservatively estimated to be ± 800 billion barrels of recoverable oil. This is more than all Middle Eastern proven reserves and three times Saudi proven reserves. The estimate is considered to be conservative and the actual deposits are likely to be 1.2 to 1.6 trillion barrels.
2. December 26, 2006 – The U.S. Bureau of Land Management licensed leases for five oil shale research projects in the GRF. The conclusion of those studies was that it is now commercially and environmentally viable to extract that oil at a world price of roughly \$70 to \$100 per barrel. (EIA) One presumes that this economic threshold would decline as technology continues to improve.
3. Full development of GRF could eliminate US dependency on Middle East Oil and allow for foreign policy development to be less constrained by such considerations.
4. On March 11, 2009, the Heritage Foundation reported that Secretary of Interior Ken Salazar rescinded leasing plans for oil shale development in GRF. Some may want to ask why.

Off Shore Drilling

The following sequence of events summarizes recent government activities regarding off shore drilling:

1. July 2008 – Then President Bush rescinded White House restrictions on energy leases in 85 percent of U.S. territorial waters.
2. October 2008 – Overlapping U.S. congressional restrictions on energy leasing off shore were allowed to lapse.
3. January 2009 – The U.S. Dept of Interior published its leasing plan for 2010-2015. The plan allowed for about 19 billion barrels of U.S. oil from territorial waters. This equates to about 30 years of U.S. imports from Saudi Arabia.
4. February/March 2009 – The Obama Administration delayed implementation of the off shore energy leasing plan by extending the 60-day comment period to 6 months. (Loris and Lieberman)

Misgivings of an Agricultural Professional

Several decades of government interventions have imposed restrictions on market driven development of fossil fuels, and resulted in government subsidized development of renewable fuels, of which agriculture and timberland products play a major role, and that role is also likely to increase significantly in the future.

As one who has been an indirect beneficiary of subsidies for corn based ethanol and other alternative energy projects, the author has become increasingly uncomfortable with the proclaimed scientific basis supposedly underlying the justification for these subsidies. This concern has become more acute since the occurrence of the dramatic rise in grain prices in recent years and the resulting increases in food prices and food shortages in developing countries. (The author appreciates that large increases in input costs also contributed to rising grain prices, but these cost increases were largely triggered by insufficient supplies of fossil fuels due to long standing government restrictions on development of domestic reserves.)

The author recently posed some questions to the Georgia Chapter of the ASFMRA. One of the questions asked was whether or not these subsidies would be helpful to our profession in the long term and should we not consider the potential negative implications before they actually occur. The fact that most of the members tend to be more aware of recent scientific developments than the general public, and in view of the fact that eventually the public will have a much better understanding regarding issues involving CO₂, including the billions being spent on alternative fuel development, should we not be more outspoken regarding our understanding of this issue for the long term good of the profession, and the good of society as a whole? As stated in the introduction, there is also the fact that many of us have been becoming increasingly skeptical regarding the justification for such expenditures of public funds in the name of avoiding catastrophic consequences purported to be linked to rising atmospheric CO₂ levels. For these reasons, the formation of a rational policy statement regarding the potential roles of the agricultural and wood products industries in the development of renewable alternative fuels was postulated. It was encouraged specifically that the argument should be framed as one of *cost efficient energy independence*, and *issues of national security*, and specifically *not* about anthropogenic global warming. Not to do so would run the risk of eventually being seen as collaborators who knew better, but just kept silent so as to continue receiving the benefits. Such a policy statement should also address the moral dilemma stemming from diverting prime agricultural land from much needed food production to producing less efficient forms of alternative energy. The following is a summary of the scientific basis for the case against anthropogenic global warming, and for the development of cost efficient renewable alternative energy sources.

It's All About CO₂

Perhaps the most famous indictment of CO₂ as the main culprit in the global warming debate was former U.S. Vice President Al Gore's documentary titled "An Inconvenient Truth" which showed a graph which purported to prove that rising atmospheric CO₂ levels have accompanied rising global temperatures over the last 650 thousand years. However, independent scientists from the Department of Climate and Environmental Physics at University of Bern, Switzerland, obtained the same data that Gore used to show the correlation on a compressed scale, and plotted the data on a scale that you could actually read. These scientists showed that CO₂ levels only rose approximately 200 to 2,000 years after global temperatures had risen. This implies that rising CO₂ levels are an *effect*, (not a cause), of increases in global temperatures. The graph in Figure 1 illustrates this point. The upper line represents atmospheric CO₂ levels. The lower line shows average temperatures in the Antarctic. On the smaller scale, they appear to coincide. However, on the larger scale on the right side of the graph, one sees CO₂ peaking later than temperature, and in fact by that point, temperatures were already on the decline (Fretwell, 19-21).

One of the several sources that the author used to research the science behind this issue was an article titled "The Real Inconvenient Truth ...Some Facts about Greenhouse and Global Warming". (Milloy) The article is a technically detailed synopsis of many studies related to the topic. The general information summarized here was corroborated by several other composite studies referenced in this paper. The following is a summary of some of its major findings.

1. The term "greenhouse gases" is a misnomer and misleading. Greenhouses work mainly by modulation of convection. Global warming ...if it's a problem...is a radiation issue. This is important as it relates to point #4 below.
2. 90 to 95 percent of "global warming" is from water vapor.
3. 5-10 percent is from CO₂ and other gases.
4. The bandwidth for CO₂ as a restricting agent for heat radiating back into space is already saturated.
5. Doubling the amount of atmospheric CO₂, (which some estimates put at about 0.038% of all atmospheric gasses), would have little or no further affect on the restriction of radiating heat energy back into space.
6. The diminishing response to increasing CO₂ is logarithmic. The way for the layman to understand this is to imagine a room with a single window through which sunlight is entering. If you put

up a relatively opaque shade, it might block say 90 percent of the light. Add a second shade and perhaps 98 percent is blocked. The third shade does very little to increase the darkness, and by the 4th and 5th shade, there is no discernable effect whatsoever. This is analogous to the law of diminishing returns.

7. Global warming and cooling is measured against an assumed average global temperature of 14°C.
8. This figure is not based on actual measurements, but was produced by averaging the results of many models.
9. However, the range of estimates for mean global surface temperatures produced from a subset of 16 of these models said to be among the most reliable is from 11.5 to 16.5°C. None from that subset of most reliable models actually produced the result of 14°C. The point of this being that the baseline of 14°C from which changes in mean atmospheric world temperature are gauged is the average of a number of models, many of which do not yield a result of 14°C.
10. Milloy postulates that the absolute mean surface air temperature of Earth is actually not known.
11. No one knows what the optimal temperature would be.
12. No one would know how to get to that temperature even if we could agree on it.
13. The most conservative variation is 14°C ± 0.7°C
14. The amount of claimed temperature increase since 1880 is 0.6°C ± 0.2°C. The author's (Milloy's) point and conclusion was that "This is less than what we can reliably measure."

Models and "Positive Feedback"

Another topic covered by Milloy's article looked at the models used to make the predictions regarding global warming. A summary is as follows.

1. Climate models use a positive feedback algorithm to come up with dire predictions of runaway temperatures caused by global warming. At the same time, they ignore negative feedback which is known to occur in nature.
2. Since climate models can't reproduce the actual measured results of the 20th century, a multiplier of 2.5 is used. The models assume the following "snowballing" effect regarding increasing temperatures.
 - Warmer temperatures result in...
 - More evaporation which results in...
 - More greenhouse gases (i.e. water vapor) which result in...

- More restriction of radiation back into space which results in...
 - More warming which results in...
 - More evaporation and
 - More greenhouse gases, etc
3. The problem with this theory (and the models) is that...it rains.
 - The atmosphere cools itself with a process called The Precipitation Effect.
 - Water vapor is self-limiting because it precipitates as rain, snow, and low clouds, all of which have a cooling effect or provide negative feedback.

Mankind's Potential To Affect Atmospheric CO₂ Levels:

Another piece of information to consider regarding atmospheric CO₂ was found in another composite review publication which cited many studies and was written at a level that school children would be able to understand. It was written to address the concerns of educators and parents alike who felt that the one sided coverage of this issue in classrooms was not helpful to their children's education. The title of the book is *The Sky's Not Falling* by Professor Holly Fretwell serving in the Department of Agricultural Economics at Montana State University, Boze, Montana. Many of the conclusions presented in that publication mirrored the findings in the Milloy's article and other references yet to be mentioned. The following series of charts illustrates just how small a proportion of the atmosphere is comprised of CO₂, the relatively small portion of total so called greenhouse gases that CO₂ comprises, and the very small portion of atmospheric CO₂ that man has any influence over. See Table 1.

To put the CO₂ issue into perspective, this data is saying that mankind through all of our industrial activities has the potential to affect 3 percent of 3.5 percent of 1 percent of Earth's atmosphere with respect to CO₂. This amount is infinitesimal. A single volcanic eruption is apparently capable of reversing any of our efforts to reduce atmospheric CO₂. (Lwi)

Collapse of the Argument Against CO₂

The author believes that the argument against rising atmospheric CO₂ levels will eventually collapse. It appears to have already collapsed in certain sectors of the scientific community, and one suspects that it will likely be largely reversed in the general scientific community. The political community is another matter, and is not likely to reverse itself until the public is better educated on this topic. The reasons for drawing this conclusion, most of which have already been discussed, are summarized as follows:

1. Rising atmospheric CO₂ levels appear to be an effect and not a cause of rising mean global temperatures.
2. The bandwidth of greenhouse gases that CO₂ occupies is already largely saturated, and in any case that same bandwidth is 95 percent composed of water vapor which, as was shown, is itself self-limiting.
3. The amount of atmospheric CO₂ that man has any control over is infinitesimal.
4. There has been no measureable rise in average world temperatures in at least 10 years.
5. The climate on Mars is warming also with polar ice caps shrinking, indicating that it is fluctuations in solar activity, not human activity that is influencing global temperatures. (Fretwell, 23)
6. An article published in Science Magazine while this paper was being finalized concluded that there was a far greater influence on world climate changes that is related to predictable variations in Earth's rotation on its axis and fluctuating cosmic rays (Clark et al., Oregon State University)

Rising Sea Levels

Referring to Al Gore's documentary, *An Inconvenient Truth*, one of the segments which many viewed as alarming was the prediction that sea levels would rise by over 20 feet in just a few decades, and that large portions of Florida would be inundated. Here are some scientific facts which were not mentioned in that documentary.

1. Often the land is rising or shrinking, not the sea. Holland, New Orleans, and the entire Gulf Coast have been shrinking for years. (Fretwell, 34,)
2. There is a major difference between land ice and sea ice as they affect sea levels. (Fretwell, 34)
3. Most glaciers of the last ice age were land ice and as they melted, sea levels have been steadily rising for 18,000 years. However, the rise in sea level was actually less in the 20th century than in previous centuries since the end of the ice age (6" during 20th century vs. 7" per century for the previous 5,000 years). (Singer and Avery, 8-9)
4. The melting of sea ice would not significantly affect sea levels because the two largest ice sheets in Greenland and Antarctica are already mostly under water. As ice water melts, it decreases in size. (Fretwell, 34)

The point about sea ice occupying more space than sea water is critical for understanding this issue. Water molecules are comprised of two

parts hydrogen and one part oxygen (H₂O). There is a certain angle between the two hydrogen atoms and the oxygen atom. As the temperature approaches 0°C, the angle increases. At the freezing point, ice occupies about nine percent more space than water. (IAPWS website) Therefore, as sea ice melts, it takes up less space so if anything, ocean levels should fall not rise or at least be a balance to any melting land ice.

Benefits of Global Warming

The fourth point made at the introduction to this article concerned the belief that "Global Warming is a Bad Thing" and environmental catastrophe awaits us all. Considering the fact that our ancestors always preferred warming periods over cooling periods indicates just how far some have strayed from that more traditional human perspective. The following information came from various sources as cited.

- Plants absorb CO₂. Plants grow faster and are stronger with increased levels of CO₂, plants can store more water and produce more fruit with higher levels of CO₂, and increased CO₂ allows plants to inhabit dryer areas resulting in less desertification. (Fretwell, 30)
- Many climate models predict that most warming would occur on winter nights thus saving fuel. (Fretwell, 31)
- Winter morbidity and mortality would decline in large population centers of the northern hemisphere if Earth's temperatures rose. (Singer, ed., 26)
- Shorter winters mean longer growing seasons, and that less land would be needed to meet global food demands. (Fretwell, 32)
- A major effect of global warming would be an increase in biodiversity with most flora and fauna extending their ranges. (Singer and Avery, 9)
- More significant warming occurred 8,000 to 5,000 years ago with no known extinctions having occurred. (Singer and Avery, 9)
- The Roman and Mayan empires collapsed during a cooling period after thriving during a period warmer than today. (Singer and Avery, 11)
- During the Little Ice Age (1300-1840), Europe had its worst floods and famines ever. (Singer and Avery, 11)

The Non-Governmental International Panel on Climate Change:

Whenever politicians or environmental groups want to quote an authority, the United Nations Intergovernmental Panel on Climate Change (IPCC) is often cited. However, this panel and its reports have come under increasing scrutiny and criticism in recent years.

Several climate scientists have requested that their names be removed from the study citing the distortion of their findings in the United Nations final report as the reason.

In response to this, an independent group of scientists calling themselves the Non-Governmental International Panel on Climate Change (NIPCC) conducted their own research and review of the United Nations' IPCC report. The group includes 24 scientists from the U.S., the United Kingdom, Italy, Australia, Sweden, New Zealand, Austria, Poland, Estonia, Canada, the Netherlands, Scotland, the Czech Republic, Norway, Spain and Germany. It was edited by S. Fred Singer, an atmospheric and space physicist, founder and president of the Science and Environmental Policy Project that is a non-profit education organization based in Arlington, Virginia, and professor emeritus of environmental sciences at the University of Virginia. Their conclusions are summarized in the following section.

Conclusions of the Non-governmental International Panel on Climate Change

1. The evidence is very weak that the causes of the current warming are anthropogenic. (Singer, ed., 1)
2. Evidence is more robust that the causes of the current warming are natural, and that the sun is a major cause of 20th century warming with greenhouse gases making only a minor contribution. (Singer, ed., 1)
3. Computer (climate) models have not been validated; they overestimate the human contribution, and are unreliable guides to future climate conditions. (Singer, ed., 1)
4. Higher concentrations of greenhouse gases are likely to be beneficial to plant and animal life and to human health. If world temperatures rose, it would lead to a reduction in winter human morbidity and mortality that would be several times greater than any increase in summertime heat stress related morbidity and mortality. (Singer, ed., 26 and 28)
5. The NIPCC report strongly rejects the alarms regarding anthropogenic global warming, and shows conclusively that human greenhouse gas contributions to current warming are insignificant. (Singer, ed., 27)
6. If CO₂ doubled by 2060, the net benefits far outweigh potential negatives to the world economy, particularly agriculture. The report concluded that the net benefit to agriculture in the U.S. would be \$41.4 billion annually in 1990 U.S. dollars. (Singer, ed., 27) This is a result of the aerial fertilization of CO₂ which some studies have estimated to be about 15 percent increase in crop yields since 1950 solely from higher concentrations of atmospheric CO₂. (Milloy)
7. The main cause of global warming and cooling is solar activity, specifically cosmic rays which affect atmospheric cloudiness. (Singer, ed., 28) It can be added here that a just published paper in Science Magazine referred to earlier in this paper concluded that the changes in cosmic ray influence are linked to predictable changes in the Earth's rotation and axis. (Clark et al.)
8. There will be little, if any, acceleration in sea levels rising even if there are decades of warming. Local relative sea level (LRSL) change is all that matters for purposes of coastal planning, and this is highly variable worldwide, depending upon the different rates at which particular coasts are undergoing tectonic uplift or subsidence, and that there is no meaningful global average for LRSL. They state that the UN IPCC report assumption that sea levels are directly related to world temperatures is at odds with actual periodic historical records. (Singer, ed., 16-18)
9. Proposals in the Kyoto Protocol are unnecessary, would be ineffective, and would waste resources. (Singer, ed., 28)
10. Even if all nations followed Kyoto strictly, it would decrease the average temperature by only 0.02°C by 2050. (Singer, ed., 28)
11. The UN's International Panel on Climate Change was pre-programmed to produce reports to support the hypothesis of anthropogenic warming and the control of greenhouse gases. (Seitz, iii)
 - They completely ignored satellite data in their 1990 report because it showed no warming.
 - They made significant alterations to the text of their 1995 report after it was approved by scientists in order to convey the impression of human influence.
 - In their latest report of 2007, the IPCC devalues evidence regarding solar activity as the primary cause of climate fluctuations. (Seitz, iii)

What Should Agricultural and Timberland Professionals Do?

Assuming that many of us working in renewable resources fields have an open mind to or agree with the scientific principals presented here, should we not get out in front of this issue? As was stated earlier in this article, an inquiring public is likely to become increasingly aware of the shift in scientific thinking, and when it does, the politics are bound to change. Perhaps we should explore and promote prospects for cost effective energy independence and agriculture's potential contributions.

The author researched comparative costs per kilowatt hour to show what agricultural/timberland alternative fuel sources must compete with. The information on this varies somewhat but the relative costs of wind and solar power may be more important than the absolute costs. One source provided the following information and was reported to be based on U.S. Department of Energy data (Preston). See Table 2.

With corn based ethanol plants running into problems around the country, maybe it's time we take a critical look at where our sectors can make a contribution to the proposed objective of cost efficient alternative energy independence. While there are likely other such initiatives currently being tested, one example is offered here because the author is aware of at least one existing agribusiness enterprise that plans to expand and go commercial with an integrated system within the next two years. The process I am referring to was developed in part based on a study by a group of researchers at the University of Illinois at Urbana-Champaign led by Stephen P. Long, professor of crop science and plant biology. The following chart summarizes initial findings regarding *Miscanthus x giganteus*, a sterile rhizome that coppices every year and will out produce corn even when established on marginal land and without much fertilization or irrigation. (Not to be confused with non-sterile varieties of *Miscanthus*, which would be invasive.) (NISC) See Table 3.

While it may be early days for this technology, efforts are already under way to establish several hundred acres of nursery stock with plans to have about 20,000 acres under cultivation within a few years. This would apparently be sufficient to support a local regional ethanol plant that would be cost competitive with gasoline and diesel. Other potential benefits could be significant such as the following.

1. An additional annual cash crop will help stabilize farming operations.
2. Cost effective competition for marginal land will possibly raise sagging pulpwood prices.
3. Switching marginal land from conventional commodity crops to *Miscanthus* or the like would lend price support to many other agricultural commodity crops.
4. Rural communities throughout most of the country will have a renewable product that is exportable to metropolitan centers. This represents a natural transfer of wealth from cities to rural areas.
5. Increased job opportunities in rural areas could stem the flight of the young to the cities where traffic congestion wastes so much of our fuel.
6. A partial devolution of economic power away from OPEC and the large oil companies to rural USA would occur.

Conclusion

Emerging scientific understanding of the climate change issue is providing compelling evidence that man plays no significant part in climate change. The scientific basis for limiting fossil fuels due to emission of CO₂ is waning. Alternative fuels will play an increasing role in meeting U.S. energy needs, but only when they are truly cost effective. The date for running out of oil is being continually pushed back, and with the discovery of the GRF, we have more oil right here than all of Middle Eastern proven reserves. Political opinion will sooner or later catch up with scientific reality. We, as renewable natural resource professionals, should get out in front of this issue and lead the way by developing and promoting cost effective renewable energy alternatives that can hold their own in the market place with little or no government subsidies. Some kind of rational policy statement may be the vehicle for this. Educating ourselves and the public as well as our politicians on the issues raised here is the key. Let the discussion begin.

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Figure 1. Historical relationship between Antarctic temperatures and atmospheric CO₂ showing CO₂ rising subsequent to rising temperatures (CO₂ on upper graph and temperature on lower graph)

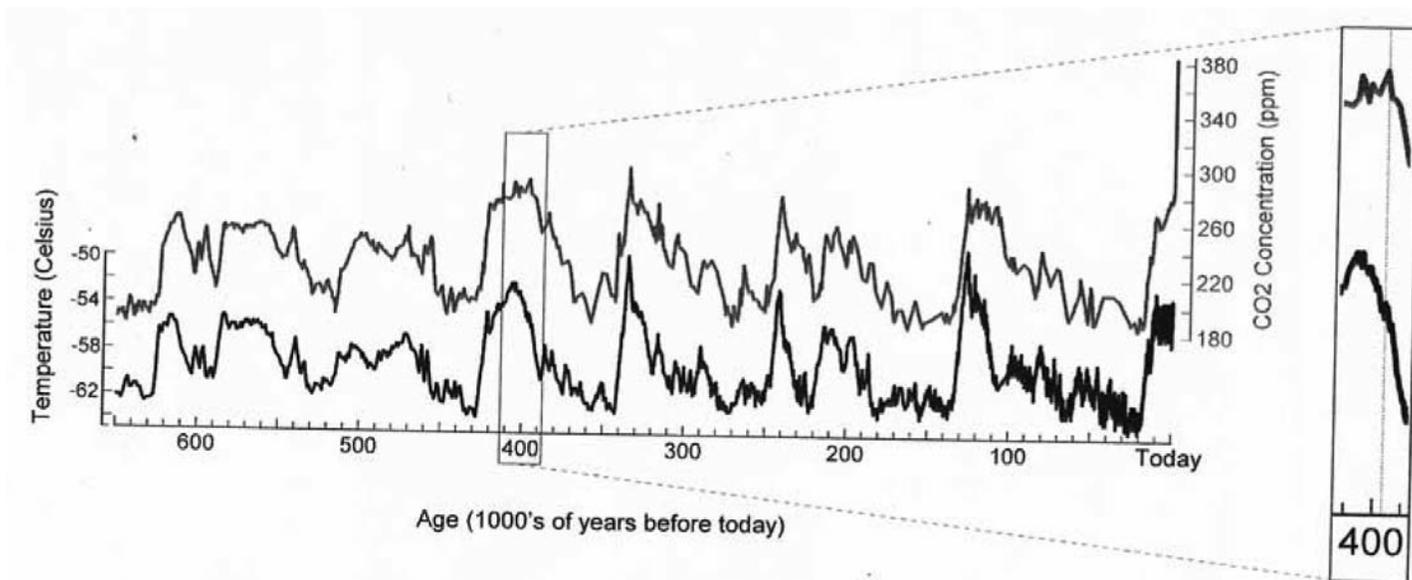


Table 1. Current proportionate natural atmospheric CO₂ vs. anthropogenic atmospheric CO₂

Earth's Atmosphere		
±80% Nitrogen		
±20% Oxygen		
< 1% All Greenhouse Gases		
Proportionate Composition of All Green House Gases		
±95% Water Vapor		
±3.5% CO ₂		
±1.5% Methane and other minor Greenhouse gases		
Man's Contribution to CO₂ Release Into the Atmosphere		
	Units	
Plants	119.0	56%
Oceans	88.0	41%
Man	6.3	3%

Table 2. Comparative cost per kilowatt hour (U.S. cents)

Energy Source	Capital Costs	Fuel & Operating Costs	Total Cost
Coal	0.72	3.14	3.86
Nuclear*	0.90	2.41	3.31
Natural Gas	0.42	4.95	5.37
Solar	17.20	1.00	18.20
Wind**	2.45	1.00	3.45
* Nuclear includes waste disposal and decommissioning.			
** Wind power costs are for optimal conditions. In places with less wind, costs can reach 20 cents per kwh. (Smith) Also, a gas fired power plant with 50 megawatt capacity has a foot print of 5-10 acres. A wind farm with equivalent capacity would occupy 10,000 acres. A modern 555 megawatt gas fired plant in CA occupies 15 acres and produces more power at just 72% capacity than all windmill farms in the state which occupy 100,000 acres. (Driessen, 90 & 41)			

Table 3. Attributes of Miscanthus x Giganteus

1.	Giant Miscanthus is a sterile hybrid grass related to sugarcane.
2.	A promising source of biomass for cellulosic ethanol.
3.	Propagated from rhizomes which re-sprout annually.
4.	27% higher rate of photosynthesis than switch grass.
5.	Grows up to 13'-14' at maturity.
6.	Yields are 10-30 tons/acre/year vs. corn at 5-6 tons/acre/year.
7.	Requires little or no irrigation or fertilization.
8.	Is not invasive.
9.	Cost of cellulosic ethanol projected to be \$1.07/gal by 2012.
10.	Will not compete with grain producing agricultural lands.
Source: LI-COR Biosciences October 2007	