

Common Bonds

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Abstract

A January 2009 Pew poll shows that from January 2008 to January 2009 there was a decline of our belief in, and concern about, climate change, global warming and their implications. This paper looks at climate change, global warming, environmental degradation and over-population as factors that are inseparable due to the feedback loop that is generated by the common bonds they have and that a change in the balance of one can, and often does, escalate the others in a non-linear fashion. These issues have become so politicized that it is nearly impossible for the science on these four problems to speak for itself with the public. Many of the debates that surround climate change and global warming overlook the glaring reality that there are millions of years of “proof” that climate change has, is and will continue to occur as long as our planet and its sun exist. The arguments disallowing climate change, global warming, environmental degradation and the refugees they are and will continue to engender allows us to shroud the even darker and equally dangerous issue of an over-populated planet that cannot possibly sustain its current population, let alone future growth of that population, with the same robe of disbelief.

The Issues & Debates

We live in an era where the perils of global warming, climate change, environmental degradation and overpopulation are something we have heard so much about that we have become, as a society, relatively blasé concerning them. Our worries about the economy, terrorism, the war in Iraq¹ (Press, The Pew Research Center for the People and the, 2009) and whether the kids have their homework done or if we can get the laundry folded while supper is cooking take precedence over issues that seem so distant, both in time and relativity, to our well being. Linking overpopulation to these other three issues stirs no small amount of controversy, even the IPCC² declared the subject essentially off limits, in 2007, when it issued the statement, “... (the) scope and legitimacy of population control....are still subject to ongoing debate” (IPCC, 2007).

The debates that surround these issues make it easy for us to put dealing with them, and the matters directly related to them, on the back burner. The debates allow us to insulate ourselves from these issues by creating a mental buffer that says “If the problems which climate change, global warming, environmental degradation and over-population cause, both directly and indirectly, were as vitally important as some say³ then all would be in agreement and the government would “do something” about them”. The arguments are varied: “Climate change is a natural phenomenon so it must be a good thing or nature wouldn’t do it, *right?* “We must balance the environment against the economy! (Diamond, 2005) Is climate change/global

¹ Over- population is not one of the issues concern was measured over in the polls examined during the course of research for this paper.

² Intergovernmental Panel on Climate Change

³ 2009 Pew Research poll revealed that while 84% of U.S. scientists believed global warming was affected by human activities only 49% of the public did (Press, The Pew Research Center For the People and, 2009).

warming, wholly anthropogenic or it is natural, or vice versa or a combination of the two? Won't future science and technology solve the problem? (Diamond, 2005) Does it really matter if CO₂ levels rise, won't plants do better?^{4,5} i. "Climategate"⁶, the latest entrant to the debate party, gave climate contrarians the world over their best argument yet: that the science on climate change and global warming was fudged. Sadly, "climategate" ended with a whimper in the fifth section of our Sunday paper (Associated Press, 2009); instead of climate science being vindicated with the same bang with which the "scandal" hit the front pages and broadcast media across the world. The arguments go on ad nauseam. Perhaps at the very core of the contention is the fear that if we accept that climate change, global warming, environmental degradation and over- population are real, who is accountable and where does the responsibility lie for "fixing" them and the attendant problems they bring? (Newell, 2008) (Jamieson, 1992)

One thing some of the critics do have right is that climate and environmental change are a natural process. Global climate change is not new to our planets environmental system, indeed it is a vital part of the processes that constitute the earth's life cycle. We are now coming to understand the earth has a series of naturally occurring cycles. Some are decadal (Hurrell, 2008), some are hundreds, thousands, tens of thousands, hundreds of thousands (Ruddiman, Vavrus, & Kutzbach, 2005), and millions of years in duration; i.e. the earth's orbital tilt cycle takes forty one thousand years to complete and the eccentricity of the earth's orbit has a cycle of roughly one hundred thousand years (Horel & Geisler, 1996, pp. 75-79). Ice ages and interglacials come and go as the earth progresses through the cyclic events of her planetary life. As the earth shifts from one part of the cycle to the next an oft repeated scenario is of some species declining and others rising to take their place as the earth's natural rhythm marches inexorably on. Climatic instability creates and closes niches for faunal and floral exploitation. Our species filled a niche that was opened by such changes

⁴ Irakli Loladze published a study that indicated even though plants use carbon from CO₂, and that higher CO₂ levels does increase crop yields in some cases, there can actually be a negative backlash for crops grown in a CO₂ rich environment. In some crops high levels of CO₂ can actually change the chemical composition of the crop. In brown rice there is a decline in nitrogen, zinc and iron levels. This loss of nutrition in staple food crops, such as rice, means that people who are already malnourished will suffer even more from the "hidden hunger of less nutritious food (Loladze, 2002). More work needs to be done in this area; an extended, but connected, area of study would be: Do animal products from the animals who forage in a CO₂ enriched environment show a decline in nutritive value?

⁵ The greenhouse gases and their effects are a complex subject. Carbon dioxide, which constitutes about ten percent of the greenhouse gases, receives the most press but water vapour, methane, sulfur dioxide and myriad others are involved. Any one of these has a limited effect but it is what happens as the actions of each one are capitalized on by the actions of the next that causes such concern.

⁶ "Climategate" resulted from the (December 2009) theft of over one thousand emails, spanning years of research, from the climate research unit of the University of East Anglia in the U.K.. At the end of its investigation the AP found the science remained solid but the reality of science politics rather sordid. It will be interesting to see who was behind the theft and release of the stolen emails and the impact the thieves intended their release to have on the eve of the Copenhagen summit on global warming. It has been said that one should never say anything in an email that the whole world can't know but I have no doubts that anyone with a email account has written something that they would prefer not receive public scrutiny, the personal comments being bandied about in "climategate" are but a tempest in a teacup.

and we have prospered greatly, perhaps to greatly (Tickell, 1993). The plasticity and ingenuity of our species has not only allowed us to subjugate our environment to meet our needs but to populate marginal environments. In times of climatic and/or environmental stress those marginal areas can no longer support the population load we demand they carry. The reality of an unstable climate and a finite earth and resources compels us to face the same forces that pushed and pulled our ancestors to migrate in search of resources to sustain themselves and to find new niches to prosper in; unfortunately, in our day, there are no new places to go.

Critics of climate change often point out that our current environment is not the warmest period the earth has seen, which is true; the Eemian interglacial, which peaked 125,000 years ago, was the warmest period in the last 150,000 years. We are living in the Holocene⁷ (Holocene means “entirely recent”) interglacial period with the Holocene Maximum, which occurred roughly five thousand years ago, being the warmest period the Holocene has seen yet (Horel & Geisler, 1996). What is new, and what the majority of the critics fail to consider, is the high human population level we have and that human activities have and continue to increase the rate of climate change as we enter into the Holocene’s newest warm episode (Kandel, 2003) (Ruddiman, Vavrus, & Kutzbach, 2005).

Climate Change & Global Warming

“warming of the climate system is unequivocal”

(Intergovernmental Panel on Climate Change, 2007)

Two of the biggest misunderstandings that fuel both our indifference to and the arguments about climate and environmental change are that we do not understand the difference between weather and climate⁸ or that climate change will not be uniform around the globe. If the warming trend continues we will see regional and seasonal variations in climate; there will be warmer nights, fewer extremely cold days and oddly enough there will be some places that cool down as the rest of the world warms up, but the average global temperature will rise (Hurrell, 2008). Climate change is the most evident at the higher latitudes (Balling, Micheals, & Bappenberger, 1998) where we see ice melting and changes in growing seasons and migrations so it is ironic that the areas that are likely to suffer the most damage from a warmer climate are the tropics because flora and fauna there are not required to adapt to seasonal changes. Research is showing that a two degree temperature fluctuation is more than some tropical species are able to adapt to (Stricherz, 2005).

⁷ The Holocene is a geological era that began roughly 12,000 years ago, the latest of the four quaternary periods of the Pleistocene.

⁸ Weather is a local occurrence while climate is regional and in the greatest sense of the word, global (Horel & Geisler, 1996, p. 4).

The vastness of geological time is difficult for us to wrap our minds around yet, in spite of that difficulty, we couch climate change in broad, sweeping, geological terms, making “it” a thing distant from ourselves. That said, climate change, by and of itself, is not the problem⁹; it is the rate at which climate change is occurring. If a drastic change takes place abruptly, we notice and react to it. If change takes place gradually over a period of years we are not cognizant of the change and by the time we do realize that change is taking place it may be too late to take action (Tickell, 1990).

In previous glacial/interglacial cycles climate change was a slow, insidious creeping thing, which snuck up on the world gradually¹⁰. McKenzie Funk called climate change “incremental”, saying “it is an ocean that rises slowly, a glacier that melts gradually or a dry spell that lasts a little longer” (Funk, 2009). It is rather like not realizing that someone you see every day is failing and in ill health till an old acquaintance, who hasn’t seen them in a long time, stops in for a visit and takes you aside before they leave to ask you what is wrong with their friend; familiarity breeds contempt, not intentionally yet it happens all the same. There is little serious disagreement in the scientific community as to whether climate change is occurring, the disagreement is on the rate of change, the implications of those changes and whether it is a completely natural occurrence, anthropogenic in nature or a combination of the two. Understanding the paleoclimate record¹¹ is of the utmost importance as that knowledge is paramount in predicting what our future climate may be and what our response to that climate should be.

Past societies faced with major environmental change either collapsed, dispersed or both (Tickell, 1993) (Diamond, 2005)¹². In hindsight it is rather easy for us to see that these societies did not understand the interconnectedness of the systems that composed their environment and the events that were taking place in their environment or the consequences of those events. Humans tend to see themselves as extant and outside the environmental system as a whole (McKibben, 1989); something possible because of the uniquely human ability to live in denial (Heath, 2009), something no other species is capable of doing.

⁹ It is possible that the global warming that has occurred since the industrial revolution has held a cold period, similar to the little ice age, at bay. Ice core studies show that one of these brief cooling periods occur roughly every 2600 years (Monastersky, 1996).

¹⁰ Paleoclimate records show that climate change can and has occurred rapidly, in some cases taking only a few decades (Monastersky, 1996).

¹¹ Paleoclimate records are derived from the study of ice cores, floral/faunal remain studies (such as dendrochronology, palynology and coral growth etc.), sedimentological and stratigraphical studies as well as computer modeling; all of which are necessary to form a complete picture of the paleoclimate as no one technique has all of the elements required to provide us with a comprehensive climate picture (Horel & Geisler, 1996)

¹² The old cliché “those who do not know history are doomed to repeat it” contains a basic truth; we *must* learn from the experience and events of the past. The climate/environmental change related failures of the Anasazi and their neighboring cultures in the American Southwest, the Norse colonies in Greenland, the Harappa, Aztec, and other ancient cultures is a clear signal to us from the past that climate change is a trigger event that disrupts the social, economic and political processes that we have in place that cannot, or will not, adapt to a changing world (Diamond, 2005) (Lister & Lister, 1990) (Kandel, 2003) (Noble, 2000).

We buy vehicle insurance on the probability, not the surety mind you, but the *probability*, that we will have an accident that we will need help meeting the cost of. The IPCC took 29 thousand observational data series from 75 different studies and found roughly 89% of the series agreed with the projected changes predicted by climate scientists (IPCC, 2007). If there is an 89% probability that I am going to have a serious car accident I can do one of three things: take my chances driving uninsured, have the bare minimum of insurance the state requires or full coverage insurance. The cost of driving uninsured, both direct and indirect costs, are higher than the cost of the bare minimum premium, provided that I “get caught” driving without insurance; if I don’t have an accident and I never get stopped and ticketed then the insurance costs more, but the 89% probability of having an accident far outweighs the 11% chance I won’t. The insurance premiums may be high because the probability rate of my having an accident is high but the insurance will pay for itself. There is the issue of diminishing returns but when the stakes are as high for humanity as worst case scenario climate change makes them then the issue of diminishing returns becomes relative.

Some of the world’s wealthiest coastal cities are “buying full coverage insurance” by building bulwarks and flood gates to stem the damage from predicted rising sea levels. Rotterdam, Europe’s busiest port, spent \$600 million on floodgates; Venice, London and New York are planning similar projects, at a cost of \$51 billion, to protect their interests and yet as a global community we are essentially uninsured having earmarked only \$398 million and some change for climate adaptation in the developing world (Funk, 2009), where the most severe effects of climate change will be felt.

Climate Change, Global Warming, Environmental Degradation & Refugees

The correlation between climate change, environmental degradation and human migration is undeniable. The ability of our ancestors to adapt, with both their brains and their feet, to changing environmental conditions is found in the flowing waves of human migration recorded in the genetic and archeological record (Finlayson, 2004) (Blunier & Brook, 2001). Climate change, global warming and environmental degradation directly affect us in the following ways: rising sea levels, the intensity and/or frequency of storms, drought, desertification, and water shortages¹³; the indirect ways we are affected by them are nearly innumerable. All of these singly are enough to start migration activity if they are severe enough but when more than one of these is occurring in an area at one time and there are any other social, economic or political issues it is a recipe for disaster (Biermann & Boas, 2007) (Podesta & Ogden, 2007) (Diamond, 2005).

Any discussion of refugees created by climate change, global warming, or environmental degradation begins with a handicap; we do not have a working definition, that is accepted across the board, of what such a refugee is. The scientific and academic communities *must* come to a consensus on what the definition of a

person who flees their home due to one or more of these three factors is. Climate change refugees and environmental refugees are not the same thing, although a climate change refugee is most assuredly an environmental refugee the reverse is not true.

Lester Brown, of the World Watch Institute is credited with coining the term “environmental refugee in the 70s; Essam El-Hinnawi ,of the United Nations Environmental Programme , brought the term into the public arena fully when he used it in a 1985 policy paper (Renaud, Bogardi, Dun, & Warner, 2008) but it was Norman Myer’s who hammered out the first serious definition of a environmental refugee.

Myers defined environmental refugees as people who can no longer gain a secure livelihood in their homelands because of drought, soil erosion, desertification, deforestation and other environmental problems¹⁴, together with the associated problems of population pressures and profound poverty (Myers, 2002). Biermann and Boas stipulated that climate refugees had to be fleeing one or more of three climate change impacts: 1) sea level rise, 2) extreme weather conditions, and 3) drought and water scarcity (Biermann & Boas, 2007). An article in a 2009 Harvard Environmental Law Review defined climate change refugees, even more narrowly, as people whom climate change forces to relocate across national borders. The authors of this document also believe that we need a new international legal instrument to deal with the plight of climate refugees which guarantees them human rights protections; as well as humanitarian aid and seeks to prevent the situations that would cause them to become climate refugees if possible and remediate where prevention is not possible (Docherty & Giannini, 2009). A United Nations University report breaks environmental refugees down even further, the author specifies three groups of refugees: 1) environmentally motivated migrants who leave a steadily deteriorating environment, 2) environmentally forced migrants who leave in order to avoid the worst, and 3) environmental refugees who flee the worst, including natural disasters (Renaud, Bogardi, Dun, & Warner, 2008). There are those who separate the migration causing events even further into sudden and gradual events and whether the events are human caused or natural.

The closest thing we have to a working definition is likely the United Nations definition which is similar to Myer’s; the U.N. defines an environmental refugee as someone who is forced to leave their traditional habitat permanently or temporarily due to natural or anthropogenically caused environmental disruption. The environmental disruption may be caused by physical, chemical or biological changes in the ecosystem/resource base that render it unsuitable to support human life.

Theoretically it doesn’t matter what we label the millions of people who flee their homes due to environmental degradation and climate change because nomenclature does not change their circumstances. At the very best the label we will finally give climate refugees is a tool to ensure that they receive what we in

¹⁴ I believe that soil salinization deserves to be mentioned on its own “merits” apart from being a environmental degradation problem. In 1999 salinization cost the world’s farmers over 11 billion dollars per year in lost income and over 2 billion acres per year are severely damaged by salinization reducing crop yields or they are lost completely to agricultural use essentially canceling out any gains irrigation brings (Postel, 1999).

the developed world take for granted: human rights, social justice and sufficient food, water and shelter to live a life of dignity and worth. At its worst, the final label we will give to climate refugees will be a tool of semantics; a device by which to dole out the blame and therefore the cost of these people. We need to remember that the developed world will see climate refugees of its own, the question then becomes is it ethical to treat first world refugees differently than the third and second world refugees who will fall victim first?

Estimates on the number of climate refugees varies from 26 million to 1 billion by 2050 (Funk, 2009)¹⁵; a number that can change tomorrow due to deteriorating conditions in the environment, natural disasters, and/or better, more detailed information from ongoing and new studies. The deputy high commissioner of the United Nations Office of the High Commissioner for Human Rights, this is the U.N. agency whose primary function is the protection of refugees, said in February of 2008 that “by 2050, hundreds of millions more people may become permanently displaced due to rising sea levels, floods, droughts, famine and hurricanes. The melting or collapse of ice sheets alone threaten the homes of one in twenty people. Increased desertification and the alteration of ecosystems.... are also likely to trigger large population displacements”.

The wide range in the estimates of refugees is due to the fact that researchers use differing definitions of what actually constitutes a climate refugee and that each study works from a different set of assumptions, uses different methods, timeframes, scenarios and measures different variables (Biermann & Boas, 2007) (Swart, Bernstein, Ha-Duong, & Petersen, 2009).

One thing all the definitions agree on is that climate and environmental refugees may not ever be able to return to their homes. Climate refugees will arrive in groups, since a whole area will be affected at once by any said climatic event (Biermann & Boas, 2007), which is something fairly unusual as people tend to migrate or immigrate as individuals or family groups. Permanent climate and environmental refugees will have to be assimilated either into the population of a new area of their own nation or whatever country will accept them.

It is naivety of the highest degree to think that we can prevent environmental refugees from coming to America, and other developed countries, or that we will not have internal refugees of our own¹⁶. Might I point out how difficult it is to deal successfully with the Mexican-American border and that is a small number

¹⁵ Friends of the Earth predict 100 million climate refugees, The Global Humanitarian Forum believes we are looking at 26 million now and expects that number to rise to 78 million by 2030. A May 2009 study sponsored by the U.N. High Commission on Refugees and carried out by Care International gave a projected refugee figure of 200 million (Funk, 2009).

¹⁶ One fairly recent article in the Washington Quarterly said that “The United States, like most wealthy and technologically advanced countries, will not experience destabilizing levels of internal migration due to climate change, but it will be affected.” (Podesta & Ogden, 2007). I question this assertion as I look at a map that shows the huge populations along our coastlines and consider the water supply of the western half of the United States (Diamond, 2005). Will we become a nation surrounded by sea walls and water control systems similar to those in use in the Netherlands?

of immigrants compared to the world picture we are currently gazing at. Climate change has been projected to send immigrants from South and Central America to the United States and Canada, people from North Africa and the Middle East will go to Europe and those fleeing South and Southeast Asia will go to Australia (Homer-Dixon, 1991). Asia in particular is seen to be the greatest source of environmental refugees with a profound rise in natural disasters, due in part to Asia's phenomenal population growth which has moved greater numbers of people into marginal areas (Hugo, 1996). Refusing asylum to climate and environmental refugees is the ultimate act of moral denial.

While it is impossible to predict exactly what, where, when and how the vagaries of climate change will come into play it is in a very real sense predictable (Biermann & Boas, 2007) as to what the outcome will be in a given area and it is prudent for us to act on that knowledge. For example, it is not a secret that island states such as the Maldives and low lying areas such as Bangladesh¹⁷ will be affected by rising sea levels and we know the approximate number of people who will be dislocated on a permanent basis. With strategic planning the disruption to both the refugees and the receiving area can be minimized somewhat and we owe that courtesy to ourselves as global citizens.

Planning is everything, we knew, as sure as the sun will rise in the east in the morning, that one day the odds would finally deal New Orleans the category five hurricane card and we *thought* we were prepared for such a disaster. Hurricane Katrina opened our eyes to the fact that there is a huge disparity in being aware that an environmental disaster is possible and truly being prepared to deal with the aftermath of that disaster; which clearly in the case of Katrina we were not. Sending financial and physical aid to an area hit by disaster is far different from having to take care of it from the ground up and the commitment of the resulting years of restructuring lives and the areas infrastructure and economy. Climate change and environmental changes/disasters are inevitable, it is the nature of the climate beast, so it behooves us to plan for the worst to the utmost of our abilities.

A secondary aspect to climate refugees that receives little attention is the well being of those who cannot speak for themselves; what do we do about the about the plant and animal life endangered by the same climate change and environmental factors that cause us to flee an area? According to the United Nations 2005 Millennium Ecosystem Assessment, humans have increased the species extinction rate by over one thousand times the rate it was before we emerged from the mists (Report, 2005). It is impossible for this paper to deal with the ethical issues surrounding floral and faunal refugees but they too must be dealt with by the global community.

¹⁷ Bangladesh is home to Dhaka whose population of 13 million people give it the title of the world's most densely populated city; over half a million new migrants annually move into the already overcrowded metropolis.

Paying the Piper

“Charity begins at home” is an old adage that we may see come into play more and more as the United States has to pay for the effects and prevention of climate change here at home and is called upon to help foot the bill elsewhere. As those costs mount the U.S. may become reluctant or even unable to send financial and other sorts of aid to other countries. Greater storm intensity alone may see huge increases in humanitarian aid needed here in addition to the billions of dollars we already spend annually in natural disaster related costs. Our nation’s health care costs may rise in response to more frequent heat waves, deteriorating air quality and water borne disease (Podesta & Ogden, 2007). Sadly, the more that we wrestle with our own demons we may simply become desensitized to the plight of others as we are continually and in greater depth exposed to a world consumed by the ravages of conflict, famine, disease and death (Podesta & Ogden, 2007).

Since the industrialized countries are the greatest causative factor in anthropogenic global warming and environmental degradation there is a certain moral obligation implied towards climate refugees since the great majority will be from undeveloped countries who have contributed little to the problem (Biermann & Boas, 2007).

It is only fair to note that the people and governments of undeveloped countries do commit actions that lead to climate change and environmental degradation, such as deforestation, abuse of water resources and pollution, but in general it is comparing apples to oranges to suggest this contribution is on the same level as the output of the industrialized world.

The industrialized nations and the wealthy of the undeveloped nations must realize that their wealth will not insulate them from the degradation of our ecosystems (Report, 2005) or from climate change; it may postpone their acquaintance but the piper will ultimately have to be paid for the dance. Humanity as a whole uses the same water, air, and food resources and frankly there is nowhere else for us to go when these things fail us.

We have had seminal moments of global accountability; the founding of the United Nations came about through the need to have a global point where, to paraphrase Harry S. Truman’s desk plaque: the buck stops here. Climate change brings the politics of accountability to the forefront of a global stage where nearly all the actors are reluctant to take their marks. Accountability is about power, without a global entity that has the means to demand accountability from the nations of the world it is impossible to enforce answerability and deliver true social justice (Newell, 2008). In the instances of climate change, global warming and environmental degradation (and manifold other issues) this concept of un-accountability and a lack of social justice is manifested in that those who contribute the most to the problem bear the consequences the least and have little incentive to ameliorate the problem.

Climate Change, Refugees & National Security

The results of global warming, climate change, environmental degradation and overpopulation¹⁸ cannot be left on the level where we think only in terms of a warmer globe and formulating refugee policies. We need to consider how climate change and the shift of resources and population that it will entail will contribute to economic and social disruption, terrorism, and ultimately the possibility of conflicts, even full blown war, over resources; as well as shifts in balances of power (Homer-Dixon, 1991). Consider one major source of fresh water alone, the rivers of the world, there are 260 trans-boundary rivers in the world; as the demand for and shortages of water grows there are at the bare minimum 260 places for conflict to erupt, especially in the arid parts of the world where tensions over water already exist (SKeGROUP & Ocean Futures Society, 2003).

The United States government began to take the consequences of climate change seriously at the national security level in the late eighties and early nineties as a scan of the articles published, in the last twenty years, in the journal International Security will show. In 1992 the U.N. Security Council issued a paper saying that their studies revealed continuing environmental degradation could threaten world peace and security through conflicts over water (and the pollution of water resources), food shortages, fuel shortages, drought and refugees fleeing these things. It is likely that as our global population increases, the disparity between rich and poor will become greater, environmental damage will increase and climate change will continue to put pressure on already stressed resources; as these things escalate the world's policy makers will have less and less capacity to intervene and prevent or lessen environmental damage, social disruption and conflict (Homer-Dixon, 1991).

The importance of the security of the world's fresh water supply cannot be overstated. Water's intrinsic value to us is that life cannot exist without it, our very survival and that of all living things depends on water. Overall, the last few decades have seen increased water demand due to: 1) growing population, 2) economic growth, 3) expanding agriculture, and 4) lifestyle change amongst all populations, not just the developed world. Irrigation is responsible for roughly 70%¹⁹ of fresh water use worldwide (Kandel, 2003) and irrigated

¹⁸ Consider a population of eight billion, if only one percent is faced with climate change caused, directly or indirectly, migration that is eighty million people and that my friends is a number like no other number of dislocated people mankind has had to deal with. If we move the percentage to five percent it becomes four hundred million people displaced, how do we meet those needs? Where do we put them? And to keep this in perspective, if sea level rises and Bangladesh floods we are looking at thirty million displaced people from there alone.

¹⁹ For the world as a whole 69-70% of fresh water used is used in irrigation. Some regions use more and some less, for instance in the Near East it is 91% and in Central Asia it is a whopping 95% (Kandel, 2003). Marq De Villiers estimates, in his 1999 book, that we use 54% of available fresh water to meet human needs with 35% going to agriculture; his was the lowest estimate that I found (De Villiers, 2001). Al Gore chooses to use the figure of 73% that the World Watch Institute and author Sandra Postel (Postel, 1999) uses (Gore, 1992). Dr. Mahmoud A. Abu-Zeid, president of the World Water Council in 2003, uses 80% (SKeGROUP & Ocean Futures Society, 2003).

crops compose 40% of the total world crop, a substantial amount by any reckoning. It takes little imagination to see many of the ways that climate change, global warming, environmental degradation and over use will impact the planet's water directly and indirectly; as the population and global economy grow so will the demand for water.

Conclusions

As scientists and academics we need to assume some responsibility for the way the public perceives climate change, global warming, environmental degradation and overpopulation. Science tends not to present its findings as part of an integrated whole but in the bits and pieces that we do our area of study in. The sciences are, until rather recently, very compartmentalized and interdisciplinary in context, yet we as individuals and a society operate the best and the most efficiently when we see the "big picture" in its entirety. The stereotype of the academic in their ivory tower is not too far off target for the majority of the public because we don't speak the same language they do and we don't make our work relative to them. As a global community we cannot afford to be wrong about climate change, global warming, environmental degradation and over population; the stakes are too important -- too high -- to allow us that luxury.

If we want and expect the public to take these issues and their consequences seriously, after 25 years of scientists, industry, and politicians arguing them, then we have to make our work relative to them and their best interest; we have to put a face on it. God bless his heart, Sir Crispin Tickell was on the money when he said, "...We need to recast our educational system to promote better understanding of broad issues and lateral thinking between them. *Specialization is the bane of wisdom* (emphasis mine)" (Tickell, 1993).

In humanity's long term big picture it does not matter who or what causes climate change, as it is as inevitable as death and taxes, what matters is: can we adapt to the changes that are coming about via climate change, global warming, environmental degradation and over-population? And, there is this: If the global temperature never rises another tenth of a degree, from now until the sun burns itself out, the issues of environmental degradation, water scarcity, and a population greater than the earth has resources to provide for²⁰ will have to be dealt with. Frankly, climate change and global warming are just two more complications in our species life, huge ones to be sure, but complications nonetheless. This complex mesh of issues is forcing us to answer questions that we do not fully understand.

²⁰ The World Hunger Project at the University of Rhode Island found, based on diet alone and with all food shared equally, the earth could sustain the following populations:

Vegan diet – 5.5 billion people

15% animal products – 3.7 billion

25% animal products – 2.8 billion

35% animal products – (the current North American diet) 2 billion These are sobering figures indeed when you consider that by mid-century we expect the world's population to hit 9 billion and to level off at roughly 11 billion (SKeGROUP & Ocean Futures Society, 2003).

As a society, in general, we are woefully ignorant of all that goes into maintaining the lifestyle to which we are accustomed. We are disconnected and distanced physically, mentally and emotionally from the resources that sustain us. In this age of genetically enhanced food crops and dreams of gene manipulation for a more vibrant human life it is time for us to eradicate the “selfish gene” that gave our ancestors their edge (Dawkins, 1990) as the earth has become far too small and limited for us to allow our genetic hardwiring to continue leading us into a global “tragedy of the commons” (Hardin, 1968).

In some sense we have known from the beginning of our species consciousness that the climate and environment affected our survival and affluence but it has only been recently that humanity as a whole has begun to understand that the relationships between ourselves, the climate and environment are so intertwined; the climate and environment are intrinsic parts of our economies, politics and culture. We must realize that we do not stand outside of nature and that nature does not exist in spite of us, but that we are part of nature and it is vital that we learn to exist in harmony with the world around us.

Inspiration for change often comes on serendipitous feet, I have a strong moral and ethical obligation within me to be a good steward but every so often something happens that inspires me to go further and do a better job of stewardship. During the writing of this paper my eight year old grandson presented me with a “super grandparent award” for attending the grandparent’s day luncheon with him and his brother at their school. Zay is learning to write in cursive and he had laboriously traced his hand and then wrote this little poem on my award, a poem that I had seen before but by his hand and in the light of the research I had been reading it took on a fresh poignancy:

Sometimes you get discouraged because I am so small.
I always leave my fingerprints on the furniture and wall.
But every day I’m growing up and soon I’ll be so tall,
That all those little handprints will be so hard to recall.
Now here is a little handprint just so you can remember
Exactly how my fingers looked this happy day in November.

I wonder, when Zay and Lija are the age I am now, what they and all those of their generation will think of the handprint my generation, and the generations before me, have left on the world they inherited from us? Will they still see us as “super grandparents” or as the architects of a world that had we been less selfish and short sighted would be a far better place?

Bibliography

- Associated Press. (2009, December 13). AP e-mail review: Climate science not faked, but not pretty. *The Herald-Times* , p. E5.
- Biermann, F., & Boas, I. (2007). *Preparing for a Warmer World*. Working Paper, Vrije Universiteit Amsterdam, Department of Environmental Policy Analysis, IVM, Global Governance Programme, Amsterdam.
- Blunier, T., & Brook, E. J. (2001). Timing of Millennial-Scale Climate Change in Antarctica and Greenland During the Last Glacial Period. *Science* , 291, 109-112.
- Dawkins, R. (1990). *The Selfish Gene* (2nd ed.). Oxford University Press.
- De Villiers, M. (2001). *Water: The Fate of Our Most Precious Resource*. New York, New York, United States: Houghton Mifflin Company.
- Diamond, J. (2005). *Collapse How Societies Choose to Fail or Succeed*. New York: Penguin.
- Docherty, B., & Giannini, T. (2009). Confronting a Rising Tide: A proposal For a Convention on Climate Refugees. *Harvard Environmental Law Review* , 349-403.
- Finlayson, C. (2004). *Neanderthal and Modern Humans: An Ecological and Evolutionary Perspective*. Cambridge, England: Cambridge University Press.
- Funk, M. (2009, Summer). Come Hell or High Water. *World Policy Journal* , 93-101.
- Gore, S. A. (1992). *Earth in the Balance*. New York, New York, United States: Houghton Mifflin.
- Hardin, G. (1968). The Tragedy of the Commons. *Science* .
- Heath, K. (2009). *Lecture Notes* .
- Homer-Dixon, T. F. (1991). On the Threshold: Environmental Changes as Causes of Acute Conflict. *International Security* , 16 (2), 76-116.
- Horel, J. D., & Geisler, J. (1996). *Global Environmental Change: An Atmospheric Perspective*. New York, New York, USA: John Wiley & Sons.
- Hugo, G. (1996, Spring). Environmental Concerns and International Migration. *International Migration Review* , 105-131.
- Hurrell, J. W. (2008). Decadal climate prediction: challenges and opportunities. *Journal of Physics: Conference Series* 125 (2008) .
- IPCC. (2007). *IPCC, 2007: Summary for Policymakers. In: Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press.
- Jamieson, D. (1992). Ethics, Public Policy and Global Warming. *Science, Technology and Human Values* , 17 (2), 139-153.
- Kandel, R. (2003). *Water From Heaven The Story of Water From the Big Bang to the Rise of Civilization and Beyond*. New York, New York, United States: Columbia University Press.
- Lister, R., & Lister, F. (1990). *Aztec Ruins National Monument: Administrative History of an Archeological Preserve*. Southwest Cultural Resource Center, National Park Service Division of History. Santa Fe: NPS.
- Loladze, I. (2002, October). Rising Atmospheric CO₂ and Human Nutrition: Toward Globally Imbalanced Plant Stoichiometry? *Trends in Ecology and Evolution* , pp. 457-61.
- McKibben, B. (1989). *The End of Nature*. New York, New York, United States: Anchor.
- Monastersky, R. (1996, March 2). The Case of the global Jitters. *Science News* , 140-141.

Myers, N. (2002). Environmental Refugees: A Growing Phenomenon of the 21st Century. *Philosophical Transactions: Biological Sciences* , 357 (1420), 609-613.

Newell, P. (2008, August). Civil Society, Corporate Accountability and the Politics of Climate Change. *Global Environmental Politics* .

Noble, D. G. (2000). *An Archeological Guide to Ancient Ruins of the Southwest* (second ed.). Flagstaff, Arizona, United States : Northland Publishing.

Podesta, J., & Ogden, P. (2007, Winter). The Security Implications of Climate Change. *The Washington Quarterly* , 115-138.

Postel, S. (1999). *Pillar of Sand: Can the Irrigation Miracle Last?* New York, New York, United States: W.W. Norton & Company.

Press, The Pew Research Center For the People and the. (2009, July 9). *Public Praises Science; Scientists Fault Public*. Retrieved November 19, 2009, from <http://www.people-press.org>: <http://www.people-press.org>

Press, The Pew Research Center for the People and the. (2009, January 22). *Environment, Immigration, Health Care Slip Down the List; ECONOMY, JOBS TRUMP ALL OTHER POLICY PRIORITIES IN 2009*. Retrieved November 19, 2009, from <http://www.people-press.org>: <http://www.people-press.org>

Report, M. E. (2005, June). Environmental Degradation and Human Well Being: Report of the Millennium Ecosystem Assessment. *Population and Development Review* , 389-398.

Ruddiman, W. F., Vavrus, S. J., & Kutzbach, J. E. (2005). A test of the Overdue Glaciation Hypothesis. *Quaternary Science Review* , 24.

SKeGROUP & Ocean Futures Society. (2003). *Water Culture*. (P. Stacey, M. Shibuya, F. Sorrenti, & Gigi, Eds.) London, United Kingdom: Trolley Ltd.

Swart, R., Bernstein, L., Ha-Duong, M., & Petersen, A. (2009). Agreeing to disagree: uncertainty management in assessing climate change, impacts and responses by the IPCC. *Climatic Change* , 92, 1-29.

Tickell, S. C. (1990, November). Human Effects of Climate Change: Excerpts From a Lecture Given to the Society on 26 March 2009. *The Geographical Journal* , 325-329.

Tickell, S. C. (1993). The Human Species: A Suicidal Success. *The Geographical Journal* , 159 (2), 219-226.
