The 'Ecological Question':
Defining the Challenge of Global Environmental Degradation for Christian Scholarship

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Paper proposal:
Global environmental degradation—including climate change, species loss, human population growth, increasing pollution, declining natural resources—presents an unprecedented challenge. How should humanity understand this problem? Some disciplines want to frame it as the 'anthropocene,' others as a overshooting 'planetary boundaries,' others as ecologically disembedded economics, and so forth. How might the Christian academy understand the 'ecological question'? Can we devise a problem definition that integrally includes its empirical, social structural and faith dimensions?

Introduction:

The theme of IAPCHE's 8th International Conference is to "explore how Christian higher education (CHE) can address the challenges and opportunities of shifting global realities with integrity and conviction."[1] Global environmental degradation—including climate change, species loss, human population growth, increasing pollution, declining natural resource[2]—is a rapidly worsening problem and among the most significant challenges of our times. Achim Steiner, UN Under-Secretary-General and Executive Director, United Nations Environment Programme recently underlined the urgency:

> If current trends continue and the world fails to enact solutions that improve current patterns of production and consumption, if we fail to use natural resources sustainably, then the state of the world's environment will continue to decline.[3]

But what exactly is the character of this problem? How should it be defined and elaborated? How might Christian higher education (CHE), in particular the social sciences—political science,

economics, sociology, geography, anthropology and psychology—help define and address global environmental degradation?

In this paper, I propose CHE not automatically adopt the mainstream definition of 'environmental degradation' but rather critically address some key underlying assumptions in this problem definition. Part I of the paper briefly identifies the mainstream problem definition of environmental degradation, along with its underlying correlated assumptions. The paper argues that all too often solutions growing out of this problem definition are paradoxically failing, making the problems worse, or creating new problems. CHE can make a contribution to reframing and redefining environmental degradation without accepting these assumptions.

Part II of the paper proposes eight characteristics of the 'ecological question.' These characteristics have been informed by a variety of approaches, including literature on the 'anthropocene,' the overshooting 'planetary boundaries,' ecological footprint, ecological economics, and so forth. Much can and should be learned from these approaches and their problem definitions, and this paper draws on each of them. Defining environmental degradation as the ecological question, however, also suggests unique elements, such as, conducting an in-depth analysis of structural problems and assumptions, and deeper beliefs and practices. This is an exploratory paper only, intended for discussing and testing these formulations and theses.

Why call it the 'Ecological Question'?

In the last centuries, some Christian communities have framed the overriding cultural challenges they faced as the 'question' of their times. For them, the designation 'question' signaled the problem had come to dominate society and ought to be the overriding agenda item for church as well as society. In the early 19th century, by way of illustration, British Christians—Anglicans, Evangelicals and Quakers—took leadership on the '***slavery question***.'[4] In the mid-19th century, both Protestant and Catholic churches in Europe and North America, identified the '***school question***' as a key question of their societies, by which they meant how might the state do justice to 'religious based schooling' in a diverse, pluralist society?[5] In the late 19th and early 20th century, protestant, evangelical and Catholic churches identified the '***social question***,' by which they focused on the poverty, societal breakdown and dislocation resulting from the deep and rapid changes brought on by the industrial revolution.[6] This practice is the inspiration to explore environmental degradation as the 'ecological question.' But there is more involved.

Almost always, the challenges Christians framed as leading questions of their times involved in some way the structures and beliefs of their cultures. In framing the 'social question' for Dutch Protestants in 1891, for example, Abraham Kuyper argued that Christians should not see the problems arising from the new industrial order—such as poverty, unemployment, class conflict, social disintegration, alcoholism—as merely moral questions or narrow concerns of piety. Rather, Kuyper argued, to truly understand and properly address these problems they must be seen as part of a larger 'social question' that is rooted in the structures of society. Thus, grasping the character of the 'social question' required a larger 'architectonic critique.'[7] Such a critique would go deeper than individualism and moralism to analyze structural causes, and would do so while examining the beliefs that shaped and directs these practices, structures, and systems. Recognizing a society and church faces a 'social question,' Kuyper argued, signals that a much more complex problem definition is required. In turn, solutions would need to tackle the problem on all levels. Personal conversion alone could never be sufficient in overcoming the inertia of the oppressive structures causing poverty. At the same time, adjustments to the institutions and structures alone would also not be sufficient, since people do not automatically become good and selfless when structures are improved. I argue that global environmental degradation of our times requires an architectonic critique of our society. The problem definition proposed in this paper grows out of such a critique.

A closing note on the use of 'ecological' rather than 'environmental' in the term 'ecological question.' I started with the phrase 'environmental degradation' since at least it clearly communicates the wide range of problems our societies face. At the same time, the concept ***environment*** has a problematic history of being defined by and associated with 'that which surrounds humans.' Sometimes, this is seen as the unspoiled natural world that surrounding the human created world. At other times, it is expanded to include "all of those conditions that sustain life and affect the health of human beings."[8] In either case, this term is slanted towards an unhealthy version of anthropocentrism. While both 'environment' and 'ecology' are tainted by this anthropocentrism, ***ecology*** seems at least to be more amenable to an understanding of the physical and biological processes of life, which fully and integrally includes the *Imago Dei* species, humans. This is how I propose to use this term.

PART I: THE BROADER ACADEMY'S ON ENVIRONMENTAL DEGRADATION

The major undertaking of this paper is to propose a number characteristics that Christian higher education (CHE) might bring to a definition of the ecological question. Before doing so (in Part II), however, I offer a short rationale (in Part I) for why it is necessary and important for CHE to make a unique contribution in the already overheated public debate on defining contemporary environmental degradation.

CHE and the environment

Christian higher education (CHE) should **participate** in re-defining global environmental degradation in our times for several reasons, First, CHE has a track record in this area. In the last decades, some CHE institutions have built up environmental studies/science programs, inserted environmental or sustainability emphases in other programs (commerce, economics, political science), and introduced sub-disciplines like ecology in their natural science offerings.

Second, in the disciplines of theology and ethics, Christian scholars have produced a significant body of literature on creation care, ecojustice, environmental justice, earth stewardship, and so on. While this scholarship is not uniform in quality, depth, or even in singleness of mind, it has served to position these disciplines within CHE to contribute to a re-framing of the problem of environmental degradation.[9]

From the point of view of the social sciences, however, Christian higher education has not done nearly as well in my opinion. This sector should have been leading CHE in conducting an 'architectonic critique' of the causes of global environmental degradation. All too often, however, the social sciences in CHE have borrowed and relied on the mainstream academy's and society's framing of this problem.[10]

Why is borrowing this problem definition of environmental degradation a problem? I am not suggesting that this framing has not produced successes. In fact, environmental action has produced many and impressive successes in civil society, business life, and government policies. In many societies, governments have effectively addressed or mitigated a number of critical environmental problems over the past decades. The Montreal Protocol to halt ozone depletion, for example, was a notable global achievement. The 'Clean Air Act' in the United States has dramatically reduced many pollutants. The US Endangered Species Act has slowed down the rate of species extinction. Many more examples could be given. Nor do I want to downplay the positive contributions of CHE that were built on this borrowed mainstream definition.[11]

In spite of these positive environmental results, however, the mainstream problem definition of global environmental degradation is paradoxically also generating solutions that are failing**.**[12] A survey of recent forms of environmental degradation shows that ***many earlier problems persist, some are***

getting worse, new problems are being identified, and together these problems appear to be merging into new complex phenomena, including those associated with tipping points. Overall, they bear many marks of what Rittel and Webber call wicked problems.[13] So, why the paradoxical outcomes?

The remainder of Part I of this paper argues that the mainstream problem definition is built on assumptions that fundamentally troublesome from a Christian point of view. It briefly identifies these assumptions, and makes a suggestion as to why they may contribute to the paradoxical failures of solutions based on this problem definition.

Mainstream response to environmental degradation

To provide a short-hand entry-point into mainstream society's approach and assumptions, let's examine the creation of 'resource economics' and 'environmental economics' as economic ***solutions*** for growing environmental degradation.

In order to secure the knowledge required for economic growth and progress, the mainstream academy in the 19th century developed a scientific approach to the discipline of economics. To begin with, economists—whether classical liberal, Keynesian, or neoliberal market emphases—sought to achieve this genuinely scientific approach by positing that the economy could operate autonomously, according to its own market laws, like an black box. They theorized on the economy as though it were not integrally related to, or embedded within, other realities such as 'society' or surrounding 'ecological, biological and physical systems.' The economy was theoretically posited as though it were an independent and compartmentalized third reality that could be theorized separate from 'society' and 'nature.' The latter two realities—society and nature—were 'inputs' in the economic system e.g. labour, human resources, and natural resources, or as receptors of outputs from the economy, e.g. waste and pollution. They were considered important input and output factors, but not intrinsically connected to the internal operation of the economy. These assumptions shaped the discipline of economics, and also the practical operation of most Western economies.

As cases of environmental degradation arose over the late 19th and 20th centuries, they were addressed through the application of market solutions and tools, as prescribed by mainstream economics. In the 1950s and 1960s, however, increasing depletion and exhaustion of natural resources and growing outputs of waste and pollution forced a new response.[14] Economic practice as well as economic science needed serious adjustment. The strategy that emerged did not involve reforming the discipline of economics itself or its core assumptions. Rather, environmental problems were tackled by devising new sub-disciplines as add-ons to economics. Problems related to the exhaustion of natural resources were tackled by 'resource economics' while waste and pollution were tackled by 'environmental economics.' Significantly, the academy's separation of these concerns into separate sub-disciplines, in turn shaped the concrete economy. As environmental problems were tackled, the solutions were treated as add-ons to an otherwise reliable and acceptable market economy.

Underlying assumptions of the mainstream

This anecdote is typical of how both mainstream Economics and economic practice started to deal with environmental degradation through *subdisciplinary* ***adjustments*** *to economic science,* or *technical* ***adjustments*** *to the economic system.* In neither case did these 'technical adjustments' for declining natural resources and increasing waste and pollution fundamentally alter mainstream economics or the operation of the economic system.

First, in responding to environmental degradation in this way, the mainstream academy showed it did not believe it need to re-theorize the nature of the discipline of economics itself, or fundamentally reform the economy system, but rather accepted them as normal and even natural. The new sub-disciplines and concrete resource and environmental policy were not assumed to fundamentally alter the traditional 'black box' of economic science or the practical market economic system itself.

Second, this response to growing environmental problems showed mainstream economists did not need to reconsider the assumption that the economics, as well as the real economy, could be treated as autonomous entities from other realities. In facing environmental problems, economic science could continue to assume that the ***economy*** was doubly disembedded,[15] first from ***society*** and secondly from ***ecological*** and physical systems. In other words, the creation of these two new sub-disciplines [and associated concrete economic practices,] revealed the assumption that the economy could be theorized and run as though it were independent of other societal realities, as well as of the surrounding ecological and physical systems.

Shifting models, stable assumptions

These assumptions were built into the mainstream problem definition of environmental degradation. As new waves of environmental problems presented ever more difficult and complex challenges to the economy and society, these assumptions stay largely the same throughout each mode of engaging these problems. Scholars chart out several key models of responding to increasing environmental problems over the course of the late 19th and 20th century, styled as "models of environmental management."[16] These include 'Frontier Economics,' (the 'environment' or 'nature' is a 'frontier' which is constituted as a 'storehouse' of 'natural resources'), 'Conservation and Resource Management,' 'Green Society' (marked by the rise of human health ecology), and Sustainable Development.[17]

Significantly, each of these four models maintains, to a large degree, the key assumptions identified above. The autonomy of the market system and of economic science, are not really challenged. Rather, the use of technical adjustments is key to each of these models, each assuming the economic system was 'normal' (in theory and practice). At core, these models resisted any questioning or tackling of 'normal,' that is, the accepted black box of economic science, or the market economic system (whether framed by Keynesian, classical liberal, or neoliberal economists).

Only in the more recent 'sustainable development model,' popularized by the Brundtland Commission Report in 1987, is there at least some recognition of significant overlap of the economy, society, and ecology. Sustainable development has pushed further to balance and adjustment these overlap than any earlier model had been willing to do. Even so, the sustainable development model did not fundamentally challenge the key assumptions that the economy (and economics) can be separated and compartmentalized from society and ecology.

Paradoxical reliance on failed solutions

In response to growing waves of environmental degradation, continued adherence to these assumptions would be understandable if they were actually solving these problems. ***In spite of good work inspired and shaped by these problem definitions, however, environmental degradation is clearly getting worse, and in many ways***. Solutions devised out of this problem definition have failed to stem the rising tide of ecological degradation. Mainstream society keeps returning to these solutions, even though they are failing to solve many these problems. In the tradition of Christian social analysis, this paradoxical situation demands CHE conduct an architectonic critique of contemporary environmental degradation. We need to dig deeply into the structural and religious roots of our current system in order to create a more adequate problem identification and elaboration.

CHE and re-defining environmental degradation

This brings us to a possible contribution that the social sciences in CHE might bring to the process of redefining environmental degradation. The temptation for Christians and CHE has been to accept the mainstream assumptions and problem framing, to accept this as 'normal' for society and the economy, and to use technical adjustments on the economy, and disciplinary adjustments in economics,

in order to address environmental degradation.[18] But if it wants, CHE has important foundational resources to conduct an architectonic critique of the larger societal processes causing global environmental degradation.

Its strength is the Biblical vision nurtured and elaborated in the creation care and ecojustice literature. This worldview narrative reveals the goodness of God's creation, the human fall into sin and alienation, God's action in history, ultimately in Christ, to forgive and bring redemption and renewal to all creatures, and the eschatological pull on all creaturely things toward a time in which God has fully renewed all things. This vision can stimulate CHE to contribute to a better, more truthful problem definition of environmental degradation, one that will inspire deep action of renewal.[19]

CHE need to work cooperatively with the general academy and other institutions in society to define environmental degradation. This means none should dominate each other, but leave each free to do its task. The academy cannot dictate the whole truth to society, but co-discovers it with other societal actors, who mutually shape a wise worldview narrative. Sometimes powerful actors—like corporations, states, churches or others—may want to force the academy to bow to its interests and wishes on environmental degradation. CHE needs to remember, as Bob Goudzwaard argues: "…science is given the divine calling to search for truth and truth alone, even if some social groups, governments or business people don't like these outcomes."[20] Defining and speaking truthfully on the 'ecological question' of our times is our vocation, even if some may not like these outcomes.

PART II: PROBLEM ELABORATION OF THE ECOLOGICAL QUESTION:

The second part of this paper makes a tentative contribution to the task of defining the problem of environmental degradation as the 'ecological question.' A number of new approaches to understanding global environmental degradation have arisen that contribute significant data and insights to such a problem definition. These include approaches such as the 'anthropocene,' overshooting 'planetary boundaries,' ecological footprint, ecological economics, and so on.[21]

Significantly, however, these competing definitions are not neutral! They are interpretative descriptions and explanations of what is happening with global environmental degradation. Problem definitions rest rather on larger worldview narratives, or assumed overviews of reality. In pluralistic societies, and global context, we need to engage in dialogue and dispute in the academy, and in public life, to contend for our different interpretations of the truth, in order to disclose the truth of the matter. [QQ Wolterstorff]. In order for CHE and Christian scholars to meaningfully participate and contribute to this university vocation, and pluralistic scholarly debate, we need to clarify whether and how we as Christians understand the problem of global environmental degradation.

The elements of the ecological question problem elaboration, discussed below, overlap with and borrow from the characterizations set out in the above approaches. I do so, however, in a way that makes clear elements of a problem definition that are critical to a Christian worldview, and often not directly addressed in these approaches.

Brief statement of the 'Ecological Question':

Drawing from these diverse approaches, a basic core description of global environmental degradation should include four tightly interlinked features:

(1) Humanity, through many of our 'developed' economies, is *over-using* many of creation's renewable and non-renewable 'resources,' e.g. wood, food and agriculture, and fresh water.

(2) Humanity is *over-using* creation's ability to absorb and disperse our societies' waste and pollution, e.g. wetlands cleansing water, atmosphere absorbing GHGs, and the ocean acidifying as it absorbs CO2.

(3) The extent of human over-use of these capabilities is now so serious, on so many fronts, that it is *progressively diminishing and destroying* the capacities of creation to produce renewable resources and to absorb waste and pollution.

(4) The rates at which humanity is overusing natural resources and dumping waste/pollution, as well as the rate at which the earth is losing its capacity to provide these functions, are now changing *exponentially*.[22] The rates of change are compounding and progressively speeding up, thus the negative effects of these developments are becoming larger and moving over us ever more quickly.

This initial statement of the ecological question hides important variations in the rates and intensities of each of these four features, on local, regional and watershed-level scales, and also by types of 'resources' and activities. Furthermore, the richest 1 billion of humanity, wherever they may live, are responsible for a disproportionately large share of the material, energy and resource consumption causing the 'ecological question.'

Well known drivers of these alarming trends include population growth, continued growth of developed economics, and the addition of poor economies to the Western economic style. Human population on earth has reached unprecedented levels and is still growing exponentially. Many wealthy economies continue to expand, and are joined by emerging economies that also expand to produce the material goods and services demanded by their populations. Most societies that are integrated into the globalized economy are deeply committed to the belief that their economies must continuously grow in order to overcome a host of problems arising from previous development [from poverty, to poor distribution of income, to rising societal and governmental debt, environmental problems, and so forth—that is, economic growth is seen as the policy prescription to overcome these emerging problems. Furthermore, economic growth today is still overwhelmingly based on material growth, which depends on growing exploitation of natural resources, and produces growing streams of waste and pollution.

However, an adequate problem description must say more.

The combination of our globalized economic systems is now approaching or surpassing many of the earth's limits and key capacities, and often doing so at exponential rates. The vast majority of this environmental degradation is linked to these economies' increased use of natural resources and dumping of waste/pollution. They are undermining the fruitfulness, stability and capacity of physical and ecological systems of creation to produce the realities on which all life forms on earth depend. So we could say that ***global environmental degradation is directly an economic problem, and must be dealt with internally to the field of economics***.

Furthermore, our economies are the essential interface between ***our society's 'way of life'*** and ***the life-giving and life-supporting 'capital' of creation***. Thus, in a larger sense, the above features of the 'ecological question' ***are integral parts of our 'way of life,' but are having their most direct impact via our economies***. So a problem definition may need to say that basically, it is our current 'way of life' that is weakening and increasingly diminishing the very creational possibilities on which it depends.

As discussed in Part I, our economic and social structures and economic thinking treat the causes of these massive global problems as though they were discrete issues, which can be tackled independently with rational technical solutions.[23] The ineffectiveness of our traditional solutions and remedies is increasingly making us feel trapped. Paradoxically, we keep returning to solutions that are habitually failing. Thus, the mantra that 'There is no alternative' [TINA] is increasingly heard. We cannot grasp or see that our current institutions and mechanisms are perhaps at fault. We are blinded to this by our belief that they are essential for arriving at progress. Thus, we have been unable to reform our key institutions and practices in order to alter our society's course and prevent the serious problems of climate change and downward spiraling of these crucial ecological trends.

At root is the worldview narrative of progress. Our unending stress on economic growth—with its concurrent resource use and waste streams—is justified with narratives that suggest ever-growing material wealth and consumption must be made available as the foundation for individuals to freely and autonomously realize themselves. Many governments, as well as international economic institutions [IMF/WB], deliberately avoid prescribing a single 'common' good, but rather focus on guaranteeing economic growth, since material abundance is seen as the 'neutral' means of allowing individuals to freely define their own ends, and pursue their private 'goods' as they define it. This is the deep ideology or faith of our way of life. It is further supported by the conviction that rapid growth in scientific knowledge, technology and innovation will enable humanity to master and control the earth in order to secure resources—including cheap energy—to spur on rapid economic growth, and also to solve any problems arising from pollution and waste.

DETAILED PROBLEM DEFINITION OF THE ECOLOGICAL QUESTION:

Global environmental degradation today is characterized by a variety of features which together are initiating quantitative and qualitative changes on earth, the pattern of which constitutes a novel 'ecological question.' As societies, and churches, move to tackle environmental degradation, we need to devise solutions, strategies and approaches that take into account the following characteristics.

Characteristic one: depleting natural resources

Contemporary societies have created economies that are interlinked, and to varying extents integrated, on a global scale. These economies now demand inputs of a variety of 'natural resources' at such high rates that some resources are in imminent danger of, or have already become, depleted. Our economies are over-using, depleting, and sometimes exhausting a variety of key resources, both renewable and non-renewable.

Non-renewables resources include resources that, once they are used once, can no longer be reused. They do not renew quickly enough to meaningfully allow humans to use them in an ongoing way, e.g. fossil fuels, once used, are gone and renew only through such long-term natural processes, that they are not meaningfully available for human purposes for millennia. Renewable resources are resources that are replaced or renewed in short time frames, and can be meaningfully harvested regularly and repeatedly by humans as they regenerate. These include forms of 'natural capital,' such as, the products of agriculture [from subsistence, small farms, to industrial agriculture], fishing [inland to ocean, small to industrial fishing], forests [local firewood to lumber and pulp and paper] and water [from drinking, industrial use, to functioning as the backbone of ecosystems].

A growing body of literature documents this trend. The UNEP report *Towards a Green Economy* (2011) shows, for example, that due to economic activity,

> 60 per cent of the world's major ecosystem goods and services that underpin livelihoods have been degraded or used unsustainably (Millennium Ecosystem Assessment 2005). This is because the economic growth of recent decades has been accomplished mainly through drawing down natural resources, without allowing stocks to regenerate, and through allowing widespread ecosystem degradation and loss.[24]

The Study points to specific examples:

> …today only 20 per cent of commercial fish stocks, primarily low priced species, are underexploited; 52 per cent are fully exploited with no further room for expansion; about 20 per cent are overexploited; and 8 per cent are depleted (FAO 2009). Water is becoming scarce and water stress is projected to increase with water supply satisfying only 60 per cent of world demand in 20 years (McKinsey and Company 2009). Agriculture saw increasing yields

> primarily due to the use of chemical fertilisers (Sparks 2009), yet has resulted in declining soil quality, land degradation, (Müller and Davis 2009) and deforestation – which resulted in 13 million hectares of forest lost annually over 1990-2005 (FAO 2010). [Ibid.]

The study concludes:

> Ecological scarcities are seriously affecting the entire gamut of economic sectors that are the bedrock of human food supply (fisheries, agriculture, freshwater, and forestry) and a critical source of livelihoods for the poor. At the same time, ecological scarcity and social inequity are clear indicators of an economy that is not sustainable. (section 1.3) [Ibid.]

While there are significant variations both within and between the categories of renewable and non-renewable resources on rates of use and depletion, the general trends point to serious challenges.

Findings such as these are being published regularly. On May 19, 2016, for example, the UN Environment Programme (UNEP) published "Global Environmental Outlook" which reports: "With no region of the Earth untouched by the ravages of environmental destruction, the state of the world's natural resources is in a rapid downward spiral" Global Environmental Outlook further concludes that "the rate of environmental deterioration is occurring faster than previously thought—and can only be halted with swift action."[25] The project Global Environmental Outlook (UNEP) "involved the expertise of more than 1,200 scientists and over 160 governments," and publishes a comprehensive assessment composed of "reports on each of the world's six regions…"[26]

There is a great deal of substitution of resources that can and has occurred in economies. The question is, with the trends summarized in the brief description of the ecological question, above, can we continue to expect humanity to endlessly find such substitutions? As Jared Diamond asks: "When we deplete one resource (e.g., wood, oil, or ocean fish), can we count on being able to substitute some new resource (e.g., plastics, wind and solar energy, or farmed fish)?"[27] If so, can it be done to produce the same sort of "life style"?

A brief look at the case of 'Peak oil'

The decline and depletion of non-renewable resources is also not a simple matter. The debate over 'Peak Oil' illuminates some key aspects of the complexity of overusing non-renewable resources. Fossil fuel energy is the lifeblood of our civilization and is central to our economy and way of life.[28] Peak oil—which in the broadest sense includes oil as well as all other fossil fuels, e.g. coal, natural gas, shale gas, heavy oil, bitumen, etc.—occurs when the discovery of new supply through geology and exploration—and believed to be technologically available—no longer meets the growth of societal demand. At the peak moment when the supply curve cuts across the demand curve, the peak has been crossed and the resource will begin to be in shorter and shorter supply. This can happen at the level of a single reserve of oil, at a national or continental level, and globally.

There are similar formulations for other natural resources besides "peak" oil,[29] e.g. peak water, peak grain,[30] and so on. They point to something very important, but need to be understood in a nuanced manner. New technologies can greatly expand supply. Charles C. Mann, in "What If We Never Run out of Oil?" does a good job of showing the amazing extent of known fossil fuels reserves, of all types. At the same time, the pursuit of new supply comes at high technical, monetary, and environmental costs, which may make the new 'extreme' energy less and less viable as a supply, even while large amounts are available, e.g. Canada's oil/tar sands. So discussions about 'peak oil' concern whether the current point, whether society is in danger of running low or out of the natural resource of fossil fuels. ***So perhaps it is better to identify the danger as the move to extreme forms of energy, rather than simply 'peak oil.'***

What makes fossil fuels hit a peak, as suggested by the 'peak oil' theory, is not simply that discoveries of supply no longer exceed rising trends of demand, but also a number of other factors. The

discovery and use of new recovery technologies are important [fracking, angle drilling, deep sea and earth drilling and so on]. What also shapes where the real 'peak' of supply is located, are a host of other costs—ecological, social, economic, technological, costs, including waste and pollution—that push up the real economic costs, as well as the dangers, of discovering, recovering, processing, transporting, and using this energy. Thus, many forms of energy are becoming 'extreme energy.'[31] Furthermore, both the EROI [energy return on investment] and the EROEI [energy return on energy investment] keep going up for these forms of energy, even as technology discovers some new ways of securing, cleaning or using them.[32] This also means more GHGs are produced per end use barrel. To keep trusting technology to solve the many growing costs and problems involved with securing these extreme forms of energy takes a great deal of faith in science and technology. The central issue with the majority of the remaining, massive supplies of fossil fuels, is whether we ***can*** technically use them, and further, whether the damage they do ***will allow*** us to use them.

Characteristic two: increasing waste and pollution

Our economies are also dumping huge amounts of waste and pollution in natural systems. These liquid, gaseous, and solid waste streams are growing rapidly, as human population and economies grow. Societies require more and larger waste facilities, sewer plants, landfills, chemical disposal plants, and so forth. This is increasingly overtaxing the air, water, and land systems as well as living ecosystems on which societies have traditionally depended to process lower levels of waste and pollution in past generations. The dumping of waste and pollution is often now approaching or exceeding the absorption capacity of these systems. In some cases, the dumping of liquid, gaseous, and solid wastes is having a negative impact on entire global systems, e.g. hole in ozone layer, climate change, and acidification of oceans. Furthermore, newer types of waste are sometimes proving too toxic for, or are being dumped in too high concentrations, and are thus posing health risks to a variety of living creatures, e.g. carcinogens ending up in the food chain, DDT damaging animals and humans.[33]

A brief excursion into GHG emissions as pollution and Canada 'extreme' oilsands

Climate change, resulting from human societies increasing the level of greenhouse gases in the atmosphere, is one type of pollution problem. Globally, most societies depend on the natural resource of fossil fuels for many key functions, the use of which is simultaneously producing a pollution problem. These two issues are bound together in the problem of climate change and burning fossil fuels. The following scenario is based on critical *factual* matters, but also integrally involves a number of *value* and *belief* choices that are empirically part of this emerging reality. The latter involve the human beliefs, assumptions and valuations about what human action will be required to prevent the physical, biological, and ecological results of climate change from occurring. Making decisions on the future development of, and production levels in, the oil/tar sands developments in Canada, requires an not just a factual addition of costs, but an evaluation of whether we are willing to bear these costs. ***There is, as I have argued above, plenty of fossil fuels including Canada's extreme oilsands, but we need to evaluate whether this 'factually available' oil—it is technically possible—ought to be exploited a the increasingly high financial, environmental, social and economic costs, including climate change and the damage it does to food supply, coral reefs, severe weather damage, more intense forest fires, and so on.***

The logic for making such fact/value assessment, goes like this. First, climate scientists warn us that "the overwhelming scientific consensus [is] that while any increase in average global temperatures from pre-industrial levels is dangerous, increases above 2 °C will likely have cataclysmic effects for the ecosystems on which we depend."[34] While the effects of climate change come slowly, over decades, former NASA climate scientist Jim Hansen argues, "The last time the world was 2 °C warmer,

the sea level was 6 meters higher, for example… scientists guarantee a whole series of major changes…"[35]

Second, Canada and most states on earth have signed onto the Paris Agreement, arrived at in the 2015 United Nations Climate Change Conference, COP 21, in Paris (Nov-Dec. 2015),[36] which aims to keep global warming under a 1.5 C limit. This reflects a consensus based on the science, including by governments, that the changes to life on earth, brought on by a 2°C increase in GHGs, would be extreme.

Third, several studies now show that "the global fossil fuel reserves that are already on the corporate books, for which development capital has largely been sunk, greatly exceed, by a factor of five, what we can safely burn to be assured of keeping warming below 2° C."[37] That means we can only burn 1/5 of known reserves, [other reports suggest 1/3 of known reserves] or we doom our grandchildren to a future of more than 2° C rise. A recent (2013) study by Lord (Nicholas) Stern puts it another way: "at least two-thirds of the world's estimated coal, oil and gas reserves have to remain underground if the international community hopes to keep global warming beneath the 2 °C goal and avoid the threshold for 'dangerous' climate change."[38]

Fourth, burning high GHG-emitting fossil fuels will likely need to be greatly reduced once states begin to be serious about tackling climate change. That means much of the heavy oil, bitumen and coal reserves will be considered too polluting to be used. For example, bitumen, the product produced in Canada's oilsands, has a significantly higher carbon impact than many current fossil fuels. The USA Environmental Protection Agency recently wrote a public letter to the USA State Department on the Keystone Pipeline (April 22, 2013) stating "…oil sands crude is significantly more GHG intensive than other crudes, and therefore has potentially large climate impacts. The [Department of State's draft Supplemental Environmental Impact Statement] reports that lifecycle GHG emissions from oil sands crude could be 81% greater than emissions from the average crude refined in the U.S. in 2005 on a well-to-tank basis, and 17% greater on a well-to-wheels basis."[39]

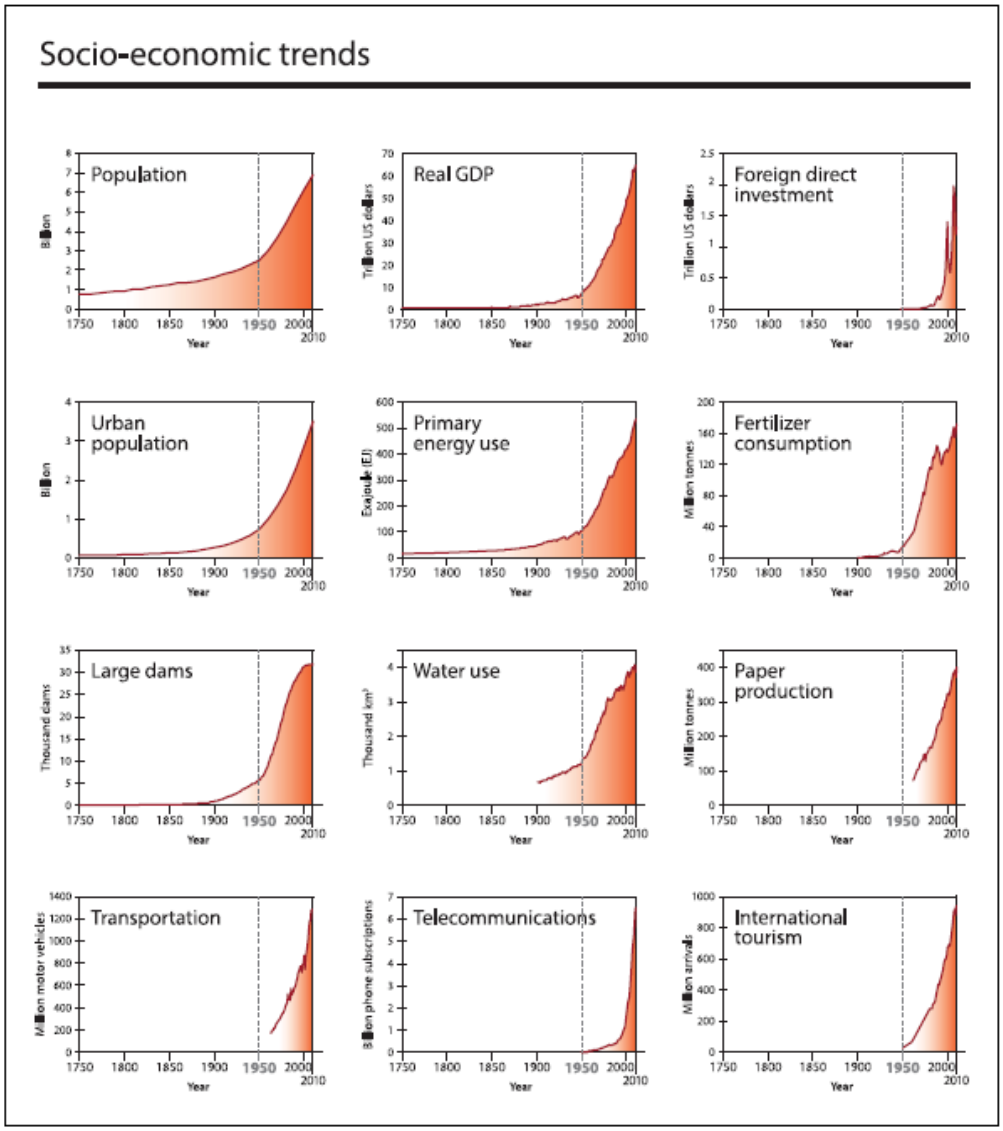
In the future, therefore, this sort of ***fact-value-inspired judgement*** will become a genuine limiting factor on the types, and the amounts, of fossil fuels that practically can be burned. ***No longer will 'peak oil' be simply a matter of geological discovery and technological capacity alone, it will also involve additional value judgements about matters related to issues like climate change.*** Such judgements of fact-and-value need to be integrally considered in peak oil, including integrating issues such as, what are the economic and energy costs of extraction, the direct ecological costs of extraction, the social costs of extraction, the costs of consuming fossil fuels, and so on. Understanding the character of peak oil must include seeing this question as integrally embedded with current economic, social and ecological realities. We must judge whether society(s) are approaching a socio-cultural-ecological point at which the real costs of extracting and using fossil fuels no longer allow us to use them, or demand we use them selectively and at reduced rates. How much and what type of petroleum products can we extract and consume given our embeddedness within current and anticipated social, economic, and ecological realities?[40]

Characteristic three: exponential growth in the pace of resource use and waste dumping

The critical feature of the above characteristics—natural resource consumption and dumping waste and pollution—is that many of the specific developments within these categories are now occurring at exponential rates. The temporal rates at which they are increasing, is exponential, and thus their overall impacts are rapidly compounding.

In a concise overview of these trends since the 1960s, the *New Scientist* shows the spectacular ***exponential*** growth patterns in a variety of human activities which intrinsically depend or impact on ecological systems. Some trends that fall within the first two characteristics of the ecological question,

which the article lists, are rapid growth in population, GDP, foreign investment, water use, damming rivers, fertilizer consumption, urbanization, paper consumption, motor vehicles, telecommunications, and tourism.[41] Strikingly, the *rate of change* for each of these increases so rapidly that humanity will, with increasing likelihood, soon face the prospect that some resources will be exhausted or vital ecological systems will fail to absorb ever increasing waste. Components of creation will be unable to sustain ever-increasing levels of human activity and impact. The exponential character of these key trends is illustrated well in the following chart of "Socio-economic trends."



Source: Steffen, Will, et. al., "The trajectory of the Anthropocene: The Great Acceleration," *The Anthropocene Review*, 2015, Vol. 2(1) 81-98. This is an updated version of the "Special report: The facts about overconsumption," *New Scientist*, 15 October 2008.[42]

Characteristic Four: quantitative change can kick off qualitative changes

As we contemplate the nature of these exponential trends, it is important to consider that they are not exclusively quantitative in character, that is, quantitative changes in the scope, scale and gravity of problems [which are well represented by exponential curves], can also involve and trigger

significant qualitative changes.[43] Evidence suggests that some exponentially increasing levels of resource extraction and waste dumping have triggered qualitative changes to physical and ecological systems.

Defining the problem of environmental degradation as the 'ecological question,' therefore, must include some accounting of the probability and possible impacts of these potential qualitative changes. Here are two examples:

A) Systemic 'tipping points'

In *Something New Under the Sun*, J. R. McNeill describes tipping points:

> The environmental history of the twentieth century is different from that of time past not merely because ecological changes were greater and faster, but also because increased intensities **threw some switches**. For example, incremental increases in fishing effort brought total **collapse** in some oceanic fisheries. The cumulation of many increased intensities may **throw some grand switches**, producing **very basic changes on the earth**. No one knows, and no one will know until it starts to happen—if then.[44]

Tipping points, or abrupt changes, or surprises, have become a point of great importance in the study of climate change. But they are also important in a variety of other problems.

B) Local to Global:

Another type of qualitative change that can occur, J. R. McNeill argues, is that a quantitative shift from local to global can also kick of substantively new qualitative developments. One way a quantitative change can become a qualitative difference, for example, is when local air pollution becomes global. Then air pollution can become "so comprehensive and large-scale that it affects the fundamentals of global atmospheric chemistry. So changes in scale can lead to changes in condition."[45] McNeill argues: "Sometimes differences in quantity can become differences in quality. So it was with twentieth-century environmental change. The scale and intensity of changes were so great that matters that for millennia were local concerns became global."[46] Examples of larger changes in condition include climate change and ocean acidification. As quantitative changes in these phenomena accumulate, they can kick of new global phenomena. Historically, an earlier version of this phenomena included the "Columbian Exchange," as Charles Mann documents in his book, *1493: Uncovering the New World Columbus Created*, in which the transfer of plants, animals, germs and people across continents over the last 500 years since Columbus, caused enormous changes in civilizations around the world and forms of globalization.[47]

In a similar vein, former White House advisor, retired Yale Law School dean, and environmental activist James Gustave Speth, argues in *The Bridge at the Edge of the World,* that staying on the current course of a profit-obsessed capitalist society will rapidly push us into environmental, economic, and political ruin. While the outcomes he identifies are rooted in quantitative changes, they clearly take on a qualitative character. He states:

> The upshot is that societies now face environmental threats of unprecedented scope and severity, with the possibility of **various catastrophes, breakdowns, and collapses** looming as distinct possibilities, especially as environmental issues link with societal inequalities and tensions, resource scarcities, and other issues.[48]

Thus, in addition to, and sometimes directly because of, tipping points, historians like Jared Diamond in *Collapse: How Societies Choose to Fail or Succeed,* are increasingly studying earlier civilizations and societies that have collapsed, and asking why, and what was done or not to prevent collapse.[49]

Characteristic five: destroying the fruitfulness and functionality of creation

The human use of natural resources and waste-absorption capacity have grown so large, in many cases and areas, that they now not only exceed the productive and/or absorption capacity of these features and locations, but are also **'eating up' or destroying the fruitfulness and functionality of creation.** In other words, some forms of natural resource extraction and waste dumping are beginning to destroy the 'capital' [metaphorically speaking] of creation. ***The capital of creation fundamentally refers to all the fine equilibriums and balances that exit in the earth's conditions, processes, cycles and possibilities that make all life as we know it possible and flourish.***

On the resource side, the 'capital' of creation could be said to involve, among other things, the renewable-resource producing ability of creation e.g. forests, topsoil and agricultural productivity, water bodies producing fish stocks, physical and ecological systems providing fresh water for drinking, water for agriculture, and so forth. On the waste side, the 'capital' of creation involves physical and ecological systems that absorb waste and pollution. As many of these systems become overused, their capacities begin to diminish and are sometimes destroyed, e.g. phosphorus waste over-fertilizes aquatic plants in waterways causing excessive plant growth; increasing GHGs in the atmosphere are changing the atmospheric chemical composition and causing climate change and the acidification of oceans; sulfur dioxide and nitrogen oxides are causing acid rain; and so forth. Thus, the physical or ecological systems' ability to provide its key functions declines or halts. Each year that this 'capital' diminishes, furthermore, the resulting 'fruit' available for human and non-human creatures in the following year also declines.

The trends are, consequently, that human consumption of natural resources and dumping of waste are growing, while the earth's capacity to annually produce and/or absorb them is progressively diminishing. Christian economist ['ecological economist'] Herman Daly has long warned us that:

> The most important change on Earth in recent times has been the enormous growth of the economy, which has taken over an ever greater share of the planet's resources. In my lifetime, world population has tripled, while the numbers of livestock, cars, houses and refrigerators have increased by vastly more. In fact, our economy is now reaching the point where it is outstripping Earth's ability to sustain it. Resources are running out and waste sinks are becoming full. The remaining natural world can no longer support the existing economy, much less one that continues to expand.[50]

'Ecological footprint'

The impacts of these characteristics and trends have been studied for some time, particularly since *The Club of Rome Report* in 1972. This report had an enormous international impact when it "demonstrated the contradiction of unlimited and unrestrained growth in material consumption in a world of clearly finite resources."[51] Jorgen Randers observes: "The mains scientific conclusion of the [Club of Rome] study was that delays in global decision making would cause the human economy to **overshoot planetary limits** before the growth in human **ecological footprint** slowed. Once in unsustainable territory, human society would be forced to reduce its rate of resource use and rate of emissions."[52] The Club of Rome Report authors believed "global society ought to reduce its ecological footprint per unit of consumption, and much more importantly, start doing so in time to avoid global overshoot."[53]

The notion of '**ecological footprint**' has been developed and refined further since the *Limits to Growth* report. It is a very helpful way of grasping and explaining the idea that humans are destroying the fruitfulness and functionality of creation. A helpful application of this concept is "Earth Overshoot Day," developed by the Global Footprint Network. It tracks this trend of human economies consuming the 'capital' of creation and reports:

> Just as a bank statement tracks income against expenditures, the Global Footprint Network measures humanity's demand for and supply of natural resources and ecological services. And the data is sobering. Global Footprint Network estimates that **in approximately eight months**, we demand more renewable resources and C02 sequestration than what the planet can provide for an entire year. In 2012, Earth Overshoot Day—the approximate date our resource consumption for a given year exceeds the planet's ability to replenish—fell on August 22. This year, it will likely come even earlier. **We will then go into ecological overshoot, and make up the deficit by drawing down local resource stocks and accumulating more carbon dioxide in the atmosphere**. …While only a rough estimate of time and resource trends, Earth Overshoot Day is as close as science can be to measuring the gap between our demand for ecological resources and services, and how much the planet can provide. [Emphasis added][54]

Overshooting 'planetary boundaries'

Another very helpful way to track and address the idea that humans are destroying the fruitfulness and functionality of creation is the scientific literature on 'planetary boundaries.' In "A safe operating space for humanity,"[55] Johan Rockström, et. al. argue, that "identifying and quantifying planetary boundaries that must not be transgressed could help prevent human activities from causing unacceptable environmental change." They define planetary boundaries define as "a safe operating space" within which humans can function without "challenging the current and benevolent state of the planet." [56] If human activities push environmental change outside of these boundaries, however, there may be "consequences that are detrimental or even catastrophic for large parts of the world."[57] The nine boundaries they have defined and are operationalizing include the following "earth-system processes":

(1) climate change;
(2) rate of biodiversity loss;
(3) nitrogen and phosphorous cycles;
(4) stratospheric ozone depletion;
(5) ocean acidification;
(6) global freshwater use;
(7) change in land use;
(8) atmospheric aerosol loading;
(9) chemical pollution.

The authors argue that these nine processes "regulate the function of the earth system; so as to maintain it in a state that has allowed human settlements and cultures to flourish."[58] Significantly, they conclude that we have already overstepped "three of nine interlinked planetary boundaries." [59] While there is significant scientific and policy debate over how to operationalize these planetary boundaries as well as how to steer society so it stays within these boundaries, this literature helps understand how humans could be destroying the fruitfulness and functionality of creation.

An interim question: "Why, if the world's ecosystems are under siege, do people seem to be prospering?"[60]

Some critics have raised this environmental question. Widespread discussion since the publication of this paradox suggests that humanity is experiencing a delayed response. In a globalized economic and social system, there are two forms of movement of resource acquisition and waste dumping, which serve to mask the full effect of these behaviors. First, "spatial displacement" of pollution from the original local region of source, to places around the globe, e.g. GHG production and the impacts spread around the globe to vulnerable societies, e.g. pacific islands. This also happens when wealthy societies use resources from other parts of the globe, depleting their natural resource

wealth as well as often leaving eco-debt in those countries, e.g. toxic tailings. Second, there is a "temporal displacement"[61] of impacts and pollution, e.g. high GHG emissions are passed from one generation to the next, thus accumulating with worsened impacts. Consequently, only later will people bear the full brunt of current overuse of resources and waste, e.g. climate impacts of current GHG production will be felt in changed weather and systems.[62]

Characteristic Six: adding *causation* into the problem definition

The five characteristics of the ecological question, discussed above, do not present a full elaboration of the problem. A number of deeper drivers are causing these problems and need to be addressed and included in any problem definition or elaboration. Any proposed solutions must be appropriated designed for the correct causation. Exponential population growth and exponential economic growth are often identified as drivers of the problems of 'rapidly increasing resource use' and 'escalating waste production,' which characterize the ecological question.

Human population growth

Exponential growth of the human population is frequently identified as the cause of environmental degradation. The human population of the earth surpassed one billion, for the first time, in the 18th century. In my 60 year lifetime alone, world population has increased by more than 4 billion! Sometime during 2012, global population passed 7 billion. While the rate of population growth is slowing somewhat, by 2050 world population is estimated to surpass the 9 billion mark.[63] Population growth is linked to increased human life expectancy due to advances in health, medicine, nutrition, food supply, and sanitation. While there is little doubt that high world population is strongly impacting global environmental degradation, this is not uniformly true. Human populations in countries with 'developed economies' and strong economic growth, produce far more environmental problems on a per capita basis, than populations in poorer countries.

Population growth is indeed a serious contributor to the ecological question. It clearly would help reduce the exponential growth in resource use and pollution if we were to reduce population growth. But scholars argue, and the logic suggests, that the earth can sustain the current level of population, if we consumed less over all, distributed wealth more fairly, functioned within the limits of creation, and learned to live better, happier lives with less [and different] material demands. If the resources and capacities of the earth were better utilized and managed, the earth could sustain even a larger population of humans, many commentators suggest.[64] Thus population growth, if properly managed and developed, would itself not have produced, nor now worsen, the ecological question. Furthermore, the richest 1 billion of humanity are responsible for a vastly disproportionate share of the of material, energy and resource consumption that is causing the ecological question.[65] This shifts our attention to economic growth.

Economic growth

The growth of many economies, the United Nations Environment Programme reported in 2011 has also been exponential. "Over the last quarter of a century, the world economy has quadrupled, benefiting hundreds of millions of people (IMF 2006). [66] In 2009, economist Tim Jackson noted that: "the average growth in global GDP in the last 50 years is just over 3 percent per year." [67] This includes the continued growth in 'advanced' economies as well as rapid growth of many 'new' economies (e.g. Brazil, Russia, India and China). As specific economies expand and new national economies are added to this growth, the resource demands and environmental impacts also grow rapidly

The explosive economic growth of China, for example, is producing vast new environmental degradation. Since 1978, China has experienced on average "nearly 10 percent a year" GDP growth

which is "the fastest sustained expansion by a major economy in history."[68] Environmental law scholar, John Nagle, shows that while China's population has grown to 1.35 billion, China's incredible rates of economic growth over the past decades are producing massive increases in resource use and pollution and waste output. On the latter, Nagle states:

> China is the world's worst polluter. It suffers more from air pollution than any other nation, hosting most of the world's polluted cities. Nearly two-thirds of the country's 360 million urban residents suffer from unhealthy levels of air pollution. Anecdotal reports by visitors to China frequently refer to the alarming nature of the air pollution there. China's water is polluted, too. About 100 billion cubic meters of China's water supply is contaminated. China is also the leading emitter of greenhouse gases that contribute to climate change. China's carbon dioxide emissions nearly tripled between 1990 and 2008. And China's pollution is only expected to get worse. It is building unbelievable amounts of coal-fired electric power plants, and the number of cars in China is increasing exponentially. China 'is expected to release five times more carbon dioxide over the next twenty-five years than the Kyoto Protocol [was] projected to save.'[69]

Thus, the ongoing growth of economies and material consumption is far more troublesome both in practice [see above] and logically. If we go further to logically project economic growth into the future based on current rates of growth, for example, the resulting scenario is clearly impossible, a fictional and fantasy world. For example, economist Tim Jackson, reflecting on endless economic growth, offered the following calculation in 2009: "the average growth in global GDP in the last 50 years is just over 3 percent per year. If the economy grows at the same rate over the next 91 years, it will be (1.031)91 = 16.1 times bigger than it is today."[70] Another logical projection of current economic growth is offered by Niko Roorda:

> Imagine: economic growth stays at a constant 2.5 per cent a year over the ages. This would mean that a nation's wealth would double around every thirty years. After sixty years, this wealth will be quadrupled, and after ninety years (three times thirty years) it has grown eightfold. Three centuries later the nation's wealth would have increased by a thousand times, and after twelve centuries it would be 1,000 billion times richer.[71]

Roorda further notes that both contemporary society as well as the discipline of economics to believe that "economic laws dictate that such an increase is necessary" (85) and that "continuous growth is essential for maintaining our level of prosperity" (65). The implications for the ecological question are obvious. This form of economic growth cannot go on indefinitely.

Dematerializing economic growth?

But what if we were to substitute non-material growth for material growth, Roorda asks? Some commentators suggest we can continue endless economic growth, if we shift the character of economic growth so the measures of wealth [growth of dollars] are decoupled from the growing consumption of physical resources and production of waste. This could be achieved by basing growth on activities dependent on computers and virtual reality, which Roorda calls "dematerialization" (p. 86).[72] In this scenario, economic growth would not increase material input demands and material outputs and waste.

Other commentators suggest economic growth can be separated from material inputs by basing growth on the financial sector. The financial market could be separated from its former role of supporting the real economy of producing and distributing goods and services, and thus economic growth could be decoupled from natural resource use, material consumption and increased waste and pollution. Unfortunately, studies suggest an electronically based form of economic growth [computer technology] still demands a remarkable inputs of energy, natural resources and produces a great deal of difficult and toxic electronic waste. Furthermore, basing economic growth on financial markets has had the ironic effect of stimulating increased material consumption.[73] It is not clear that dematerializing

economic growth can allow global and national 'economic growth' to continue in such a way that it does not worsen the ecological question.

Excursion: anthropocene as problem definition[74]

Paul Crutzen, a Nobel Prize–winning atmospheric chemist, coined the term "anthropocene" as a new "geological time scale attribution" in the discipline of Geology.[75] Along with colleagues, he argues that humans are now impacting **the entire planetary structure** and becoming the leading agents of change in the earth's ecological and geological systems. Geological change is now "dominated by human activity" (p. 2228),[76] including "dominance of biological, chemical and geological processes..."[77]

As originally aimed to be a new geological classification, this argument was advanced as an ***objective, factual, scientific description of empirical reality***. It described a wide variety of human actions that are impacting and transforming the chemical and biological character of the earth, e.g. causing problems such as climate change, and combined with other human impacts, increasing the rate of extinctions (p. 2229). Thus, they argue, "the world has changed, substantially and irreversibly, through human activity." (p. 2331). In fact, the "**course of earth's deep history**" (my emphasis, p. 2228-9) is being transformed by humans. The core of this argument is that we have believed nature was separate from humans and had its own laws that would bring nature into equilibrium over time. But now science is showing us that the human-nature distinction is idealist, and nature is no longer adjusting and self-correction to human influences. Humans now dominate and alter nature at the global level and usher in a new geological epoch, which they call the anthropocene. Massively increased population and economic systems in the 'human created world,' have a scale and scope so large that their impacts now rival the magnitude of many natural systems and flows. Thus the Anthropocene, they conclude, "represents a new phase in the history of both humankind and of the earth, when natural forces and human forces became intertwined, so that the fate of one determines the fate of the other." (p. 2231)

Significantly, these studies are ***objective and scientific***. The authors specifically identify the **source** of, and **the explanation for,** the phenomena of the anthropocene as the recent rapid rise in human ***population,*** combined with ***increased fossil fuel use***, and ***new technology***, which created ***industrial society***, and is transforming the "course of earth's deep history" (my emphasis, p. 2228-9). This occurs through building of cities, impacts on the chemical and biological character of the earth. (p. 2229)[78] These quantitative increases cause larger effects and damage. Furthermore, these quantitative increases in human activities are also, sometimes, kicking off qualitative changes.[79]

Today, the idea of the anthropocene is widely and popularly used to signal that humanity faces a massive set of problems, that these problems threaten human and ecological wellbeing, and furthermore, that humans must change their behavior to survive. In other words, it has become a problem definition of ecological degradation, as well as other human impacts, that is ethically loaded. Significantly, this moral imperative in many contemporary uses of anthropocene, is already present in Crutzen and colleagues' original studies and arguments. They embed within their scientific arguments implicit value judgements about the outcomes that we can expect. Human dominance of the planet's systems is causing a variety of physical, ecological and biological processes, such as, climate change, species disappearance, ocean acidity, and so on, that are judged to be negative by the authors, and thus require some form of human remediation or changed behaviour. In other words, the use of the scientific argument for the anthropocene as a new geological era, includes value judgements and thus presents us with a moral problem, that is, ***a problem that requires a change in human values and action***.

This comes through more clearly in Paul J. Crutzen's, with co-author Christian Schwägerl, argues is the solution for these developments, that is, the changes that are required to live in the Anthropocene in ways that do not cause problems. Significantly, their explanation of how human

action is transforming the natural world, leads them to consider new thinking on how humans ought fit in and use nature, thus changed attitudes and behaviours.

First, Crutzen and Schwägerl argue, "we must learn to grow in different ways than with our current hyper-consumption. What we now call economic 'growth' amounts too often to a Great Recession for the web of life we depend on." We need to "pioneer a modest, renewable, mindful, and less material lifestyle."[80] Second, the authors call for massive increases in "investments in science and technology."[81] Third, the authors call for a change in thinking, concluding that "we should adapt our culture to sustaining what can be called the "world organism.'.. [cites Alexander von Humboldt some 200 years ago] … [who suggested] we should shift our mission from crusade to management, so we can steer nature's course symbiotically instead of enslaving the formerly natural world." The authors conclude "Living up to the Anthropocene means building a culture that grows with Earth's biological wealth instead of depleting it." [82]

The problem definition offered in the anthropocene literature is helpful on many levels. There is much CHE can learn from its problem definition. At the core of its concern is that humanity is causing these changes, and some of these changes are bad. But Christian Higher Education should be intensely concerned with debates over philosophical and religious questions like "What does it mean to be human?" and "What does it mean to live?"[83] Answers to these shape understandings of who is to blame? What are the roles of our market economic system, or administrative state apparatus, in causing these changes? CHE may have unique answers to these, including ideas about nature, humanity as the image of God, responsibility, normativity, idolatry, social structure, and so on.

The next sections propose two characteristics of contemporary structures and society that require more investigation as deeper causes of the ecological question. Other Christian scholars may have other suggestions.

Characteristic seven: structural causes of the ecological question

Discussion of the above characteristic of the ecological question—the causal factors of exponential population growth and economic growth—shows they contribute to the 'rapid increase of resource use' and 'escalating waste production.' Economic growth in particular, certainly lies at the core of the ecological question. This raises a deeper question. Since our economies are designed and structured to require more economic growth, are they not also pre-programmed to continue increasing resource consumption and increasing waste? The problems characterizing the ecological question seem to be deeply structured into our society and economic systems. We now turn to describe and analyze key deeper structural features of our society and economy.

Canada's oil/tarsands developments

As entry point into understanding the structural characteristics of the ecological question, I use an incident that occurred in my current research project, conducting an architectonic analysis, including a cultural-philosophical reading, of Canada's oilsands.

To begin with, the oil/tarsands are hydrocarbon deposits that contain around 1.7 to 2.5 trillion barrels[84] of bitumen, of which 169.3 billion barrels are proven (or currently economically recoverable reserves). This makes them the third largest national reserves in the world.[85] To recover bitumen and turn it into fossil fuels, oil companies have invested billions of dollars to construct open pit mines, ***in situ*** recovery plants, upgraders and other related industrial installations. In 2012, Canada's former Minister of Natural Resources, Joe Oliver called the oil/tarsands developments "the largest industrial project in the entire world."[86]

The oilsands developments, however, cause massive environmental degradation. Some of the more egregious costs range from: damage to ground water and the McKenzie River watershed, air pollution, open pit mines, in situ operations that fragment the Boreal Forest, damage to endangered species, social and cultural costs borne by nearby First Nations, social and health costs borne by commuting workers and their families, reclamation costs for land and wetland ecosystems, reclamation costs for massive toxic tailings ponds (182 sq km of ponds, and one pond is held in by the 2nd largest dam in the world, by volume of fill), low Energy Return on Energy Investment (ERO(E)I), high rates of GHG emissions, and more. Consequently, Dr. David W. Schindler, a world-renown Professor of Ecology (University of Alberta), says about the oil/tar sands: "I would nominate this for the world's most unsustainable development."[87]

'Need' is compartmentalization

At one crucial moment in my research, the environmental values entrenched in our social architecture came crashing into my consciousness. I was reading a scientific article on water use in the oilsands. In the official publication of the American Chemical Society, "the world's largest scientific society," the author lamented and proposed solutions for water use in the oilsands industry. He stated:

> Whether or not anyone likes the idea of ripping up the landscape of northern Alberta or poking lots of well holes into it to access oil-rich sand deposits, the world—and more specifically the U.S. and China—***needs*** the oil. Because of this ***need*** for petroleum, and the billions of dollars and nearly 140,000 jobs that already go with oil sands development, ***the process is going to continue***.[88]

An element of fatalism jumped out of this description. Energy need and economic processes are simply 'given' and left unquestioned. This assumption is, remarkably, one of the most often repeated statements in the vast oilsands literature!

At the same time, I had also been researching energy consumption. There I read that 70% of bitumen is refined into gasoline, diesel, and jet fuel for transportation. Furthermore, this literature showed that the very architecture of our society demands dramatic consumption of fossil fuels. High energy demand is built into transportation systems, global economic trade, the structure of urban and suburban living, into industrialized agriculture, and our excessive consumerism. Since our social architecture demands huge amounts of energy, it simultaneously asserts environmental values! After 50 years of oilsands mining, for example, there are 182 square kilometres of toxic tailings lakes and growing. Government and industry have still not adopted a workable, cost-effective plan to get rid of them. The second biggest dam in the world (by volume of material) holds back Syncrude's Mildred Lake Tailings lake! But there is no alternative, we must mine the oilsands.

When I brought these two observations together they immediately sparked another possible solution. If we reduce our structural demand for fossil fuels, perhaps this would allow us to slow down the rapid oilsands development and thereby reduce their massive environmental impacts? But somehow, this is simply not assumed imagined to be a solution. Why?

The 'economy' is disembedded from 'society'

The environmental values implicitly built into our socio-economic architecture assume the double disembedding of the economy. The nature of this separation and compartmentalization involved in double disembedding are revealed by an architectonic analysis. First, as the chemist cited above assumed, our society assumes the *economy* is disembedded from *society*. [See assumptions of economics and the economy in Part I, above.] 'Society' is structured as a free zone in which autonomous individuals may live as they wish. Here, people consume, travel, live suburban dreams, trade globally, and engage in consumerism in order to freely maximize their choices. In turn, the 'economy' is compartmentalized from 'society' and simply takes any and all individual demands as

'given,' provided you have the power (money) to back up your choices. The market economy, as currently structured, restricts itself to efficiently supplying whatever demand is expressed. As a market economy, it may price items higher or lower, but it does not, nor may it, second-guess the worth of a demand. Industry may not look behind the curtain of sovereign consumer to question the legitimacy of any particular desires or demand. Thus, oilsands producers get on with efficiently supplying energy demand, and never ask whether society genuinely *needs* more oil?

Why not ask? The structural architecture of our society assumes a 'wall of separation'[89] is erected between the 'economy' and 'society,' one that is inspired to protect the values of individual freedom and autonomy. Individual consumer demand is walled off from powerful producers by the doctrine of 'consumer sovereignty.' No one may interfere with, or second guess, the free, rational choices of individual consumers in society. Thus, since individual desires and demands can grow virtually forever, the market economy's duty is to efficiently and effectively supply this demand. This helps to explain the widespread assumption of continuous economic growth in our society, that is, society needs more material goods as a platform on which individuals can freely realize themselves. And as discussed above, economic growth is directly linked to growing environmental degradation.

Disembedding both the 'economy & society' from 'nature'

But there is a second more insidious form of disembedding. This second level of disembedding involves the separation of both the 'economy and society' from the realm of 'nature.' Anthropocentric values have structured our socioeconomic system so that it is treated as though it were a realm of human freedom freely floating above the realm of natural necessity. The overall socioeconomic system of capitalism—both 'society' and the 'economy'—are compartmentalized from a full, interactive relationship with the physical and ecological systems on which they fully depend. We trust that human rationality and science have so mastered nature that we can make it to supply, although at fluctuating market prices, every expressed individual 'need.' Society draws resources out of nature and counts on nature to absorb waste. Thus, the 'economy' and 'the discipline of economics' address efficient production in isolation from and without full consideration of the physical, biological, and ecological realities on which they both depend completely.

The market structure of the economy is believed to guide society to the most efficient use of any and all resources as well as waste disposal possibilities, and to signal problems through higher prices when problems arise. If serious environmental 'issues' arise from our economy, we follow market signals and make technical adjustments to it. Thus, we have come to add 'resource economics' on the input side of the economy and 'environmental economics' on the output or pollution side. ***But,*** [as discussed in Part I], ***we have no systematic way of ensuring that our socioeconomic system does not overuse or destroy nature, since most feedback from nature is compartmentalized and not adequately captured by sub-disciplines, and practices, of resource and environmental economics***.

Even though our system generates global environmental degradation, such as, climate change and the global ecological question, we do not question this assumption of ***double disembedding***. Thus, this structural analysis leaves us with a strong sense of fate and determinism, we believe 'There is no alternative' (TINA). We are locked in to a necessary system and can at best only make technical adjustments to it.

Characteristic eight: idolatry

What is driving us to create and accept these structures and systems? Even if this practice generates global environmental degradation, such as, climate change and the global ecological question, ***we do not question this assumption*** of double disembedding, of the economy from society,

and both from nature. A full and robust problem description of contemporary environmental degradation must include a still deeper level of analysis of vision and beliefs.

The structure of our social architecture—the way it arbitrarily separates and compartmentalizes functions like 'society,' the 'economy,' and both of these from 'nature'—seems to reflect a kind of extra-terrestrial urge. According to *Google* dictionary, *terrestrial* refers to being "of, on, or relating to the earth" while *extra* is a prefix referring to outside or beyond. Have we devised socioeconomic architecture that assumes humans can freely transcend the bonds of God's creation?

Spiritual depth-level analysis

Conducting a spiritual depth-level analysis of society, as part of an architectonic analysis, involves employing techniques to detect the beliefs actually operating within and shaping everyday life. Bob Goudzwaard has developed a way of doing this with his distinctive understanding of ideology and idolatry.[90]

Briefly put, Goudzwaard argues that when people become obsessed with achieving their ***goals***, they tend to indiscriminately justify the uncontrolled use of ***means***—e.g. market, technology, science, the state, or otherwise—to achieve these goals. This indiscriminate use of means requires us to give birth to an ideology, or perhaps more properly understood as some sort of a pseudo-religion, that serves to justify and remove restrictions from the means. The means then begin to function like an idol, giving us salvation, hope and meaning. The birth of ideology, which creates idols, begins deep within the human heart, but unfolds in narratives or stories that we use to give meaning and justification to our actions and pursuits. Ideologies can be defined, therefore, as the words we weave together to justify lifting the normative requirements off of the means we have chosen to attain the goals which we obsessively pursue.[91]

A spiritual depth-level analysis of these separations and compartmentalisations in society's structures shows they are designed to protect our core values: i.e. individual freedom, autonomy, independence and mastery. In this hides the desire to transcend God's normative creation. This is not surprising, since in the Enlightenment tradition philosophical liberals see law and norms as ***restraints on*** human freedom, and thus they sought to design social, economic and political institutions to make humans fully free. Just as John Locke, in the *Second Treatise*, saw the invention of money as a means to escape or transcend the limits of natural law, so our social architecture is designed to separate us from and transcend the limits of nature. In contrast, Scripture sees God's laws and norms in creation not as restraints on, but as ***conditions for,*** freedom. They guide us to walk in paths of flourishing, wholeness and blessing for all creatures. Laws and norms guide us to be fully at home on earth. Creation flourishes and provides abundance when humans live in harmony with God's good intentions.

Our societies' commitment to individual freedom and self-creation requires a strong foundation of material plenty. This gives birth to our society's infatuation and obsession with economic growth. Looking around us empirically, at the majority of national economies and global economic and political institutions, we see a virtual unanimity on, and practice of, economic growth. It is a central doctrine of the dominant ideological commitments and values of our times. In *Something New under the Sun,* for example, J. R. McNeill notes that in the twentieth century "almost everyone, communists included—worshipped at this same altar because economic growth disguised a multitude of sins." McNeill further talks about "…adherents to the faith" [of economic growth] and refers to it as a "state religion."[92] This is shaping not only economic practice but the development of the discipline of economics as well. Herman Daly observes,

> …economists have not grasped a simple fact that to scientists is obvious: the size of the Earth as a whole is fixed. Neither the surface nor the mass of the planet is growing or shrinking. The same is true for energy budgets: the amount absorbed by the Earth is equal to the amount it

> radiates. The overall size of the system—the amount of water, land, air, minerals and other resources present on the planet we live on—is fixed. [93]

The best explanation for this odd blindness, given the growing evidence of the problems associated with economic growth, is that many people operate with idolatrous ideological blinders. This final trend, that includes empirical observations about commitment to economic growth ideology, beliefs and values, must also be part of our new problem definition of environmental degradation.

In addition to our society's deep trust in economic growth, we also see a heavy faith in technology. This is often a good thing, and has solved many problems. But in face of the mutating and rapidly worsening problem of environmental degradation, is blind confidence and trust in technology still justified? In fact, in important ways, our heavy reliance on science and technology as solutions, is now increasingly failing, worsening problems, or even creating new ones.

To summarize, we are today profoundly ambivalence about being human creatures that are totally embedded in the Creator's good creation (Gen 1-2). Our social architecture compartmentalizes different sectors in a way that presumes we have no responsibility to each other or to the laws and norms of any Creator. At the heart of my proposed problem description of the ecological question, therefore, lies a form of idolatry.[94] According to Psalm 135, idols trap those who trust in them in a state of powerlessness and determinism, just as our society feels facing the ecological question. Ironically, when we devise social architecture motivated by idolatry, it does not end giving us mastery of creation, but rather destroys it, generating widespread environmental degradation. Idolatry also prevents us from questioning the structural architecture of our society.

Finally, Christians need to admit that we share fully with non-Christians in the environmental failures of our times. Thus, all humanity stands in solidarity before the dynamic revelation of God that identifies our human failures, argues the Christian philosopher J. P. A. Mekkes.[95] But this revelation also invites all humans to respond to Christ by renewing our environmental values and restructuring our social architecture.

Conclusion:

This paper proposes a tentative problem definition of global environmental degradation as the 'ecological question.' This definition elaborated on 8 key characteristics to show that this problem integrally involves our entire 'way of life,' including its structures, systems, practices, assumptions, and beliefs. This problem definition suggests any solution must consider changes to our structures and system, as well as a turning around, metanoia, of the beliefs, ideologies and commitments that shape our 'way of life.' Solutions devised to tackle the ecological question, therefore, will need to be more than technical adjustments to the system, but rather re-orienting step for our 'way of life,' structures and system, and our hearts and vision.

This diagnosis of the ecological question can be liberating, since it helps us regain degrees of freedom to act wisely. Our system is not fate, nor is exponential environmental degradation. This problem definition suggests currently unthinkable options, such as, stepping back from the mad rush to increase material consumption. We can take the foot off of the gas pedal of economic growth and slow down. We can give up on societies overriding goals, e.g. endless economic growth and the continuous growth of material consumption. We can ask whether increasing economic growth and material wealth is genuinely making people happier. And, is our society really achieving progress? [96] Do current societal indicators like GDP, actually measure happiness and progress?[97]

Furthermore, the problem definition proposed in this paper requires the academy, and CHE in particular, to reflect deeply on the ways we think about these problems. For example, we need to reject the standard 'economics' model in which 'resource economics' and 'environmental economics' are simply added onto an essentially 'unchangeable' body of economic science. They need a deep

rethinking, just as 'ecological economics' is doing, but from a Christian point of view.[98] We also need to rethink the role and place of disciplines, sub-disciplines, and interdisciplinarity.

A new problem definition can promote alternative economic, social and political practices. We can stop accelerating our pace of material consumption, and increasing GDP, for example, and instead invest in human health and education, build social capital and community services, strengthen societal bonds, community. We could invest in natural capital, care of creation, carrying capacity of the earth, vulnerable ecosystems, thus in order to attend to ecological embeddedness. [99] We need to learn how human and natural wellbeing can increase without increasing personal consumption. This problem definition lets us see that these changes require a changed heart, that is, which gives the gift of spiritual openness required for disclosing community, solidarity, stewardship, and justice in our way of life.

Appendix A:

Problem definition is an ongoing project. Thus CHE should continue to develop a deeper more comprehensive problem definition of global environmental degradation that:

- honours the integrality of God's good creation, by respecting and recognizing the interrelatedness of the problems we face
- recognizes nature is not a blank canvas, but God's good creation, which is normatively charged to reveal the ways of creaturely flourishing and grace
- recognizes that human problems today are rooted deeply in the structural architecture of our economies, political orders, and society, a reality which makes these structures appear normal and even necessary
- recognizes human agency is possible and essential, both in shaping institutions and systems, and in living within them
- identifies clearly the role our way of life plays in shaping and operating these structures and systems
- identifies the role of different societal actors, and the government, in causing these deformed structures, and in also in stimulating a return to creation care
- goes deeper than mainstream problem definitions, by identifying the role played by deeper religious/spiritual/philosophical beliefs of our culture

Endnotes

[NOTE: endnotes are incomplete, and need editing]

[1] "Strengthening Christian Higher Education in an Era of Global Transformation," IAPCHE's 8th International Conference, accessed May 10, 2106 at http://iapche.org/events/iapches-8th-international-conference.

[2] Endangered and disappearing species, erratic and extreme weather events, population growth, shifting climatic zones, mass movement of refugees and migrants, industrial pollutants, hazardous waste, pesticides in agriculture, disruption of ecological systems, mining waste, loss of forests, loss of bio-diversity, new tropical diseases, and more. These are linked with social justice issues like population growth, continuing poverty, health challenges, and economic challenges like economic growth and injustice.

[3] Cited in article by Andrea Germanos, "UN Assessment: Global Destruction of Mother Earth on Fast Track," Common Dreams, Friday, May 20, 2016, accessed May 21, 2016, at http://www.commondreams.org/news/2016/05/20/un-assessment-global-destruction-mother-earth-fast-track. [related -- Achim Steiner, United Nations Under-Secretary-General and Executive Director, United Nations Environment Programme, from UNEP 2016. GEO-6 Regional Assessment for Asia