CONVERGING ECOLOGICAL CRISES AND THE NEED TO ESCAPE THE BOX OF CONVENTIONAL RESPONSE:

or

FACING THE 21ST CENTURY

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INTRODUCTION

This perspective reflects ideas and concerns developed over decades of research, university teaching, resource management, and watching the world around me. The discussion is offered in an attempt to generate a fuller awareness of large-scale social and ecological issues. We will not be able to deal with complex societal challenges, such as those that loom before us, without the fullest possible appreciation of their nature. Dismissal of concerns about the scale of issues, as "gloomy pessimism", will only help to ensure that we experience the problems 'sooner and harder'.

Some of the concerns are not new. Many other people, over the past three decades have expressed concern about the kinds of questions that I will try to deal with here (see D. Pirages and P. Ehrlich "Ark II", Clive Ponting "A Green History of the World", J. H. Kunstler "The Long Emergency", Bill McKibben "The End of Nature", and Roy Woodbridge "The Next World War"). However, the idea that we face several simultaneous challenges, as elements in a developing 'convergence', is not frequently presented as such.

As a species we are at a 'cross-roads'. Humankind has only a few decades left in which to 'get it right'. The combination of elements, i.e., human numbers and per capita resource use, may vary in different geographic regions, but the sum of it all remains the same. This "sum" involves our belief systems, our attitudes and our increasing numbers which drive the processes of change leading to overuse of resources and degradation of the environment around us.

CHALLENGES AHEAD IN OUR VOYAGE AS A SPECIES

The challenges, many at crisis level, are formidable:

1) We add about 75 million people per year to an already overloaded planet. Writers who hold the darkest vision suggest that after reaching 8 or 9 billion people on earth, environmental collapse may drive human numbers back by two thirds. In the Pacific Northwest (Oregon, Washington, Idaho, and British Columbia) population is forecast to reach between 50 and 100 million by 2100 (see Chapter 3 in "*Salmon 2100: The Future of Wild Pacific Salmon).* California is already in a 'run-away' state. In British Columbia, like almost everywhere else, we are 'in the growth game'. In this province, we add about 55 thousand per year to our own province with its southern portions already people-stressed.

2) We are at, or past, 'peak oil'. The major reserves have been located and we are now using them up. There are no comparable and flexible substitutes for this energy bonanza, laid down over millions of years but consumed in only one or two centuries. The sub-urban sprawl of North America, the long-range transport of food, the operation of our great sky-scrapers, and life built around the automobile are all in peril. (see *J.H. Kunstler's "The Long Emergency").* The influence of declining oil supplies will affect nations, worldwide. In Canada, declining supplies and increasing costs of oil and gas will be critical to people living in colder regions, wherever these may be as climate warms up. Across the globe, recently increasing demands for oil by such large consumers as China and India, plus the high rates of use already occurring, will lead to competition and, potentially, warfare.

3) Climate is changing with a powerful array of potential impacts on water availability, forests, fishes, infrastructure, health conditions, and livability in the many regions 'cheap energy' is not available. (see Al Gore's movie*, "An Inconvenient Truth",* or read the book). The impacts of climate change are many and diverse. At this very time the people of central British Columbia are living with one of major importance to their future livelihood. The population explosion of Mountain Pine Beetle over vast areas of central British

Columbia is, in large measure, due to warming winter climate conditions. It is projected that pie beetles will destroy over 900,000,000 m^3 of pine before the outbreak ends.

4) In association with increased CO_2, ocean pH is decreasing, i.e., acidity is increasing. The effects of such change on corals reefs, and production and composition of marine plankton, are not known. Prof. D. Pauly, Head of the Fisheries Centre at the University of British Columbia, in a recent interview on CBC radio, regarded ocean pH change as enormously significant and risky. I know little about this issue. However, a major concern is that many species of marine plankton and corals may not be able to develop the hard shells that they need for survival.

5) Freshwater resources of the world, are dangerously over-taxed with use, or are being degraded. It is projected that by 2025, between 2.4 and 3.4 billion people will live in conditions of water scarcity or stress. If we consider local British Columbia situations, we find that the Okanagan region is already in a 'water shortage' state. In the lower mainland of 'Supernatural British Columbia', water quality is a developing problem. In the valley of the lower Fraser River, groundwater is being heavily charged with nitrate from chicken farms. Nitrate is well above the level of 10mg/L, the acceptable standard for drinking water. (*This level was set because there is particular risk to children under four months old. The gut of <4 month old children has a higher pH than that of older people. The high pH enhances the conversion of nitrate to nitrite which oxidizes the hemoglobin to methemoglobin. There is also a risk of nitrate poisoning for livestock foraging under drought conditions).* Groundwater is a critical water source for hundreds of thousands of people. Worldwide, about 460 million people depend, almost entirely, on groundwater reserves that are being used faster than replenishment. Such use includes that of the 450,000 km^2 Ogallala Aquifer underlying eight U.S. states. When that aquifer is depleted, American water users will come to Canada for water. If such required water is deemed to be of "national security" to the USA, it is an ominous question as to how effectively we will be able to "negotiate".

6) Major fisheries of the world are under assault. According to a study in the scientific journal *"Nature" (2003),* industrial fleets have fished out about 90% of all large ocean predator fish – tuna, marlin, swordfish, sharks, cod, halibut, skates, and flounders. This done in the last 50 years. Mid-water fish species, that were at one time considered unusable, are now being fished down as well. Pacific salmon are in decline from central B.C. southward through the US Pacific Northwest. California has been hit the hardest with salmon population loss already. The challenges involved in saving these remarkable fish, if it is possible to do so at all, are daunting (see "*Salmon 2100: The Future of Wild Pacific Salmon*", edited by R. Lackey, D. Lach, and S. Duncan). On a wider scale, freshwater resources and non-marine fish in many countries across the planet are put in jeopardy by human activities. Much of this, with an emphasis on forestry, is covered in a book by T.G. Northcote and G.F. Hartman, *"Fishes and Forestry: Worldwide Watershed Interactions and Management".*

7) Since the dawn of agriculture we have lost about half of the earth's natural forest. The annual, worldwide, loss of natural forest is currently about 120,000 km^2 per year. Tropical forests are under assault from both the forestry and agriculture sectors. Twenty percent or more of the Amazon rainforest has already been lost to agriculture and logging, much of which is illegal. About 50% of the rainfall in that basin is recycled; i.e., it has fallen, been transpired by the forest, and has fallen again. The possibility of two or three successive years of drought plus agriculture and logging threaten the very existence of vast areas of the Amazon rainforest. The disruption or loss of this gigantic climate engine and oxygen generation system has serious implications for the all of us (see the January 2007 issue of *NATIONAL GEOGRAPHIC magazine*). Rain forests in Africa fare no better than those in South America. From 1980 to 1995 Africa lost about 0.7 million km^2 of forest due to forestry, mining, agriculture, and elephant damage (see Chapter 34 in "*Fishes and Forestry:…."* edited by T.G. Northcote and G.F. Hartman). Boreal forests across the world are at risk of loss due to northward expansion of logging, direct climate warming impacts and indirect impacts (insect population explosion). Russia contains about 70% of the world's Boreal forest. Large parts of it are at risk. In Siberia, 65% of the Boreal forest is located within the permafrost zone. Illegal logging
and melting permafrost put this zone at risk.
The Boreal forests of the world may be just as vulnerable as are the tropical rainforests.

8) Our perennial demand for economic growth, which invariably results in conversion of ecosystems to human use, reduces biodiversity which ultimately affects the stability of these systems (see *http://www.countercurrents.org/cc-dawe030406.htm).* Functional ecosystems of the earth provide us with

vital services such as water treatment and detoxification, waste assimilation, regulation of air quality, control of erosion, regulation of local climate, spiritual fulfillment, and many other things. These services, valued at near 33 trillion dollars per year, have been put at risk by our collective activities. The *"Millennium Ecosystem Assessment Synthesis Report" (2005)* states that 60%, 15 out of 24, ecosystem services evaluated are being degraded or used unsustainably.

ON THE 'PLUS' SIDE

On the 'plus side', there are important positive elements in our future. Even though they are over-balanced by the 'negatives' they must be pursued even more than they are now:

1) Awareness of our plight is increasing, and hundreds of thousands of individuals and groups are actively involved in dealing with environmental issues. The powerful documentary movie and the book, *"An Inconvenient Truth"* by Vice- President Al Gore has reached millions of North Americans.

2) Most recently, the *NATIONAL GEOGRAPHIC* magazine *(January 2007)* has shown the plight of the Amazon rainforest in its ecological, demographic, and socio-economic dimensions. While the latter components of the problem are Brazilian, the ecological implications of Amazon rainforest degradation are global. Although the article is disturbing, it has great value inasmuch as thousands of people will read it.

3) Means and scale of communication have increased. Television and the internet, if used responsibly, have wonderful potential to inform and connect people. The David Suzuki shows have increased awareness among tens of thousands of viewers in Canada.

4) The development of the concept of sustainability offers a foundation around which to build future relationships among all living things and the environment. However, the application of the idea must transcend its simple use or sloganeering for some particular agency or interest sector. Sustainability, in the best sense of idea, should imply the maintenance and normal functionality of natural (or near natural) ecological conditions and processes.

'SINGLE PROBLEM' SOLVING IS NO LONGER ENOUGH

If there was such a thing as a report card on humanity, at the beginning of the 21st century, the failing grades would outnumber the passes and pluses. Ecological and demographic dangers are not offset by the positive and encouraging things that are occurring. Not only that, when we do look at issues, the examinations are too often only skin-deep. If and when media coverage is given to large-scale environmental crises, the coverage is on a single problem basis. In addition, mass media coverage is, far too often, absorbed with the symptoms of problems rather than base causes. Blood and tears sell, penetrating analysis does not.

We have arrived at a time in which we face demographic challenges and global ecological disruptions on scales like nothing that people have seen before. These are the 'cross-roads'. For many, this is no longer news; the information is out there. In spite of this, however, most people in more fortunate areas like North America are still 'sleepwalking' into the future. In less fortunate areas, e.g. Africa, parts of Asia and the Middle East, destroyed landscapes, starvation, and war preclude almost any development of an ecological, long-term perspective.

What is crucial to understand, is the fact that we are not confronted by a single issue such as climate change, depletion of oil, or loss of fish resources, serious as each of these may be. We face a 'convergence' of inter-connected, complex, environmental and resource loss and/or breakdown challenges. These will have enormous cumulative effects on the shape of societies of the future.

INADEQUACY OF POILITICAL SYSTEMS

Part of the quandary we face is that the more complex and long range the issues are, the less suited our political system is to meet them, and the less inclined people are to think about them. For the politician, discussion of mega-environmental issues and the politics involved does not attract votes for the next

election. Indeed, thinking beyond the next election does not fit the agenda in our power-obsessed political system. For much of the public, discussion of impending crises is apt to lead only to dismissal – *"Doomsday talk; now let's see who is winning the hockey game"*. It is a societal failure that, at a time when we need political people to share responsibility as we face rough seas ahead, there is neither leadership nor vision. There is no one at the wheel. The irony of this lies in the fact that there are many thoughtful politicians who understand, but do not know how to fit such thinking into the current political process without rejection by the public or rebuke by political competitors. The politicians do, indeed, 'represent' us.

The list of demographic, environmental, and resource challenges indicates the powerful but unbalanced array of processes occurring on our planet. One way or another, some or all of these will affect people everywhere. Many of these dangerous and disturbing processes are interconnected, and the interconnections lead back to the reality that excessive numbers of people and their consumptive demands are overstressing the planet. As it stands, and as we behave now, increasing crowding and "shortages" will exacerbate the ongoing lawlessness and civil strife on earth.

HUMANS: LIKE ANY OTHER SPECIES IN THE END

If we go back to biological principles, every animal species on earth lives in some state of balance with other species and the physical environment. Whether it is a population of snowshoe hares in the Arctic, salmon in Canada's Fraser River system or in a (healthy) California river, the numbers go up and down, but they don't rise indefinitely. We too, are bound by this ecological reality. Compounding technology, as we have too often used it, has served only to increase, our numbers, our developmental pressures on the environment, and ultimately, the distance we may fall when the system collapses.

I believe that the next few decades will make it even more clear to us that we can not sustain the kind of social and economic systems that have prevailed over North America. Environmental and resource changes will force us into a very different relationship with the earth. It will be one that involves less consumption, less waste, and less travel. Life in the future may, in fact, be less comfortable. Our legacy may be that future generations look back at us with dismay and resentment.

CHANGING RELATIONSHIPS WITH THE EARTH

There are three attributes of ecological processes that we might try to recognize in regard to the expanding environmental disruptions caused by the rampant growth of human numbers and resource use. These three are momentum, feed-back, and complexity.

Momentum

I will use a small-scale example of momentum. In the Carnation Creek watershed on the west coast of British Columbia we studied the effects of logging on ecological processes in the system. Early logging cleared riparian vegetation from limited sections of the stream bank. After stream bank logging was ended and, the first breakdown of stream banks occurred there was a continuing cascade of effects. Stream-bed gravel movement increased, stable woody material in the channel moved, the channel continued to widen and impacts were transmitted downstream beyond the area of cutting. A cascade of events, has changed, and will continue to change that small stream for may years to come. If we go from ten square km to global scale, processes still have momentum. A role of CO_2 in climate change is accepted by most who think about it. However, if we stopped putting CO_2 into the atmosphere now, the effects of that which is there now would continue.

Feed-back

I will cite a large-scale example of feed-back. The CO_2 that is being put into the atmosphere now, by our fuel uses, is causing warming of peat deposits, wetlands, and permafrost. Warming and drying of these areas will release enormous stores of carbon in the form of CO_2 and methane. The "*Stern Review: The Economics of Climate Change*" says that peat deposits and wetlands contain around 1600 $GtCO_{2e}$, and permafrost areas contain about 1500 $GtCO_{2e.}$ (one Gt is a billion tons). The release of even part of this carbon will feed back contributing to the climate warming process independent of what we do in reducing auto emissions.

Complexity

The history of much of the human 'success' on earth is a story of solving 'immediate' problems with technical innovation. It is also a history of recent population increase to the point where our technologically supported activities cause ecological disruption on a planetary scale. The disruption and its complexity evolved and increased with our growing numbers and technology.

Our beginnings were modest and our impacts were light. However, we have been a restless animal, and whatever we had was never good enough. At the earliest stages, we needed warmth and protection – we developed the use of fire; we needed sharp edged tools to skin, or cut, dig, or fight with. We developed them from stone, then copper, then iron. Earlier in our history, we existed in simple communities. Across the centuries, we changed and now we exist in cities of tens of millions. Our needs and impacts on nature became heavier.

In modern times, we needed to grow food (and make money) faster – we developed huge, energy-dependant, farm machines and agro-business. To get more fish, and catch them faster, people developed more powerful boats, equipped them with better fish-finding gear, and fished harder, deeper, and farther away from home. This voyage from the 'cave' to 'modern society' has been built on a linearly expanding technology, i.e., problem-solution, the creation of new problems, new technology to solve these, then a consequent array of further problems.

Our expanding technology, based on use, has led us to the point where we now use resources of the earth rapidly and with heavy impacts. We might view these types of resource use as points of contact with the environment around us. In meeting our expanding population-driven needs for the resources around us we have escalated our technologies to "solve" whatever problem of "needs" that existed.

The solutions escalate the levels of impact and/or create new problems. For example, to meet the problems of depleting oil, we drill in sensitive marine or Arctic areas. If not that, we use more 'bio-fuels' thus reducing our own food supplies. To culture more fish, we cut down mangroves that protect coast lines. In the temperate zones of the world we "farm" salmon. To do this, we use in a large part, pellet-form meal from smaller marine fish for salmon food. In some respects this is analogous to feeding sheep and rabbit to lions, and then eating the lions. To sustain high levels of catch of marine fishes, we fish harder with destructive methods (large bottom trawls), and we fish deeper in the ocean. To grow more food, and to grow it faster, we use chemical fertilizers and we have filled in wetlands. The expansion of use in one sector eventually impinges on others.

It has become progressively more apparent during the past five or six decades that resource use in one sector creates impacts in others. The use of forests for logging creates impacts for fishery resources in fresh-water environments. The expanding use of water for irrigation depletes rivers or ground-water supplies and may result in degraded water for other users. The expansion of farms, cities, industrial infrastructure, etc, degrades biodiversity and the function of ecosystems that support us. The point is that there is a cost and an impact with each new "solution".

With rising numbers of sectors of use and, increasing intensity of such use, the numbers of points of interaction and conflict among them rise. As a result, the level of complexity continues to increases in the world around us. Problems that were once inter-sector in nature have been 'globalised'.

In the past three decades our species has expanded numbers, activities, and environmental impacts to the point where we affect global climate systems and marine ocean water chemistry. These changes now reverberate with further disruptions back into forestry, fresh-water resources, fisheries and agriculture. The convergence of ecological crises into mega-issues demands that we go further than trying to deal singly with climate change, or depletion of oil, or some other single sector problem. We must strive for enough vision to allow us to move beyond the 'problem - solution' trap in which each new techno-fix creates it own next generation of problems.

MOVING BEYOND TECHNO-FIXES

The complexity and uncertainty about the future is so great and so daunting that the response may be to simply give up and take what comes. This may be a matter of personal choice. However, by our choice or

through processes of nature, the human numbers and resource-use growth syndrome will have to stop. Anything else seems counter-intuitive in the extreme.

In the end the convergence of resource and environment crises will demand that we move to 'steady state' economies and populations, not those growing endlessly upward (see Brian Czech *"Shoveling Fuel for a Runaway Train"*). A 'steady state' will demand, also, a form of human behavior in which we are part of the system, not an increasingly dominant element within it. Perhaps, most difficult, it will require that we recognize that our numbers, like our use of resources, can not rise much further. They may be well beyond the limits of the earth by now.

The things that recent human society has done to get us to where we are now involve the legacy of our history, our ethics, values and basic human behavior. In that regard, changes that involve an interlocked 'triumvirate' of economic growth, religion, and politics that currently guide our society may be very difficult to make. However, the driving forces behind such processes as climate change, forest loss, degradation and depletion of freshwater, destruction of fisheries, etc., are locked within this behavioral triumvirate. These are interconnected, macro-ecological issues that will have to be dealt with at the core of their being. In the long term, it will be futile to deal with them at the points where the symptoms which we call "shortages", and our behavior that we call conflict, occur.

Politically and socio-economically, our society is at a point where it will have to make a quantum shift in behavior. The challenge of doing so, and having a vision-driven, earth-centered role, one that is beyond growth and profit, may be one of the most difficult that we have faced, or will have to face, as a species. It will require changes in beliefs, values, and our relationship to the environment. This part of the message from my brief discussion is not new. In 1974 Dennis Pirages and Paul Ehrlich published *"Ark II: Social Response to Environmental Imperatives".* They wrote about the challenges (and implied need) of changing the "*Dominant Social Paradigm*" (DSP) of the USA. They regarded the DSP as the collection of norms, beliefs, values, habits, etc that are transmitted from generation to generation, and form the world view that is held within a culture. Time has only made their writing more meaningful and, our thoughtful response more urgent.

The political systems of today seems to be quite unsuited for dealing with the massive and complex ecological and social challenges that are either here or on the horizon. These challenges eclipse most of the issues that currently occupy our politicians. Normally, individuals and groups, followed by politicians, act in their perceived self-interest. Such self-interest is usually short-term. In many regards, the pursuit of short-term self-interest is the companion of the techno-fix.

NEED FOR A LONG-TERM BRAIN

I believe that we should seek some national or international forum whose role it would be to discuss and understand these complex 'macro-issues', and to inform and encourage elected people everywhere to become involved in dealing with challenges that may not be popular in the short term. I do not know exactly what the structure of such a forum might be, but we need a '*long-term brain'* for government. It will probably be very difficult to create the best arrangement and sell the idea. It is clear, however, that as part of the foundation for this, we need awareness and an understanding of the urgency.

This critical foundation requires that we recognize and begin to understand the full nature of our situation. This situation is indicated by the eight challenges listed earlier in this paper. As we attempt to deal with these eight issues, each of which involves resource use and ecological responses, it is necessary to understand: first, that the processes involved may already have momentum that may cause them to continue, and second, that they may create feed-back that causes secondary processes to occur, thus driving a spectrum of new responses and problems. Third, it must be remembered that the processes are complex and can not be dealt with through simple 'problem – solution' responses.

The framework of our thinking for the future should include hope and positive thinking set in a context of realism. We cannot avoid our future challenges with blind optimism any more that we can live with them in total pessimism. The extent to which we can wrestle with such a complex of challenges and have some influence on our own future, rather than having nature make the decisions for us, may tell us just how much we deserve the *"sapiens"* in *Homo sapiens*, the Latin species name we have so immodestly given

ourselves. In the near future, we had better be “sapient” (wise) because ‘nature bats last’. Hurricane Katrina has told us that she also bats hardest.

G.F. Hartman, April 2008

BIOGRAPHICAL NOTE

I was born in Fraser Lake, B.C. in 1927. I experienced the end of the ‘great depression’. I worked in sawmills and logging camps, in central B.C., before coming to UBC where I earned degrees, including a Ph.D. in zoology and fisheries. I have taught at the university level for five years and served seven years as a research scientist for DFO. My ‘offshore’ experience includes one year studying in Sweden, 8 months volunteer fisheries work in New Zealand, and three years on FAO and CIDA projects in Africa. I have a publication list of about 85 scientific and management papers.