Proceedings of the Abraham Kuyper Consultation

February 2, 2002

Responsible Praxis in the Ecological Economy:

Contributions of Science and Theology.

Calvin B. DeWitt

University of Wisconsin-Madison

and Au Sable Institute

This paper was originally delivered at the

First Abraham Kuyper Consultation,

"Common Grace: Theology, Ecology, and Technology,"

at Princeton Theological Seminary

on February 2, 2002.

This version represents an edited form of the original paper.

Abraham Kuyper Center for Public Theology
Princeton Theological Seminary Libraries
P.O. Box 111
Princeton, NJ 08542-0111
(609) 497-3642
Email: kuyper.conference@ptsem.edu

Responsible Praxis in the Ecological Economy: Contributions of Science and Theology.

Calvin B. DeWitt
University of Wisconsin-Madison
and Au Sable Institute

A century ago, the work and teaching of Abraham Kuyper opened and exemplified a way to develop and take seriously a life system that embraced theology, science, art, and politics. Kuyper's life showed that this embrace could join "profound theological learning, great statesmanship and extraordinary intellectual acumen" with "childlike simplicity of faith, mystical insight and sweetness of soul."[i] His was a "Reformed world-and-life view" developed as a "fellowship of being near to God"—a fellowship of a "warmhearted Christian" made vibrant and alive by a full and vigorous life, "the passion that breathes" in every aspect of living.

As one raised and educated within this world-and-life view, I have aspired to engage theology, science, art, and politics as a "warmhearted Christian" with a passion for life, inspired in particular by God's work in Creation.[ii] In this chapter I write to show how this passion brings one to take seriously the fields of science and theology. And more particularly, I write to show how these contribute individually and interactively toward understanding the character and inspiring qualities of Creation, the privilege and responsibility we have of conducting our lives and our technology within the ecological order of Creation, and the gifts and capacities we have been given than enable us to address the unwanted consequences that arise from our relationships within Creation.

From science—our exploration and scientific understanding of the universe—we have come to know Earth and its enveloping *biosphere* as a solar-powered dynamic life-support system. Earth is a system whose marvelous economy sustains a fabric of living things that, interactively with its physical environment, maintains the gaseous composition of the atmosphere, transfers and transforms energy in support of all its biophysical processes, maintains flows and cyclings of materials across submicroscopic and macroscopic scales, and regulates global temperatures within a narrow *biokinetic zone* that is conducive to life. This scientific knowledge is produced from the investigative work of a highly disciplined research community that, inspired by the early example of Robert Boyle and others, has developed and maintains a system of investigation and refereed publication that assures that its scientific investigators have no reason to misrepresent how matters stand in nature.[iii] This knowledge is sought by scientists who seek to understand how the biosphere and biophysical systems of the planet work, how human beings operate within and contribute to the biospheric and biophysical systems and processes of which they are part, and how human actions within these systems can operate sustainably within the context of these biospheric and biophysical systems and processes.

From theology—our exploration of religious experience and religious understanding of God and God's relation to the world[iv]—we have come to know the physical Earth and its habitable *oikomene* as a life-support system that expresses God's love for the world. All Creation—the whole Universe, and planet Earth with its enveloping *oikomene*—are created by God according

to God's word and God's Torah by which all things (*ta panta*) are ordered rightly and held together with integrity. God's love for the world is expressed in a universal economy that provides for all things, in a life-economy that provides for every living creature. God's love for Earth's life-economy—Earth's *oikomene*—is bestowed as bountiful and inexpressible care that breathes in the air, shines in the light, streams from hills to plains, that distills and condenses as dew and rain. This theological knowledge is produced in the context of prayer, religious practice, and religious experience, disciplined by a theological community dedicated to seeking God's truth. In Christian theology, production of theological knowledge is inspired by the Holy Spirit and is conformed to Christ as the incarnate Truth. This knowledge is gained from sifting and winnowing for God's truth, free from vested interests, so that theologians have no reason to misrepresent God and God's creation.[v] This knowledge is sought by theologians who seek to understand God in relation to God's world, the proper relationship of human beings to God and God's world, and how human beings can seek God's will and live and act rightly on Earth.

This paper draws both of these contributions of science and of theology to describe the economy of Earth and the biosphere and to provide a scientific/theological framework for responsible praxis within this economy. Its focus in on Earth's *biosphere*, Earth's *oikomene*—the dynamic and vibrant fabric of life that envelops the planet—and the premise that the biosphere and everything it contains belongs to God.[vi] Moreover, in recognition of the prominent Dutch theologian whose name is honored by this series of inaugural lectures, this paper pays particular regard to Abraham Kuyper, founder of the Free University of Amsterdam, whose life and work was established in 1880 to be "free from the control of the state and the restraints of the church." Kuyper and his co-founders "envisioned a university in the service of the society from which it sprang, characterized by a spirit of academic freedom and a commitment to the Bible as the word of God."[vii] Accordingly, this paper views science and theology in this same spirit, free from control of the state and other vested interests, free from the restraints of the church, and in service to human society as *public science* and *public theology* that bring good news to the whole creation and to every creature.[viii]

Abraham Kuyper on Science and Christology. In his fourth Stone Lecture, delivered at Princeton University in 1898, " Kuyper emphasized that Reformed theology[ix] "fostered *love for science*" and "restored to science *its domain*."[x] Observing that the "cosmical science" that originated in the Graeco-Roman world vanished in the middle ages as the church focused on heaven, he made the point that Reformed Christianity rehabilitated the cosmic sciences. And, emphasizing that he does not over-rate the classical world, he claimed that "Aristotle knew more of the cosmos than all the church-fathers taken together; that under the dominion of Islam, better cosmic science flourished than in the cathedral- and monastic-schools of Europe..." He maintained that Reformed Christianity by its doctrine of *common grace* and its principal that "constantly urges us to go back from the Cross to Creation," opened anew to science the entire cosmos, "now illumined by the Sun of Righteousness..." Christendom, on account of "its love of things eternal," he wrote, "has neglected to give due attention to the world of God's creation. And this one-sided, inharmonious conception in the course of time has led more than one sect to a mystic worshiping of Christ alone, to the exclusion of God the Father Almighty, *Maker of heaven and earth.*" In this one-sided conception, Christ was conceived exclusively as the Savior, and His *cosmological* significance was lost out of sight."

By contrast, a harmonious and full conception embraces the significance of God's creation and the cosmological significance of Jesus Christ as affirmed by John who writes in his gospel that Christ is the "eternal Word, by Whom all things are made, and who is the life of men" and by the apostle Paul, who testifies that 'all things were created by Christ and consist by Him'. And

further (in Kuyper's words), "that the object of the work of redemption is not limited to the salvation of individual sinners, but extends itself to the redemption *of the world,* and to the organic reunion of all things in heaven and on earth under Christ as their original head. Christ himself does not speak only of the regeneration of the earth, but also of a regeneration of the cosmos (Matt. 19:28)." And so Kuyper points to Romans 8 where "Paul declares: 'The whole creation groaneth waiting for the bursting forth of the glory of the children of God.'"[xi]

Kuyper affirms the importance of the Creation and of its exploration by science by reminding us of scriptural testimony that "the final outcome of the future... is not the merely spiritual existence of saved souls, but *the restoration of the entire cosmos,* when God will be all in all under the renewed heaven on the renewed earth." While recognizing that "our salvation is of substantial weight" he asserts that "it cannot be compared with the much greater weight of the glory of our God, Who has revealed His majesty in His wondrous creation. This creation is His handiwork, and being marred by sin, the way was opened, it is true for a still more glorious revelation in its restoration, yet restoration is and ever will be the salvation of that which was first created, the theodicy of the original handiwork of our God." And, affirming science, Kuyper notes that Reformed Theology "puts an end once and for all to contempt for the world, neglect of temporal and under-valuation of cosmical things. Cosmical life has regained its worth not at the expense of things eternal, but by virtue of its capacity as God's handiwork and as a revelation of God's attributes."[xii] Science is restored to its proper domain."[xiii]

Contributions of Science

What then are the contributions of science to understanding the character of creation and human capacities for addressing related environmental issues that confront us?

1. Earth is a Dynamic Life-Support System. Among the contributions science has made to understanding the character of Creation is an understanding of planetary and biospheric structure, dynamics, and processes as well as the richness of the interactive and dynamic organizational character that is maintained through complex exchanges of matter, energy, and information. As for the specific dynamic lineages called *species* we have identified these in numbers that are orders of magnitude greater than were known at the time of the book of Genesis, and species new to science are still being identified daily. As for the interactions among these lineages in space and through time we know next to nothing due in large part to their sheer number which is estimated at this time to be somewhere between 5 and 50 million. As for life-sustaining material cycles, fluxes, and flows we believe we have described most of these in their broad outlines and we know them to occur throughout the biosphere from the deepest sea to high in the atmosphere and from the equator to the poles. As for cycles, we have found them to be sustaining life at every level of organization, from the Krebs cycle at the cellular level to life cycles of each of the biotic lineages at the organismic and population level, to the global-thermohaline ocean conveyor belt[xiv], to the hydrologic cycle at the planetary level. As for flows, we have found them operating across a spectrum that ranges from the electron transport system in cellular metabolism to the continuing flow of energy to Earth from our star, the Sun. We have described life-sustaining fluxes that range from submicroscopic ones of ions involved in nerve cells that are vital to nerve impulses within the information transmission and processing systems of organisms to planetary fluxes at surface and atmosphere of the earth that keep Earth's temperatures within the biokinetic zone. And we have gained insight into regulatory systems that range from those that regulate gene expression in the genome to those

that maintain the atmosphere at 21 per cent oxygen.

2. Human Beings are Part of, not Apart from, this Life-Support System. The scientific description of planetary and biospherical structure and processes of Earth have removed what few doubts we might have had about the inherent embeddedness of human beings in biospheric systems. More than providing concrete verification of human imbeddedness in these systems and our dependence on their fluxes and flows, science is making another major contribution toward understanding human capacity to manage the planet. For more than a century we have made working models of ecosystems and their fluxes and flows by attempting to create self-sustaining microcosms. Early on this took the form of "balanced" aquaria for which we attempted to provide light as the only outside input. In recent decades this has taken the form of space capsules and orbiting space laboratories. Most recently it was in the form of Biosphere 2, the self-contained 1.27 hectare glass house that became operational in 1991 and since 1994 has been operated by Columbia University. Far from giving us the confidence that we could manage planet Earth, these models taught and are teaching us that our planet, throughout the course of history has been providing and has been sustaining life on the planet through a highly integrated system of energy flows, material cycles, and dynamic lines and networks of living systems all of which work together to maintain the biosphere. We now know that as it is beyond our capacity to manage these microcosms and mesocosms it also is beyond our capacity to manage our planet. The best we can do is to work with it, bringing human actions in accord with its operations. Even the minor tests of our capacity to control a single species, such as extirpation of the killer bee in the new world and and rabbits in Australia have met with failure.

3. Every Creature Promotes what is Immediately Useful

The highly respected biologist, Theodosius Dobzhansky, prominent for his research on the genetics and population biology of the fruit fly across the continent in the 20th Century, concluded that "selection promotes what is immediately useful, even if the change may be fatal in the long run."[xv] This conclusion is widely accepted and has been most recently been supported and addressed by the distinguished Harvard biologist, Agassiz professor of zoology emeritus Ernst Mayr, now in his nineties, in his recent book, *This Is Biology*. He applies this principle to children, who without ethical guidance and education, indulge in their own immediate self-interest. Mayr writes, "We have just passed through a period in which exaggerated importance was placed on the so-called freedom of the child, allowing it to develop its own goodness.... Why? Because, one may be told, brainwashing a child is an interference with its personal freedom, or moralizing is not entertaining and therefore will not sell." And having come to the same conclusion as Dobzhansky through decades of research, that every creature promotes what is immediately useful, he gives his readers the "seemingly old-fashioned advice to dedicate a "half an hour of ethical education a day in elementary school." Our children need to be taught ethics; it is not part of their genes.

4. Human Beings Tend also to Promote what is Immediately Useful

Extending what Mayr sees as a major issue for children to the rest of the human population, Wisconsin's biochemist and leading bioethicist, Van Rensselaer Potter identified this problem in human beings as "evolution's fatal flaw."[xvi] Defining this fatal flaw "as the biological predilection for short-term gain" and noting that it is built into our very selves, he sees it as the primary basis for the problems of the future as these are identified by anthropologist Elwyn Simons:

> The extreme novelty of humans as the dominant force on this planet is as surprising as is our current rate of destruction of our own habitat and that of the earth's other life forms. This disregard is all the more striking since, in geological

> terms, our species has only recently departed from its "place in nature." ...In its very success, our species has raised grave problems that demand new kinds of solutions. Will we, by better understanding the processes that made us what we are, grow in capacity to solve the frightening problems of the future arising from our very selves?[xvii]

In response to recognizing this problem with our species, Van Potter advocates a "global bioethics" in order "to further the development of a morality that will attempt to respond to the concerns of Simons and others. However, he believes that we neither have the understanding of the world that is needed nor the moral or religious stature that is required. Potter seriously doubts whether existing institutions or individuals in general have an adequate notion of what is true about the structure and processes of the biosphere and a real knowledge of the place of human beings within it. He calls for "moral responses based on continually developing the best possible understanding of the world and humankind's place in it."[xviii]

Beyond the problem Mayr identifies for children for whom we already can identify a core of ethical principles they should be taught, is that the problem with the kind of ethics we need in our time is that we have not yet identified them in ways that can be taught across human society. Not to be teaching ethics is one problem, but a greater one is that for global bioethics we have not formulated what needs to be taught. And, of course, what needs to be taught will include principles that necessarily will be contrary to immediate self-interest.

5. Human Actions Pose Serious Threat to the Biospheric Life-Support System

In recent decades—thanks to our growing ability to observe the face of the earth across the planet by ground observations and aerial imagery, to measure and interpret what we find by visual and instrumental analysis, to store and process the information we gain, and to assemble and analyze ancient texts, historical documents, research journals and data in searchable databases—we have been able to describe and evaluate many of the consequences of human action on earth. And these include those actions that threaten, degrade, and destroy creatures and processes. Among the many things we have learned and know from science are that human beings have desertified the fertile lands of the Tigris and Euphrates Rivers, generated large-scale starvation through mono-culture of potatoes in Ireland, produced air degradation and associated large-scale lethal lung disorders across London in the early days of industrialization, extinguished the Passenger Pigeon, transformed Indiana's Calumet River into an industrial drain, produced millions of deaths to lung cancer through cigarette smoke, transformed benign creatures into devastating pests, degraded the flood buffering capacity of the Mississippi River, destroyed Hiroshima and Nagasaki, Japan with atomic bombs, and destroyed the rice production capacity of the Mekong Delta with herbicides. Some of these degrading actions of human beings are done deliberately, others not. Some are consequences of our not caring for the contexts of our enterprise and still others are consequences of intentional ignorance, of innocence, and of what we believed to be military necessities.

The broad categories of these actions include alteration of energy between Earth and the Sun, land degradation, deforestation, species extinctions, environmental toxification, water degradation, and human and cultural degradation.

6. Science Seeks to Provide the Knowledge of Biospheric Processes

Science, and in particular that part of it that increasingly is being called Environmental Science,

works to understand how the biosphere and biophysical systems of the planet work. Environmental science focuses on environmental problems and issues such as those that became widely known following publication of *Silent Spring* by Rachel Carson in 1962.[xix] G. Tyler Miller, Jr., a chemist at St. Andrews Presbyterian College has been a principal definer of the content of this area of science through 9 successive editions of his *Environmental Science: Working with the Earth*, 12 successive editions of *Living In The Environment: Principles, Connections, and Solutions*, and 5 successive editions of *Sustaining the Earth*. From this and numerous textbooks by other authors, we have come to recognize clearly that this area is largely defined by environmental problems and issues.

Environmental science also is an area of science that is strongly related to values and ethics.[xx] Investigation of the contents of environmental science textbooks finds that nearly every part has an underlying ethical relationship. This is reflected in topics such as planetary energy exchange and climate, renewable and nonrenewable resources, soil formation and erosion, biotic species diversity and extinction, forest processes and deforestation, water balance and desertification, water use and seawater intrusion, and atmospheric circulations and pollution. Miller's 8th edition of *Principles of Environmental Science*, is illustrative. A non-exhaustive investigation of its first four chapters, for example, readily discloses a minimum of eight major ethical relationships, one of which has at least six components and another of which has at least 15 components (Table 1).

7. Science Instills Awe and Wonder and Provides a Basis for Right Living

The understanding of planetary and biospheric structure, dynamics, and processes that comes from environmental science and appreciation of the richness of the interactive and dynamic organizational character of the Earth, maintained through complex exchanges of matter, energy, and information, instills awe and wonder for the world that inspires people to seek to live rightly on the Earth. This awe, wonder, and appreciation for the Earth leads people to seek the means to live in accord with it. Environmental science provides a knowledge base for people to work to live ethically, in accord with principles and practices that will achieve and spread right living. The ethics presented in Table 1 are examples of what substantial knowledge of the Earth and biosphere can contribute toward living responsibly in the context of Earth's *oikomene*.

Philosopher Mary Midgely notes that respect for the biosphere can produce "the reverent scientist." For the scientist as a person there is a faith, she observes, that acts not merely on self-interest or future rewards. Instead it involves emotions of "awe, veneration, a sense of vastness and mystery" and

> much of the appeal to self-interest is of the more indirect kind which offers prestige by association with this cosmic vastness. Reverence for the thing studied is perhaps even a necessary part of the scientific spirit, one with a strong tendency to generate parallels with religion. Today this is a rather surprising matter, and there are certainly plenty of scientists who dislike this kind of suggestion and would declare war on the whole notion of revering anything. Others insist that, merely because our relation to the universe is that of tiny part to whole, our study of it cannot but be a reverent one.

Midgley adds further reflections by geneticist Theodosius Dobzhansky in 1967:

> Man's conscience, the existence of life, and indeed of the universe itself, all are parts of the mysterium tremendum .... there is no more succinct, and at the same time accurate, statement of the distinctive quality of human nature than that of

Dostoevsky; "man needs the unfathomable and the infinite just as much as he does the small planet which he inhabits."... in every known human society... peoples have arrived at some system of religious views concerning the meaning and the proper conduct of their lives .... religion enables human beings to make peace with themselves and with the formidable and mysterious universe into which they are flung by some power greater than themselves.

Table 1. Stated or Implicit Ethics in the First 4 Chapters of Miller's Environmental Science, 8th ed.

1. ENVIRONMENTAL PROBLEMS, THEIR CAUSES, AND SUSTAINABILITY
- Our global society ought to be on a sustainable course.

2. ECONOMICS, POLITICS, ETHICS, AND SUSTAINABILITY
- We ought to use economics to improve environmental quality
- We ought to reduce poverty
- We ought to convert to Earth-sustaining economies

3. SCIENCE, SYSTEMS, MATTER, AND ENERGY
- We ought to shift from an economy based on maximizing throughput to low-throughput
- We ought to learn from the natural world on how we can live sustainably on the earth, including
  - Reusing and recycling most non-renewable matter resources
  - Using potentially renewable resources no faster than they are replenished
  - Using matter and energy resources efficiently
  - Reducing unnecessary consumption
  - Emphasizing pollution prevention and waste reduction
  - Controlling population growth

4. ECOSYSTEMS AND HOW THEY WORK: CONNECTIONS IN NATURE (including Figure 1-2)
- We ought to respect ecosystems and how they work, including:
  - Using renewable solar energy as their energy source
  - Recycling the nutrients its organisms need for survival, growth, and reproduction
- We ought to respect ecosystem services including:
  - Climate control
  - Recycling vital chemicals (carbon, oxygen, nitrogen, water, phosphorus, sulfur)
  - Renewable energy resources (sun, wind, flowing water, geothermal heat, plant matter, biomass, hydrogen
  - Nonrenewable energy resources (oil, coal, natural gas)
  - Nonrenewable mineral resources (copper, aluminum, iron, uranium)
  - Potentially renewable matter resources (forests, grasslands, wildlife, soil, water, food)
  - Biodiversity
    - Genetic diversity (for adaptation to changing conditions)
    - Species diversity (the variety of species in different habitats on the earth)
    - Ecological diversity (the variety of biotic communities that interact with each other and abiotic environments)
  - Natural pest and disease control
  - Waste removal and detoxification
  - Soil formation and renewal
  - Water resources and purification
  - Air resources and purification

And she observes that Dobzhansky "is the kind of scientist who emphasizes the inevitable slightness of the whole scientific achievement and its absurd disproportion to the vastness of what there is to be known."[xxi]

Literary scholar C. Wayne Booth helps us deal with the awe and wonder that develops within scientists and others who delve deeply into the workings of the biosphere and work to understand its overwhelmingly great diversity of interrelated creatures, by proving us with a fresh and vibrant definition of religion.

> "Religion is the passion, or the desire, both to live right—not just to live but to live *right*—and to *spread* right living, both desires *conceived as responses* to some sort of cosmic demand—that is, to a demand made to us by the *way things are,* by the way the world is, by the nature of Nature (as some would say) or by God himself (as explicitly religious people put it)."[xxii]

By affirming the inescapable situation of human beings within the biosphere rather than over and above it, by incorporating the human causes of environmental issues and problems into its cognitive core, by describing the necessity of right living that is respectful and supportive of the dynamic processes that sustain the biosphere, and by describing the necessity for spreading right living by human beings throughout the biosphere, environmental science helps people individually and corporately to shape a life system directed at choosing and shaping their actions in the world to live sustainably with the rest of the creation of which they are part. Environmental science therefore readily elicits the development of the broader interdisciplinary field of environmental studies with which it helps shape and affect the institutions that inform human endeavor in all of its many forms. The areas of environmental science and environmental studies join with ecology to help bring an ecological world-and-life view to individuals, households, religions, governments, professions, industries, and business.

Contributions of Theology

What are the contributions of science to understanding the character of creation and human capacities for addressing related environmental issues that confront us? "[xxiii]

1. The World is God's Creation and Reflects Divine Order and Integrity

As a concept, the idea of *Creation* is long-standing. Stemming from earliest written texts, it is a concept that puts human beings into their place, *in* Creation among the other creatures. It does not allow people to conceive of themselves as apart from the world. It does not allow us to see ourselves separate from Creation. It does not permit a division between human beings and "the environment." And as for the question we oftentimes hear in our day, "What is more important? People or the environment?" it disallows it, for is meaningless. This currently popular question misinterprets people and the world; it misunderstands Creation; it "misses the mark."

In the earliest biblical texts this unity of people in Creation is powerfully presented. And because these have come down to the present day as basic texts for Judaism, Christianity and Islam the concept of *Creation* is very much a part of these major world religions and also of contemporary society. In the Pentateuch (for Judaism, Christianity and Islam) and the Hebrew

Bible (for Judaism and Christianity) there is no capacity for making reference to "the Creation" as some kind of "thing" since no Hebrew noun apparently existed for this concept. While God's action of creating is referenced by the verb for *create* (*bereshith*) as in Genesis 1:1, the corresponding noun is absent throughout the Hebrew Bible (Old Testament). In the biblical view of the biophysical world there is nothing else, and thus there also no need to give it a label. Even in the subsequent Christian canon, the New Testament, extremely limited use is made of the Greek noun for Creation. It is used for example in Romans 8 where we read that the whole Creation (*ktisis*) groans; but its use is so limited in its reference to the whole of God's created works[xxiv] that it also gives force to an integral concept of human beings that embraces human beings. In the biblical worldview, therefore (Pentateuch, Hebrew Bible, and New Testament) there is no setting apart of *Homo sapiens* from Creation; human beings are creatures.

There is a psalm put to music in the Psalter Hymnal that accords the Creator all glory, strength, and dominion throughout all Creation, "And through all Creation, His wonderful temple, All things He has fashioned His glory declare." In the biblical view, God's temple is all Creation which also is the theater of God's glory. Human worth-ship, human worship, is public and all of Creation is God's temple. It is therefor a public temple, a published temple, a grand publication. Public worship is a reflected, mirrored response that publishes in lives and landscapes.

And as for worship, so with theology. The Belgic Confession reminds us by what means God is made known to us:

> We know him by two means:
> First, by the Creation, preservation, and government of the universe;
> which is before our eyes
> as a most elegant book,
> wherein all creatures,
> great and small,
> are as so many characters
> leading us to see clearly
> the invisible things of God,
> even his everlasting power
> and divinity,
> as the apostle Paul says (Romans 1:20).
>
> All which things are sufficient to convince men
> and leave them without excuse.
>
> Second, He makes Himself
> more clearly and fully known to us
> by his Holy and divine Word,
> that is to say, as far as is necessary for us
> to know in this life,
> to His glory
> and our salvation.

2. Human beings are a part, and not apart from, God's creation.
The biblical view of people is that they are part and parcel of creation, integral beings who live and move and have their being through the gift of God's grace supplied through the gifts of God's creation—nourished within God's gift of the ecological order of which they are part. And

yet, human beings also are blessed with the divine image that gives them the capacity to image God's love for the world with their own. Human beings, made in the image of God, are created with the full capacity of mirroring God's love for the world's ecological order. As imagers of God they also "tend the garden" and participate with their Creator in caring for the created world. John Calvin, whose theology is the focus of Kuyper's Stone Lectures, describes this tending based upon Genesis 2:15, the literal reading of which is "And Jehovah God taketh the man and causeth him to rest in the garden of Eden, to serve it and to keep it."[xxv] Commenting on this passage in 1554, John Calvin wrote:

> The custody of the garden was given in charge to Adam, to show that we possess the things which God has committed to our hands, on the condition, that being content with the frugal and moderate use of them, we should take care of what shall remain. Let him who possesses a field, so partake of its yearly fruits, that he may not suffer the ground to be injured by his negligence; but let him endeavour to hand it down to posterity as he received it, or even better cultivated. Let him so feed on its fruits, that he neither dissipates it by luxury, nor permits [it] to be marred or ruined by neglect. Moreover, that this economy, and this diligence, with respect to those good things which God has given us to enjoy, may flourish among us; let everyone regard himself as the steward of God in all things which he possesses. Then he will neither conduct himself dissolutely, nor corrupt by abuse those things which God requires to be preserved.

By the phrase "this economy" Calvin is referring to:

1. Our contentment with the frugal and moderate use of the things God has committed to our hands.
2. Our care for what we do not ourselves use.
3. Our taking of the fruits of a field without letting the ground suffer through our negligence.
4. Our handing down our land to posterity as good or better cultivated than we received it.
5. Our feeding on its fruits in a manner that neither dissipates it by luxury nor permits it to be marred or ruined by neglect.

By the term "custody[xxvi]" Calvin interprets dominion to mean a responsible care and keeping that does not neglect, injure, abuse, degrade, dissipate, corrupt, mar, or ruin the earth.[xxvii] God's economy, "God's plan or system for government of the world,"[xxviii] is always the context and framework within which the human economy works.[xxix] The human place and role in creation, therefore is integral to creation's economy, integral to creation's ecological order. The biblical idea of economy, expressed in Genesis 2:15, involves human beings serving and keeping Creation, not oppressing it through domination. The role of human beings involves working out their economy within God's economy for creation, serving and keeping the garden, cultivating society as part of God's creation, seeking and preserving truth,[xxx] building civilized societies, and and praying not only in words but also in deeds "Thy will be done on earth."[xxxi] Calvin's commentary on Genesis 2:15 makes it clear that the question is not whether there should be a human economy, but rather which of the two economies—the human economy, or God's economy—should be a subset of the other.

Deeply rooted in biblical theology, and committed to his belief that the whole world should be affected by the transforming power of the Gospel Abraham Kuyper helped many to understand the place and role of human beings in creation. The world is our proper place and we are to do our part, with full energy and vigor, to repair and renew this world which we have upset and broken. It is our privilege to image and to honor God in caring for his world, polishing it to new

luster.[xxxii] In his world-and-life view, both human beings and the ecological order are to be greatly respected; every human being is honored "for the sake of his likeness to the Divine image" and the ecological order is honored “as a Divine Creation." Affirming the world he wrote, "Henceforth the curse should no longer rest upon the world itself, but upon that which is sinful in it, and instead of monastic flight from the world the duty is now emphasized of serving in the world, in every position in life."[xxxiii]

3. God’s Son creates all things; God’s Spirit sustains all things with the breath of life
God’s Son, the Logos, creates all things and holds all things together,[xxxiv] and God’s Spirit sustains the ecological order of the biosphere by infusing every creature with the breath of life and empowering human beings to live to the glory of God. And on the human level, the incarnate Son adopts our human nature and the Spirit enters people, inspiring them to glorify God.[xxxv] This is confessed in the Nicene Creed, where Jesus Christ is identified as the one “by whom all things were made” and the Holy Spirit is identified as “the Lord and Giver of Life.”[xxxvi]

4. God enables people to temper self interest and seek integrity of creation
We know from our observations of the world through history that the human economy does not always fit in with creation’s economy. Degradation of earth and society is an unfortunate part of human history, however. This is detailed in Genesis 1 through 11, is addressed through the cleansing by the biblical flood (Genesis 6-9) and culminates with the coming of Jesus Christ who “makes all things new” (Gr. kainos).[xxxvii] God’s love for the world brings the flood. God’s love for the world sends Jesus Christ into the world. God’s love for the world is not for the degradation that people have brought to the world, but for the world as God intended and intends it to be. In commenting on the love passage of John 3:16, Kuyper writes:

> "God so loved the world, that he gave it his only-begotten Son." ... God loves *the world*. Of course not in its sinful strivings and unholy thrashings-about... But God ves the world for the sake of its origin; because God has thought it out; because God has created it; because God has *maintained* it and *maintains* it to this day. We have not made the world, and thus in our sin we have not maltreated an art product of our own. No, that world was the contrivance, the work and the creation *of the Lord our God.* It was and is his world, which belonged to him, which he had created for His glory, and for which we with that world were by Him appointed. It did not belong to us, but to him. It was his. And *his* divine world we have spoiled and corrupted.
>
> And in this is rooted God’s love, that He will repair and renew this world, his own creation, his own work of wisdom, his own work of art, which we have upset and broken, and polish it again to new lustre. And it *shall* come to this. God's plan does not miscarry, and with divine certainty he carries out the counsel of his thoughts. Once that world in a new earth and a new heaven shall stand before God in full glory.
>
> But the children of human beings meanwhile can fall out of that world. If they will not cease to corrupt his world, God can declare them unworthy of having any longer part in that world...
>
> And therefore whoever would be saved with that world, as God loves it, let him accept the Son, whom God has given to that world, in order to save the world.[xxxviii]

5. Yet, People are Prone to Promote Religiously what is Contrary to Creation's Integrity

Even with this tempering capacity, however, people often do what they put their mind to do, often yielding to the inherent drive to promote what is immediately useful at the expense of creation and Earth's life-support system and defending what they do religiously.

As science helps us understand the human place and role in creation, so does theology. From the study of ourselves in the present and through history, we know that we have within us the capabilities both for living in accord with the laws and ordinances that govern human society and that govern the natural world. Kuyper's theme of "common grace" in his life and work is developed by him to explain the good we see accomplished by people in the world. Every human being is enabled to appreciate the ecological order of things and to live in accord not only with human law but also within creation's ecological order. This, according to Kuyper, is the gift that God gives to all humankind.

We also know however, from the study of ourselves in the present and the past that we human beings have the capacities, and even the inclination, to work against these laws and ordinances both in society and in creation. We find ourselves sometimes bringing about conditions that even degrade and threaten the integrity of the biosphere upon which we and other life depends. This might be done out of ignorance, arrogance, or greed, as we all know too well. At the time of this writing for example, the energy corporation Enron and their accounting firm, Arthur Andersen, are capturing the news for the arrogance and greed that is so vividly apparent in their collapse and bankruptcy. Greed is the term we apply to our (1) seeking first our own gain; (2) adapting our belief systems to our own self-interest; (3) and cultivating a mind-set that emphasizes winning over against cooperating. There is for all of us not only the gift of "common grace" but also the apparently inherent drive to out-compete our competitors in what at times has been described, ecologically speaking, as a "struggle for existence."
This drive is shared widely with other creatures, but coupled with our human capacities for planning and buying goods and service well into the future beyond "our daily bread" this drive must be constrained by our ethics. We find from looking at ourselves, that our "natural tendencies" to supercede God and our neighbor need to be constrained to the ultimate benefit of ourselves and human society.

Land ethicist and scientist, Aldo Leopold writes that, "An ethic, ecologically, is a limitation on freedom of action in the struggle for existence."[xxxix] In stating this, in the context of his famous essay, "The Land Ethic," Leopold is extending the ethical constraints that operate on the personal level to biotic communities and ecosystems. At the personal level as well as at the ecosystem level, he would say that an ethic is a limitation on human freedom of action in the struggle for existence. With an ethical limitation, for example as given by the biblical Ten Commandments, what we might call "Darwinian behavior" is constrained. Without it, however, we often observe the emergence of oppression of the weak by the strong, declaration of one race or individual human being as superior to others, and arrogation of the people by the powerful. In this scriptures the prevalence of this behavior is affirmed, as in Psalm 37, with the assurance that ultimately the meek shall inherit the earth.[xl]

6. God Blesses Those Who Seek Wisdom and Knowledge to Apply it

A major contribution of theology to understanding the human place and role in creation is its identification of the human problem of embracing a too restricted view of themselves spatially

and temporally. The problem with people that gets the human race into trouble in creation is that the world is likely to have spatial borders that tend to stop at the boundaries of one's self that connect only to the world as we can see it from self, and that the world has temporal borders that confine the self largely to the present with only faint realization of a generation or so prior and after our being here. Theology, and particularly biblical theology, counters this spatial and temporal implosiveness of the self and directs it outward to consider the cosmos and eternity. While this counterforce of self-implosion does run the risk of developing an other-worldliness it nonetheless puts us as individuals and society in grand spatial and temporal context. By so doing, it also helps us address the problem of our responding only to the here and now as we live and work in the world. What this contributes to our well-being and also the well-being of creation is that we are enabled to go beyond what is immediately present and useful to embrace the wider creation and many generations of life on earth, even enabling us to consider the universe and eternity. This world-and-life view, informed by theology, can be enabled within society toward sustaining flourishing life on earth for our species and for all of creation. And, to assure that the needs of immediate place and space do not overwhelm us we can establish colleges, universities, and seminaries whose professors, in their prophetic role as describers of the present, past and future, as heralds of creatures great (such as the biosphere) and small (such as sulfur bacteria), keep us and our society from destroying the earth.[xli]

God blesses human beings who humbly seek wisdom and knowledge and who apply these to with love to inform human actions in society and in the wider creation (cf. 2Chronicles 1:10-12; Proverbs 2:3), and do not hurt or destroy (Isaiah 11:9), warning those who do otherwise (including confusing knowledge) and those who are perverted by cunning and cleverness to arrogance (Isaiah 47:10) that they will perish (Hosea 4:6 - perish for lack of). Rev. Clifford Bajema, a contemporary pastor in the Reformed tradition, put it this way in a recent sermon:

> "Stewardship of God's creation and charity with creation's goods is more important to the meek than a controlling and selfish ownership. The meek are often those actually dispossessed, who, for reasons of faith prefer the role of serf over the fight for turf. The meek do not separate capital gain from capital gift. Profits and losses are not their ultimate concern because they know by Christ's promises that God has prepared a new earth and a holy city, called the New Jerusalem, to come down out of heaven and be their home with Him.
>
> Think for a moment of Christ's sensible logic in linking meekness with inheritance of the earth. Since the quality of meekness is restrained power, channeled energy and disciplined effort, this must mean that care of the creation, conservation of natural resources, and discipline in the earth's development are likely sisters of meekness. And that is why the meek will inherit the earth!
>
> Yes, it is a good thing the meek will inherit the earth, for they will hug, indiscriminately, forests and pandas and wetlands and unborn children and senile septuagenarians! They will love the least of these! Without the meek in control in the kingdom of the heavens, the new creation would not be very safe. It would not be very new either – just the same old power-controlled earth, still lamenting its travail, waiting for the meek children of God to be revealed.[xlii]

7. Theology Seeks to Inspire People to Image God's Love for the World as Earth-Keepers
As an all-embracing science, theology seeks to join scientific knowledge of the Earth and its

biosphere with knowledge of ourselves under the eye of our Creator to inspire and to bring human beings to live rightly on Earth, not as lords, but imaging the Lord's love for the world, becoming conformed to the image of God's son.

The context of this "biospheric" or "ecumenical" economics is the Sermon on the Mount (Matthew 5-7) in which "one is free to leave one's best interest in God's hands and to respond to others out of love rather than self-interest."[xliii] The answer of agroecologist Wes Jackson to a question by essayist Wendell Berry illustrates this inspiration. Asked about what kind of economy would be comprehensive enough to prevent the ruination of farmland, Wes replied, "The Kingdom of God." This inspiration went well beyond the bounds of Christendom to affect Mahatma Ghandi. In an talk to the Economic Society at Allahabad University, India in 1916 he told his audience he had read the most basic book on economics: the New Testament, and then paraphrased Matthew 6:33, "Let us seek first the Kingdom of God and His righteousness and the irrevocable promise is that everything will be added to us." Saying that "These are real economics" he told his audience, "May you and I treasure them and enforce them in our daily lives."[xliv] This theological and biblical teaching not only affected India but has affected people across the world as a major ethical teaching that tempers self-interest and promotion of what is immediately useful toward the furtherance of integrity in the longer run.

The teaching of Matthew 5-7 is summed up in many respects by the word and concept of *stewardship*—caring for something on behalf of its owner. Since in the biblical view, the *ge* (Earth) is the Lord's and everything in it, the *oikomene* (biosphere) and all the creatures that live in it, stewardship of creation is done in behalf of its Maker. Stewardship, in theological and biblical perspective is *oikonomia*, the responsible living and working of human beings within God's *oikomene*.[xlv]

Summary of the Contributions of Science and Theology

For each of the two sections above on the contributions of science and on the contributions of theology, a series of summarizing statements were written, each identified either as a theological contribution [T] or a scientific contribution [S]. These statements in turn have been put together, in interdigitated form, as a series of seven conclusions, as follows:

● 1. Earth was created, is sustained, and is loved by God as a dynamic highly-ordered and inherently-consistent life support system. Earth's *oikomene* and everything it contains, including the tens of millions of interdependent species that live within it, belongs to its Creator. [T] This *oikomene* is the biosphere is a solar-powered life-support system that sustains a fabric of living things that, interactively with the physical world, maintains the gaseous composition of the atmosphere, transforms and transfers energy, maintain flows and cyclings of materials, and maintains global temperatures within the biokinetic zone [S]. The *oikomene*, with its ecological ordering of all things, provides the breath of life for all creatures, provides a myriad of life-sustaining services, and produces and sustains the lineages of the creatures [S]. Among these creatures are human beings, made by God as part of Creation, with the same biological dynamics as other creatures, yet with the capacity to know the creation and its ecological

order and to mirror God's love for the world in their life and work [T].

● 2. Human beings are within, and not apart from, this life support system [S,T]. Every breath we take reminds us of this fact, and holding our breath reminds us even more [S]. Human beings and and other creatures all are empowered by the Sun, the star that energizes Earth [S]. God breathed into Earth's creatures the breath of life by the life-giving Spirit and holds all things together by the Son, the Logos by whom God made all things (*ta panta*) [T].

● 3. From the beginning, every creature on earth has promoted what is immediately useful, even if fatal to that creature in the longer run. [S] This has brought both extinction and persistence, and is a means whereby living things adapt to a dynamic environment through the ages and through this also maintain a sustainable biosphere. [S]. God's Son, the Logos, creates all things (*ta panta*) and holds all things (*ta panta*) together, and God's Spirit sustains the ecological order of the biosphere by infusing every creature with the breath of life and empowering human beings to live to the glory of God, with joy [T].

● 4. As with other creatures, human beings tend also to promote what is immediately useful, even if fatal in the longer run, and even when gifted with the capacity to know their actions and the consequences of their actions in the past, present, and future [S]. Yet, God enables people to temper the drive inherent in every creature to promote what is immediately useful by providing human capacity to comprehend the creation order, to discover God's divinity and everlasting power, to envision eternity and to seek integrity of creation into the future [T]. God enables human beings to seek first the kingdom of God, over and above self-interest [T].

● 5. Even with this tempering capacity, however, people often do what they put their mind to do, often yielding to the inherent drive to promote what is immediately useful at the expense of creation and Earth's life-support system and defending what they do religiously [T]. Human actions in the world pose serious threats to this life-support system locally, regionally, and globally [S]. The broad categories of these actions include alteration of energy between Earth and the Sun, land degradation, deforestation, species extinctions, environmental toxification,

● 6. God blesses human beings who seek wisdom and knowledge and who lovingly apply these to guide human actions in society and the wider creation, warning those who confuse or destructively misuse knowledge by cunning and cleverness that they will perish [T]. Science provides the knowledge base necessary to inform and promote actions in personal, governmental, corporate, business, industrial, and technological work and life that are in full concord with maintaining the biophysical complexity and order of the biosphere and its life-sustaining processes [S]. God and God's love for the world is the reason people have for caring for Creation.

● 7. Science works to provide the knowledge base for understanding the Earth and its biosphere as a wonderful complex of millions of species mutually shaping themselves and their biophysical world, and seeks to do this with sufficient detail of the complexities and beauty of the Earth human beings gain the humility, awe, and wonder that protects us from thinking we have made and control this marvelous Earth, and directs people not to lordship above the biosphere but citizenship within it [S] Theology works to join scientific knowledge of the Earth and its biosphere with knowledge of ourselves under the eye of our Creator to inspire and to bring human beings to live rightly on Earth, not as lords, but imaging the Lord's love for the world, becoming conformed to the image of God's son [T].

Utilization of these Integrated Summary Statements. The summarizing statements on the contributions of science and theology have been written to describe in brief the economy of Earth and the biosphere and to provide a scientific/theological framework for responsible praxis within this economy. Before proceeding with their application it is helpful to reflect on how the summarized statements from science and theology are complements of each other, in the sense that *complement* means "to make whole, to fulfill, to complete" and that *to complement* means "to make complete or perfect, to supply what is wanting."[xlvi] Taken together, these summarizing statements can contribute toward doing what is necessary for human beings, individually and corporately, to live rightly on Earth and to work within the sustaining operations of Earth's *oikomene*.

How then can we come to apply the contributions of science and theology, and their complementarity, to practical use? To address this question it is necessary I believe to (1) first put these into the context of ourselves and our society, and (2) second to present some concrete examples of these contributions being put into practice.

The Context of these Contributions

● First, we must know where we are; we must know ourselves; we must know how we are going about our business. While there are good signs here and there that we "have it together," we confront the serious problem of dualism between human beings and "the environment." It is captured by Thomas Gladwin and his colleagues in a paper from the a special topic forum on ecologically sustainable organizations in *The Academy of Management Review.* In their abstract they write:

> Modern management theory is constricted by a fractured epistemology, which separates humanity from nature and truth from morality. Reintegration is necessary if organizational science is to support ecologically and socially sustainable development.

They make the case for an approach to management “as if sustainability, extended community, and our Academy mattered.”[xlvii]

● Second, we must gain sufficient knowledge of the highly complex transfer, cycling, and homeostatic processes of the biosphere that maintain its tens of millions of species under an atmosphere of regulated gaseous composition in a fabric of multifaceted system-sustaining interactions that we will recognize that for all of our impacts and influences, human beings do not run the Earth and the biosphere, neither are human beings capable of doing so.

● Third, we must gain sufficient knowledge of ourselves as organisms totally dependent upon Earth’s *oikomene* within which we see the need and the good sense, not to control the Earth, but to control ourselves, and then proceed to put our knowledge and understanding into practice.

● Fourth, in controlling ourselves, we must learn to temper our predilection for doing what is immediately useful, seeking first sustained biospheric integrity or as many religious people would put it, the Kingdom of God, through ethical education of our children, ourselves, and our society on the things that matter most in the wider world and in the long run.

● Fifth , we must exemplify in our approach and actions that our putting of this knowledge into practice is an activity of the greatest humility while also being an activity of the greatest responsibility to ourselves, to other creatures, to the biosphere, and to the Creator and Sustainer of Earth and God’s *oikomene*.

In summary: Human praxis in technology and society is praxis in greatest humility and greatest responsibility. As such, it must relate to people and the biosphere in a manner of humble physicians who understand that they themselves do not heal but help establish the conditions for healing. It must relate to people and the biosphere in ways similar to humble public health scientists seek to identify disease at its very start and move preventively to averting catastrophe. It must relate to people and the biosphere in ways that humble nutritionists so take care of living beings and communities that the seeds of disease are never planted. It must relate to people and the biosphere in ways that humble scientists find and make known the poisonous and toxic nature of materials we are about to put into soil, water, and air to the detriment of us, other creatures, and biospheric processes.

Three Examples

Where and how are we doing such work as this? The answer is, In many places and in many ways. And while none of these is not yet adequate, they are hopeful. Three examples are given here: the Presbyterian Church (USA), the Town of Dunn in the State of Wisconsin, and Au Sable Institute.

Presbyterian Church (USA). This large denomination is among many who have adopted major statements and goals for their denominations on environmental stewardship and earthkeeping, based upon research of biblical and theological material coupled with assessment of the environmental problems faced by society. Many denominations have a special office or a division for church and society that oversees the implementation of these statements and goals in their congregations. The statement adopted by the General Assembly of the Presbyterian Church (USA) in 1990 is illustrative. This declaration (1) recognizes and accepts restoring creation as a central concern of the church, to be incorporated into its life and mission at every level; (2) understands this to be a new focus for initiative in mission program and a concern with major implications for infusion into theological work, evangelism, education, justice and peacemaking, worship and liturgy, public witness, global mission , and congregational service and action at the local community level; (3) recognizes that restoring creation is not a short-term concern to be handled in a few years, but a continuing task to which the nation and the world must give attention and commitment, and which has profound implications for the life, work, and witness of Christian people and church agencies; (4) approaches the task with covenant seriousness——"If you obey the commandments of the Lord your God . . . then you shall live" (Deut. 30:16)——and with practical awareness that cherishing God's creation enhances the ability of the church to achieve its other goals.[xlviii] This and most other denominational statements are readily accessible on the internet using a web search.

Town of Dunn, State of Wisconsin. A land stewardship plan was adopted by this Wisconsin town of 34.5 square miles by its citizens in the late 1970s, following a process that involved a comprehensive inventory of natural and cultural resources and numerous rounds of debates and discussions by the townspeople. This plan not only provides for a population of 5400 people but also maintains a system of wetlands that include a number of marshes and a tamarack bog, all of which have been protected along with their wildlife, and an array of agricultural lands that are being kept in production. This town, the Town of Dunn, is featured on the U. S. Department of Energy web site as an example of ecological and social sustainability. It uses a combination of policies and tools that have been widely adopted with what ultimately has become nearly unanimous support of its citizens. These policies and tools address the problems identified by the scientific and theological sections in this paper include a

purchase of development rights (PDR) program in which landowners who wish to receive the financial benefits of land development are paid the difference between agricultural use value and development value, paid by the town from a fund generated by a modest increase in the property tax rate. This increase in tax rate actually has kept the total taxes down, since farms generally receive much less in public services than the taxes they pay in contrast to housing developments which receive more than paid in taxes. Extensive information is available on the internet by entering "Town of Dunn" in a web search engine.

Au Sable Institute of Environmental Studies. This institute, transformed from a Christian youth camp in 1979, was developed to serve Christian colleges and universities across North America, which in 2002 number 56 participating institutions. Designed to supplement academic offerings by a student's home college, Au Sable Institute gives a wide array of courses and grants certificates whose credits apply to each student's college degree. Given in the Great Lakes Forest of northern Michigan and on Whidbey Island in Washington State's Puget Sound, with sites also located in East Africa and South Indian, the Au Sable program is focused on environmental stewardship and earthkeeping with each course with deep roots both in theology and in science. A wide array of environments are utilized for teaching and learning that span from the tropics to boreal forests, marine to montane, rural to urban, and professors are drawn widely from Christian faculty members in the United States, Canada, Africa, and India. A central feature is a weekly "integrative session" in which all courses, faculty and students work on a common environmental issue or problem in the field, with work being done across the disciplines represented by the faculty and integrated with biblical teachings on environmental stewardship. Participating colleges agree to cross-list some or all of the Au Sable courses in their college catalogs and bulletins and also commit themselves to promotion of caring for creation on their campuses. A comprehensive web site at www.ausable.org provides details on how this institute is addressing the findings of this paper in science and theology, and is helping people put what they learn and know into practice.

Business, Industry, and the Next Industrial Revolution

We now turn to how what we learn from the contributions of Science and Theology, individually and interactively—together with the three concrete examples above—that can be productively applied to business and industry.

First, there is very clear movement by many businesses and industries to adopt in whole or in part "green practices" in their operations. Searching the internet shows wide activity in this area as many business and industrial leaders seek to

use our growing understanding of creation and environmental problems to do good work. The concept of "good work" recently featured in the book, *Good Work: When Excellence and Ethics Meet*[xlix] has joined with Green Business, introduced to many by Paul Hawkin to provide a base for discussion, reflection and action by business and industry. Named one of the 12 best entrepreneurs of the 1980s, Hawkin and producer and host of a public television series shown on 210 stations nationwide and in 115 countries, is an inspiration for many business and industry leaders. Of his writings, *The Ecology of Commerce* is particularly influential. In a guest essay in Miller's textbook (see above), he writes,

> In our pursuit of dominance over the natural world, we have not taken into account the basic principle that industrialism, for all its sophistication, is enormously inefficient with respect to resources, energy, and waste. ...The next stage, whatever it may be called, is being brought about by powerful and much-delayed feedback of information from high levels of inefficiency and waste. As that happens, the foundation of industrialism is giving way while the basis for the next industrial revolution is being established.
>
> This shift is profoundly biological. It's not about the celebration of nature, although that is certainly part of it; it's about the incorporation of cyclical natural systems into our industrial life, our way of making things, and our way of processing things and deprocessing things. The reason this shift is going to happen is because cyclical industrial systems work better than linear ones. They close the loop and reincorporate wastes as part of the production cycle... There are no landfills in a cyclical society.

Science and ecological research has as a major task the comprehension of energy and material balances that range from the bacterial culture dish to aquatic and terrestrial ecosystems to the biosphere. For every biogeochemical cycle, whether that be for carbon, nitrogen, phosphorus, oxygen, or sulfur, there are complex budgets of matter and energy. And given the material isolation of our planet from the other material of the universe we know that everything must "add up." If it were a matter tracking of dollars and cents that would be enough of a challenge. And if it were a matter of tracking the chemical elements such as carbon, nitrogen, phosphorus, oxygen and sulfur, that would be a much greater challenge. However budgets in the planet and its biosphere include transformations of one kind of molecule to another meaning that some substances disappear as others appear with all the elements adding up, but not the molecules that are constructed from these elements. And there are tens of millions of species engaged in these transformations in a myriad of ways that add

to various abiotic transformations. Biospheric economics is overwhelmingly complex and is largely out of reach of human understanding. It is because of this wonderful complexity, already a glimmer in the mind of Carl Linnaeus (Carolus von Linné) that this Swedish systematist could write already in 1791,

> By the Oeconomy of Nature we understand the all_wise disposition of the Creator in relation to natural things, by which they are fitted to produce general ends, and reciprocal uses. All things contained in the compass of the universe declare, as it were, with one accord the infinite wisdom of the Creator."

Theologians of Linnaeus' time, not having the word "ecology," made the word *oikonomia* interchangeable with God's "dispensations," so that by the seventeenth century, "oeconomy" was frequently employed to refer to the divine government of the natural world.

> "God's economy was His extraordinary talent for matching means with ends, for so managing the cosmos that each constituent part performed its work with stunning efficiency."[l]

The concept of God's economy here, as we look at the contributions both of science and theology, is particularly relevant to our purposes. This concept does not put God outside of the economy, neither does it put the economy outside of God's work. It gives the Maker of heaven and earth immense respect for "having thought it ought" (to use Kuyper's words) and yet invites us to behold and to study *oikomene* and the economy of the biosphere. As the complexity and "stunning efficiency" of this economy is humbling for the biosphere economists, so too should it be for monetary economists. It should be so, because as the next industrial revolution is getting under way, and proceeds with incorporation of cyclical natural systems into industrial life—because cyclical industrial systems work better than linear ones—we come face to face with God's economy for creation. And as we do so, our accounting principles will come face to face with ecological accounting principles as ecologists are beginning to understand these for the biosphere. And here we will have the confrontation between two economic systems: one that has been successful over millennia, is clearly successful in the present, and will be successful far into the future and our modern economic system with no provision for operating on the time scale of a century and more. Paul Hawken sums up the problem of this confrontation.

> As it stands, our economic system is based on accounting principles that would bankrupt a company. Not surprisingly, it is posing problems for the world as a whole. When natural capital is placed

> on the balance sheet, not as a free resource of infinite supply but as an integral and valuable part of the production process, everything changes. The near obsessive pursuit of improvement in human productivity becomes balanced by the need for improved resource productivity. Using more and more resources to make fewer people more productive flies in the face of what we now need to improve our society and the environment. After all, it is people we have more of, not natural resources, so it is people we must use to reduce the flow of matter and energy resource through economies. And that is what can happen when we move from linear extractive systems to cyclical ones.

In the first of his Stone Lectures, delivered at Princeton in 1898, Abraham Kuyper addresses such a life system that embraces the whole of individuals and society. With particular reference to Calvinism (which is the focus of his lectures) he defines religion as a life system. As a life system religion is concerned not only with religious ritual but with all of life. So considered it permeates and integrates every aspect of human reflection, contemplation, and action. As a life incorporates every aspect of life and living, being the permeator and integrator of art, politics, science, technology, and business. It is all-embracing; it is a life system. The relation of religion as a life system to the Creation order is indicated in the definition given in the first section of this paper, by C. Wayne Booth.

A wide-spread respect for the ecological and creation order is translated into responsive human action that includes very well-defined kinds and qualities of manipulation, technology, and ritual. Respect for the ecological and creation order promotes actions that sustain life and discourages actions that threaten life.

When respect for the Creation order is continually and consistently incorporated into individual and corporate behavior it becomes integrated within the life system of individuals and human society. Right living on earth is a consistent and continuous response to what C. Wayne Booth calls the cosmic demand.

It is in this context of understanding of religion as a life system and a passion and desire to live right and spread right living in response to the way things are and function in the Creation order —in response to the creatures present in Creation, to the cycles, flows, and fluxes in Creation, and to the regulatory systems in Creation— that we can order our own lives. Can humanity help achieve in Creation what is “normal?” we may ask. And the answer to this question has to do with engaging in human actions that work in accord with the processes that sustain the biosphere and its habitability. And how should we seek to do this? By understanding the systems of which we are part with such depth that we will

recognize, for example, that responding to unwanted herbivory of crops and garden plants is better accomplished by achieving conditions that do not transform relatively innocuous insects into pests, rather than eliminating these herbivores with insecticides.[li] This means that prevention of the growth of "thorns and thistles" can be achieved by eliminating the conditions that lead to their invasion and dominance. Pest creation, while currently a result of human actions on the land, does not have to be the consequence of human actions.

Our great problem, it appears is the problem of the human species to which Genesis 1-11 is addressed. Not satisfied with the fruit of the garden, Adam decides to make things "bigger than life" by "doing things his way" and the result is a lot of sweat! Giving over to the regulatory systems of the planet, much like giving over to our body temperature regulation control of our body temperature, will mean less exercise of power on our parts, but also will mean the achievement of greater freedom.

The human problem is expressed in our sometime willingness to utilize our power for grand-scale destruction of our foes. From observations of ourselves, particularly of the potential for destruction using nuclear power, it becomes clear that we have the capacity to destroy the earth, at least as we know it and as it supports us and the rest of life. And the scriptures tell us that we have the capacity to destroy the earth, at least if we take seriously the proclamation of Revelation 11:18: "The time has come to... destroy those who destroy the earth."

But with our destructive capacity comes another capacity not to destroy the world. Human beings have the capacity to do their work in accord with the way the Creation works, in harmony with the ecological and creation order, and as Abraham Kuyper puts it: to image and to honor God in our caring for God's Creation, polishing it to new luster.[lii]

So what must we do? We must not ban body temperature regulation or blood sugar regulation in our bodies, or do the equivalent for Earth's biosphere. Instead, we must be going about setting the conditions for healing. We must not overestimate the power of the strong, but believe that the meek will inherit the earth. And we must not get so caught up in making things "bigger and better" only to find our selves so much in control that we lose our freedom.
It seems then, that the wise approach toward living in the world is to strive to live rightly, to serve, protect and preserve the processes of earth that are earth-sustaining and life-sustaining, to set the conditions for giving over to the earth control of processes we have tried to claim for ourselves and to develop an economy of action in the world that fosters freedom within the constraints of maintaining the processes of earth that sustains the life of the biosphere,

including our own.

Religion nurtures the capacity of people, not to master the world, but to master themselves, responding appropriately to the cosmic demand. And when we master ourselves in this way, we will again discover joy.[liii]

Endnotes

[i] From the Biographical Note in Abraham Kuyper's *Lectures on Calvinism*, first delivered at Princeton University in 1898 under the auspices of the L. P. Stone Foundation, and printed by Wm. B. Eerdmans Publishing Company, 1953, p. vi.

[ii] Described for example in my *Earth-Wise: A Biblical Response to Environmental Issues*, Grand Rapids, Mich.: CRC Publications, pp. 7-24.

[iii] Stephen Shapen. 1994. *A Social History of Truth: Civility and Science in Seventeenth-Century England*. Chicago and London: University of Chicago Press, p. 180. Also note that for our day, journal editors may require a statement by the author of vested interest, as in the journal *Nature*.

[iv] This definition reflects *Merriam-Webster's Collegiate Dictionary*, Tenth Edition (1993), s.v. "religion," given as "the study of religious faith, practice, and experience; *especially* **:** the study of God and of God's relation to the world."

[v] Stephen Shapen. 1994. *A Social History of Truth: Civility and Science in Seventeenth-Century England*. Chicago and London: University of Chicago Press, p. 180.

[vi] I use the word *biosphere* here as the equivalent of the biblical Greek word, *oikomene*. For Psalm 24:1 in the Old Testament we read that the *eretz* is the Lord's and the fullness there of, the *tebel* and all that dwell therein. The Septuagint translates these Hebrew words into Greek as *ge* and *oikomene*. The New Testament uses the same Greek words, *ge and oikomene*.

[vii] From their web site (http://www.vu.nl/english/algemeen/zelfbeeldeng.html): "The Vrije Universiteit was set up in 1880 to pursue academic excellence as "a sovereign organization within its own circle". From the very first, the university''s founders, who included Abraham Kuyper, had the intention of establishing a fully fledged university but one which was free from the control of the state and the restraints of the church. They envisioned a university in the service of the society from which it sprang, characterized by a spirit of academic freedom and a commitment to the Bible as the word of God."

[viii] It was also Kuyper's core conviction that the world belongs to God. His statement on this, delivered in his Stone Lectures Princeton, was that "...not only the *church*, but also the *world* belongs to God and in both has to be investigated the masterpiece of the supreme Architect and Artificer." Stone Lectures, p. 125.

[ix] Kuyper consistently uses the term "Calvinism" for which I often substitute "Reformed Christianity" in this paper.

[x] Abraham Kuyper. [1898] 1953. *Lectures on Calvinism: Six Lectures Delivered at Princeton University Under the Auspices of the L. P. Stone Foundation*. [Stone Lectures.] Grand Rapids: Eerdmans, p. 117.

[xi] Stone Lectures, p. 119.

[xii] Stone Lectures, pp. 117-120.

[xiii] This also is affirmed by Herman Bavinck in the third of his Stone Lectures delivered at Princeton University on Revelation and Nature in 1908-1909: "It is often represented as if only the special science of theology concerned itself with God and divine things, and as if all the

other sciences, particularly the natural sciences, have nothing whatever to do with God; nay, as if they would even forfeit their scientific character and become disloyal to their task, should they refer to him or take account of him. A chasm is thus created, objectively, in the sphere of reality...." *The Philosophy of Revelation*. London: Longmans, Green & Co., 1909., p. 83; reprinted Grand Rapids: Eerdmans, 1953.

[xiv]14. Wallace S. Broecker, 1991. "The great ocean conveyor," *Oceanography* **4**:79-89.

[xv]15.Theodosius Dobzhhansky,1958. Evolution at work. Science Vol. 127 1958):1091-1098, p. 1098.

[xvi]16. Van Rensselaer Potter, 1990. Getting to the year 3000: can global bioethics overcome evolution's fatal flaw? Perspectives in Biology and Medicine 34(1):89-98.

[xvii]17. Elwyn L. Simons. 1989. Human origins. *Science* 245:1343-1350, p 1349.

[xviii]18. Potter, pp. 89-90, and personal communication, May 2001. Also see George E. P. Box, 1993. Changing management policy to improve quality and productivity. Report No. 108, 4pp. Center for Quality and Productivity Improvement, University of Wisconsin, p. 3.

[xix] Rachel Carson. [1962] 1994. Boston: Houghton-Mifflin.

[xx] Here is something like I usually say at the beginning of my course: People, if you open your textbook for this course in Environmental Science and check out the headings of each section, you will find that nearly every one has an underlying ethical concern. This is not your usual textbook in natural science. Its author has little interest in having you know the characteristics of endangered species or about the various ways to quantify the rising levels of pollutants in a stream. On the contrary, its author is ethically concerned with the loss of biodiversity and the toxification of the world. The author is asking you the question, "Is it right that we diminish the variety of species on earth? Is it right that we poison the environments of ourselves and other creatures?" You know his personal answer clearly from the way he writes. His answer is "no!" The subject matter of courses in environmental science is ethically-derived. Nearly every topic is undergirded with an unstated ethic. And taken together these constitute an ethics that is widely held by practicing environmental scientists. What is this ethics? It is that human beings should live on earth in ways that respect the way the world is, that people should not adversely alter the systems and workings of the world that sustain us and all the other creatures. It is an ethics not expressly articulated and yet an ethics that operates as some kind of cosmic demand—a demand that we live rightly on earth, a demand that we do what is right for the earth and everything in it, for the biosphere and all that it contains.

[xxi] Mary Midgley. 1987. Evolution as a Religion: A Comparison of Prophecies. Zygon: Journal of Science and Religion 22(2): 179-194.

[xxii] This is Booth's restatement of Ernest Hocking: "If, to agree on a name we were to characterize the deepest impulse in us as a 'will to live,' religion also could be called a will to live, but with an accent on solicitude—an ambition to do one's living well. Or, more adequately, *religion is a passion for righteousness, and for the spread of righteousness, conceived as a cosmic demand."* W. C. Booth, "Systematic Wonder: The Rhetoric of Secular Religions." *Journal of the American Academy of Religion* 53(1984):677-702.

[xxiii] Stone Lectures, 125

[xxiv]24. In the KJV and NAS *ktisis* is used but 16 times and of these it refers to the whole of creation in no more than 5 places (Mark 10:16; Mark 13:19; Romans 8:19,20,21,22; 2 Peter 3:4; and Revelation 3:14).

[xxv]. *Young's Literal Translation of the Holy Bible: A Revised Edition*, (Grand Rapids: Baker Book House, 1953).

[xxvi]. "Custody" is from the Latin *custodia*, meaning "guarding, keeping" according to Webster's Unabridged Dictionary (*Webster's Third New International Dictionary of the English Language Unabridged*, Springfield, Mass.: Merriam_Webster, 1981), 559.

[xxvii]. This teaching is strongly reinforced by Revelation 11:18, "The time has come for destroying those who... destroy the earth."

[xxviii]28. This definition, interestingly, is the first definition of "economy" in *Webster's*, 720.

[xxix] This material is taken from my Kuyper Lecture delivered at Fuller Theological Seminary, Pasadena, Calif., Oct. 1 - Nov. 1, 1996 and published in Calvin B. DeWitt. 1998. *Caring for Creation: Responsible Stewardship of God's Handiwork*, Grand Rapids: Baker Books, p. 31-32.

[xxx]. See for example, Steven Shapin, *A Social History of Truth: Civility and Science in Seventeenth_Century England*. (Chicago: Univ. of Chicago Press), xv. _ xxiii., 126_192, 409_417.

[xxxi]. See Richard Mouw, *Uncommon Decency: Christian Civility in an Uncivil World* (Downers Grove, Ill.: InterVarsity Press, 1992)

[xxxii]32. See Kuyper's "So God Loved the World!" Chapter 7 in *Keep Thy Solemn Feasts: Meditations by Abraham Kuyper*. Grand Rapids, Wm. B. Eerdmans Publishing Company, pp. 70_71.

[xxxiii]. Stone Lectures, 30.

[xxxiv] Colossians 1:15-20.

[xxxv] Abraham Kuyper puts it this way: First, God has so created human nature that without the Holy Spirit it can not have any virtue or holiness. Adam's original, righteousness was the work and fruit of the Holy Spirit as truly as the new life in the regenerate is to-day. The shining-in of the Holy Spirit is as essential to holiness as the shining of light into the eye is essential to seeing. Second, the work of the Son according to the distinction of three divine Persons is other than the work of the Holy Spirit with reference to the human nature. The Holy Spirit could not become flesh; this the Son alone could do. The Father has not delivered all things to the Holy Spirit. The Holy Spirit works from the Son but the Son depends upon the Holy Spirit for the application of redemption to individuals. The Son adopts our nature, thus relating Himself with the whole race; but the Holy Spirit alone can so enter into individual souls as to glorify the Son in the children of God. Applying these two principles to the Person of Christ, w e see that His human nature could not dispense with the constant inshining of the Holy Spirit. For which reason Scripture declares: "He gave Him the Spirit without measure." Nor could the Son according to His own nature take the place of the Holy Spirit; but in the divine economy, by virtue of His union with the human nature ever depended upon the Holy Spirit." Abraham Kuyper [1900] 1946. The Work of the Holy Spirit. Translated from the Dutch by Henri De Vries. Grand Rapids: Eerdmans. Volume 1,102-103.

[xxxvi] The Nicene Creed is available in Philip Schaff, ed. 1931. *The Creeds of Christendom*. Grand Rapids: Baker.

[xxxvii] 2 Corinthians 5;17 and Revelation 21:5.

[xxxviii] Translation from the Dutch: "*Alzoo* lief heeft God de wereld gehad, dat Hij haar zijn eeniggeboren Zoon gegeven heeft."... God heeft *de wereld* lief. Natuurlijk niet in haar zondig steven en onheilig woelen. Als zoodanig is vijand Gods al wie een vriend der wereld genaamd wordt. Maar om haar oorspong; omdat God ze uitgedacht; omdat God ze geschapen heeft; omdat God ze in stand *hield* en *houdt* tot op dezen dag. Niet *wij* hebben de wereld gemaakt, en alzoo in onze zonde ons eigen kunstproduct mishandeld. Neen die wereld was het uitdenksel, het gewrocht en de schepping *van den Heere onzen God.* Het was en is zijn wereld, die Hem toebehoorde, die Hij geschapen had tot zijn glorie, en waarvoor wij met die wereld door Hem

waren bestemd. Niet ons hoorde ze toe, maar Hem. Ze was zijns. En *zijn* goddelijke wereld hebben wij verdorven en verstoord. En hierin wortelt nu de liefde Gods, dat Hij deze wereld, zijn eigen schepping, zijn eigen wijsheidsgewrocht, zijn eigen kunstuk, dat wij verstoord en gebroken hebben, herstellen en vernieuwen wil, en weer polijsten tot nieuwen glans. En dat *zal* er toe komen. Gods bestel mislukt niet, en Hij voert met goddelijke zekerheid uit den raad zijner gedachten. Eens *zal* die wereld in een nieuwe aarde en een nieuwen hemel volheerlijk voor God staan. Maar de kinderen der menschen kunnen inmiddels uit die wereld uitraken. God kan ze, zoo ze niet ophouden willen, zijn wereldd te verderven, onwaardig verklaren, om langer aan die wereld deel te hebben... En daarom wie met die wereld, gelijk God ze lifheeft, wil behouden worden, die grijpe den Zoon aan, dien god aan die wereld gegeven heeft, om die wereld te behouden. From Abraham Kuyper, 1903. "Alzoo lief heeft God de wereld gehad!" Chapter 7. In: "Vier Uwe Vierdagen (Nahum I:15). Meditatiën van Dr. A. Kuijper. Amsterdam: Höveker & Wormser, pp. 56-57, based upon a translation by John Hendrik deVries from the Dutch and published in 1928 in the book, *Keep Thy Solemn Feasts: Meditations by Abraham Kuyper*. Wm B. Eerdmans Publishing Company, Grand Rapids, Michigan, pp. 70-71.

[xxxix] Aldo Leopold. The Land Ethic. In: Aldo Leopold. 1949. *A Sand County Almanac and Sketches Here and There*. New York: Oxford University Press, p. 202.

[xl] Psalm 37:11; Matthew 5:5.

[xli] See my discussion of prophets, ancient and modern, in Chapter 3, “Spiritual and religious perspectives of creation and scientific understanding of nature” in Steven R. Kellert and T. J. Farnham, eds., *The Good in Nature and Humanity: Connecting Science, Religion, and Spirituality with the Natural World*, Washington, D.C.: Island Press, 2002, in press.

[xlii] Clifford Bajema, from a sermon entitled, “Blessed are the Meek,” delivered at Geneva Campus Church, Madison Campus Church, January, 2002.

[xliii] Robert A. Guelich. 1993. In: Bruce M. Metzger and Michael D. Coogan, eds. *The Oxford Companion to the Bible.* New York: Oxford University Press, p 689.

[xliv] Mahatma Ghandi, 1916. In the inaugural speech of H. E. Sri Krishna Kant, "Caste, Community, Conversion," at the conference on "Main Streaming the Church for Nation Building," National Council of Churches of India, Hyderabad on 6.7.91. Copy from Job Ebenezer, Director, Environmental Stewardship Office, ELCA, 8765 Higgins Road, Chicago, IL 60631, USA.

[xlv] See endnote 6.

[xlvi] *The Compact Edition of the Oxford English Dictionary*, s.v. “complement.”

[xlvii] Thomas N. Gladwin, James J. Kennelly, and Tara-Shelomith Krause. 1995. Shifting paradigms for sustainable development: implications for management theory and research. *The Academy of Management Review*, Vol. 20, No. 4. (Oct., 1995), pp. 874-907.

[xlviii] Presbyterian Church (USA), Call to Restore the Creation, 202nd General Assembly, 1990.

[xlix] Howard Gardner, Mihaly Csikszentmihalyi, and William Damon. 2001. *Good Work: When Excellence and Ethics Meet*. New York: Basic Books, 289pp.

[l]. Quotes in this paragraph are from Donald Worster, *Nature's Economy: the Roots of Ecology* (San Francisco: Sierra Club Books, 1979).

[li] Uvarov, B. P. 1964. Problems of insect ecology in developing countries. Journal of Applied Ecology 1:159-168. This paper is reprinted in Barbosa, Pedro and T. Michael Peters, eds. 1972. Readings in Entomology. Philadelphia: Saunders. pp. 8-17.

[lii]52. See Kuyper's "So God Loved the World!" Chapter 7 in *Keep Thy Solemn Feasts: Meditations by Abraham Kuyper*. Grand Rapids, Wm. B. Eerdmans Publishing Company, pp.

70_71.

[liii] Lutheran theologian, Joseph Sittler, wrote in this regard that “If the creation, including our fellow creatures, is impiously used apart from a gracious primeval joy in it, the very richness of the creation becomes a judgment. . . . When things are not used in ways determined by joy in the things themselves, this violated potentiality of joy . . . withdraws and leaves us, not perhaps with immediate positive damnations but with something much worse—the wan, ghastly, negative damnations of use without joy, stuff without grace, a busy, fabricating world with the shine gone off.” Sittler also reminds us, "...there is an economics of joy; it moves toward the intelligence of use and the enhancement of joy. That this vision involves a radical new understanding of the clean and fruitful earth is certainly so. But this vision, deeply religious in its genesis, is not so very absurd now that natural damnation is in orbit, and man's befouling of his ancient home has spread his death and dirt among the stars." Joseph Sittler, The Care of the Earth, in Franklin H. Littell (ed.), *Sermons to Intellectuals* (New York: Macmillan, 1963).