Institute for Christian Teaching
Education Department of Seventh-day Adventists

SCIENCE, FAITH AND INTERVENTION INTO THE NATURAL ORDER:
AN INQUIRY INTO THE PRINCIPLE OF HUMAN-EARTH ENGAGEMENT

by

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Prepared for the
"Christ in the Classroom" Series
Institute of Christian Teaching
General Conference of Seventh-day Adventists
October 31, 2000

ABSTRACT

The purpose of this paper was to propose a rationale for human intervention in the natural order that is morally defensible. It seeks also to establish the idea that scientific pursuits are to be at the center of such intervention. The rationale is based upon the Biblical world view which posits that the natural order of earth is not self-existent, as God is believed to be. Not only was the earth incapable of creating itself in the first place, but also it is now neither autonomous nor capable of self-perpetuation. Accordingly, the author submits that although the Creator continues to be preeminent and processes of natural law are central in earth's journey through time and space, the earth was also from its creation to be dependent upon humankind for the unfolding of its destiny. The natural order was designed that humankind should be not only products of nature but also should function as intelligent guardians over nature, capable of entering into constructive engagement *with* it and of exercising dominion *over* it.

Theorists who hold low views of human dignity, together with well-meaning environmental activists, contend that such an interventionist attitude is inherently self-serving and inconsistent with the very idea of a natural order. According to this view, interventionism is, *ipso facto*, a contradiction of that order. It is argued that the trail of environmental abuse and degradation, so extensively documented in our time, is the inevitable consequence of human domination of the earth. Some go further and suggest that earth's ecological system is self-sufficient, and that mankind's natural role is simply to occupy a niche *within*, not *over*, the biotic community. The earth, guided by its own inherent intelligence manifested in natural laws and processes, will then be left untrammeled to work out its own destiny.

That concept of the natural order might be an intriguing one, but one can find little foundation for it within the Biblical world view, Christian tradition, or unambiguous scientific proof. What one finds instead is an injunction to subdue the earth and to exercise dominion over its organic and inorganic forms, its animate and inanimate resources. This injunction embodies the principle of constructive engagement. The mandate as described in Genesis 1 and 2, does not rule out the possibility of abuse being inflicted on this planet. However, at no point does the concept of dominion over the earth even imply that human intervention is, by definition, a corruption of nature. To have dominion is not to assume the liberty to dominate and degrade. To "subdue" and "replenish" the earth is not to plunder its resources, pollute its atmosphere and waters, and distort its flora and fauna. Rather, it is to accept the honor and challenge of entering into partnership with the Creator of nature Himself, whose creative power is continually at work in the natural order throughout the entire cosmos.

The Genesis mandate, then, is positive and expansive in content and tone, not negative or constrictive. It does give some broad clues as to what engagement with the earth might entail, such as to guard and keep the garden, to know earth's creatures by name and nature, to procreate and fill the earth. However, terms such as "subdue" and "dominion over" seem quite open-ended and define no categorical limits. This is so, not because there are to be no limits to human intervention, but rather because the earth was designed to hold inexhaustible or inconceivable possibilities to engage the dimensions and depth of the human mind and spirit. Furthermore, in being formed in the image of the Creator and in being true to the dignity enshrined in that image, humanity was empowered with unimaginable capacities for this magnificent vocation. We need only a brief pause to consider what wonderful things we now know, have created, and are capable of doing compared to what the most progressive minds could hardly have conceived in the year 1000 or even 1900. Undergirding this human task of engagement with the earth are the scientific method and disciplines, which provide the avenues and mechanisms for constructive intervention.

It is reasonable to conclude, then, that to exercise authentic dominion over the earth must include the freedom to understand earth's design, to explore its resources, to pursue deep secrets it conceals, to procreate, co-create, and recreate. That is to say, the essential human vocation was to engage with the vast and profound creation in ways that would protect against the intrusion of destructive forces, restrain any tendency toward natural degradation, preserve earth's essential integrity, and foster the progressive unfolding of its unfathomable potentials in ever new surprises, delights, and wonders. This unfolding of earth's destiny is the context of humanity's self-actualization.

Ultimately, constructive intervention into the natural order means entering into partnership with the Creator whose power and presence is the creative life-line of that order. To assume such a vocation is, for this reason, a sacred moral act -- an act of faith that justifies and inspires science, and that authentic science does not contradict.

INTRODUCTION

Purpose and Thesis. This concept paper has two basic related purposes. First, it seeks to set forth a rationale for human intervention into the natural order as a moral mandate and as a fundamental necessity in the Creator's vision for the earth. Second, it seeks to establish the idea that scientific pursuits are at the center of such intervention and are a sacred vocation, completely compatible with biblical faith.

Though organized according to natural law, the earth was not to be self-perpetuating any more than it was self-existent. As a special unit of creation, continuously sustained by God, earth was designed to hold inconceivable potentials. However, it was a world dependent not only upon the Creator's constant care to achieve its destiny, but also upon humanity and human action. This paper submits that by creating man in His image, the Creator empowered humanity to exercise dominion over the earth as his moral responsibility and privilege. This included the tasks of restraining tendencies to degradation and of fostering the progressive unfolding of the rich potentials that lay dormant and invisible. Otherwise forces of degradation, inherent in the fabric of nature, and/or perhaps destructive forces of evil, extrinsic to the natural order, would hold the earth in bondage to change and decay and thereby deny the unfolding of its fullness and destiny.

Limitations and Structure. Essentially, this essay must be viewed as a conceptual and descriptive exploration rather than an experimental or applied study. Although it makes reference to scientific issues the purpose for doing so is to be illustrative or indicative rather than exhaustive. The intent is to write a coherent essay that is the product of careful reflection and study, but that is not weighed down with many technicalities. The style is to be as non-dogmatic as possible and as philosophical as necessary. An important limitation is that ideas must be made to fit in twenty pages or less.

The essay considers the subject under the following major headings: (1) Background and Context; (2) Some Assumptions and Postulates; (3) Degradation in the Natural Order; (4) The Dominion Principle: Engagement and Constructive Intervention; (5) The Cause not Lost; (6) Conclusion and Application.

BACKGROUND AND CONTEXT

The principle of human intervention in the natural order is best appreciated when viewed against the background of key concepts and attitudes which influence the approach many people to science, faith and human personhood. The following five attitudes and conceptual streams are particularly relevant examples of such influences.

Reactionary Negativism Toward Science. Many people of faith cling to such attitudes regarding science in general and expect or imply that one must choose either faith*or* science. This, of course, is nothing new and both perspectives have managed to coexist for centuries often under extreme tension. However, the breath-taking speed with which scientific achievement is transforming all aspects of modern life poses a serious threat to those who are yet to come to terms with its essential validity. For example, during the last four decades of the 20th century, the achievements in space exploration provided little cause for celebration among many devoted Christians. To some it was presumptuous enough to project man-made satellites into

orbits around the earth, however much this expanded the human capacity to surmount the barriers of time and space. But when incredible scientific and technological resources were harnessed to land men on the moon, many viewed the achievement as building a modern tower of babel in direct opposition to the will of God.

Attempting to cut the umbilical cord that had confined morally flawed humanity to the earth was deemed not only wasteful, but an impossible dream whose fulfillment the Creator would not allow. If it did occur at all, some asserted, it would be a clear sign of imminent judgment. Thus, the finest achievement of modern science in understanding the created universe became an occasion to reinforce the old notion that there might be something intrinsically unworthy or perverse about science itself. Vast undercurrents of this negativism still abound.

The Worship of Science. This is the other side of the coin. Influential scientists who instruct our children on the great questions of the nature of the universe, of human origins and destiny, and who influence both moral and legal conduct, have allowed themselves to become high priest of this type of faith. As observed by biologist Leonard Brand (1997), some prominent scientists state, and large numbers imply, that even if creationism were proved right they would have to deny it in order to remain scientists (p. 55). To them science could never be compatible with creation and, out of loyalty to the scientific establishment, they would hold on to a position known to be at odds with the evidence, rather than abandon it. This appears to be a form of idolatry.

It is surely quite amazing that, as in politics and warfare so even among many involved with science as a culture, the need to win often renders truth stranger than fiction. Is it any wonder that leading dogmas within that culture are often perceived by many outside of it, and not a few within it, as little more than speculative philosophy, devoid of authoritative foundation? This paper views science, not as a god to be worshiped, but as a way of thinking and a human method of operating that enables us to make discoveries about the natural world that are reliable and truthful, and that empowers us to fulfill the role and responsibility toward the earth vouchsafed to us by the Creator Himself.

The "Thingification" of Humankind. Championed by behaviorists such as the late B. F. Skinner (1971). The theory of behaviorism directly confronts humanistic idealism, asserting that there is nothing about human beings to suggest that they have freedom or dignity. Essentially, human beings are things, and a thing can be acted upon and it may have the capacity to react to environmental stimuli, but rationality and volitionality have no part in human personhood. In his book *Beyond Freedom and Dignity*, Skinner sees human beings and all human behaviors as solely the product of their environments and bids "good riddance" to all notions of free will as the distinguishing quality of mankind.

Behaviorism in its various forms flies directly in the face of the Christian view of the nature and capacities of the human person. The theory, supported by narrow interpretation of experimental observations, informs the attitude of many towards the world around them, toward other persons, and toward themselves - engendering possible environmental exploitation and abuse of personhood. The subject of this paper must be clearly distinguished from behaviorism. The "thingification" of persons is diametrically opposed to the idea of the human capacity for responsibility intervention, which is a reflection of the divine image.

The "Humanization" of Things and Processes. As held by classical Darwinian theory of origins and natural selection, intelligence is the ultimate product of non-intelligence, sense of non-sense, and persons and personhood of things and processes. It is largely this presupposition of classical evolutionary philosophy that inform the attitude that nature has its own innate intelligence and is not to be interfered with. Human beings

are both the embodiment and the product of nature and cannot therefore exercise dominion over nature. Any attempt to exercise dominion over nature constitutes a threat to the natural order and leads, inevitably, to the abuse and degradation of the earth and its environment. Man's role is to occupy his particular niche within the ecological system, like toads and crustaceans, and no more - lest his brain lead him to inflict irreversible damage. Obviously, for classical Darwinian evolution, the principle of human intervention cannot apply.

The Natural-Supernatural and Sacred-Secular Dichotomy. Both people of faith and good scientists have tended to think of these two areas of reality in dialectic terms in which there is a great deal of ambiguity and tension. One detects in this echoes of Gnostic thought and Greek dualism. God, it is widely held, dwells and operates in the supernatural - not in the natural. Visible, tangible, audible material phenomena are circumscribed by natural law and therefore essentially secular by nature. The supernatural, on the other hand, being under the supervision of the invisible spiritual powers of God, transcends law, and is sacred. This approach to what is sacred and what is not influences attitudes and behaviors toward the whole of reality, including the natural order. Many theistic scientists are prepared to accept and live by this dichotomy.

This paper, however, emphasizes the view that while the Creator transcends what we call the natural realm, his presence and power operate within that realm, as well as in the supernatural. The Creator is one, and the world of reality is a universe - not a multiverse. To Him all things are natural, "naked and open". To us, limited as we obviously are, many aspects of reality are beyond our present understanding and seem unavailable for our rational analysis; hence we call them supernatural. Consequently, while it is alright to say that many scientists are truly secular-minded, it is not alright to say that science itself is a secular enterprise. Fundamentally it is sacred because, when authentic, it seeks true and accurate understanding of God's universe, thus better enabling man to think God's thoughts after Him. Further, since sacredness may be defined as wherever God's presence is, God can be viewed as our contemporary because His presence was, is, and will be in the natural world no less than in the supernatural.

To summarize these issues, there is a long-standing conceptual iron curtain that separates the two important areas of human experience, faith and science. This impenetrable divide maintains a cold war between groups of people who belong to the same family, organization, discipline and community. Strangely, too, the iron curtain can exist within a single individual, splitting him into two compartments: a compartment of faith and a compartment of science. This paper, at its heart, seeks to contribute to the enormous task of tearing down that iron curtain. It proposes a conceptual model in which authentic scientific pursuits are drawn from the distant edges of man's faith to its very center.

SOME ASSUMPTIONS

In order to uphold arguments in support of the intervention thesis, it is essential that relevant assumptions be clearly stated. These assumptions are informed primarily by the wisdom of Scripture. The following are brief descriptions of five key assumptions.

Assumption about the Bible. The Bible, including the Genesis account of creation, is acknowledged as a truthful account of earth's origin and of the duty and destiny of humanity. That book enunciates foundational theological truths from the cultural perspective of time, place and circumstances in which its authors wrote. While the Bible does not teach a final scientific theory, the cultural accommodation of scripture does not loom so large as to obscure essential and timeless truths.

Assumption about Christianity and Nature. When properly understood, Christianity as taught in Scripture cannot be separated from nature and from history. Bernard Ramm (1954) puts it succinctly when he states that the hope of some to relegate Christianity to "the world of pure religious experience, and science to the world of physical phenomena, may suit some religious systems but not Christianity" (p. 244). Not only does Christianity arise in a universe created by God, but it appears in historical situations under divine providence. This, in fact, is one of the greatest strengths of the Christian faith as it is shown to be integrated into the very fabric of reality, and not just a side show.

Assumption about Jesus Christ and Nature. The position of Jesus Christ in the cosmos, including His relation to the earth, is primary and central. He, the Word, is Creator of heaven and earth and the ultimate reference point for everything having to do with it - whether relative to its past, present, or future (John 1:1-3). If creation was *ex nihilo* it was His fiat that made something out of nothing. If energy was converted into matter, His word was the instrument of conversion. The world of the present is being upheld by Him and in Him (Col. 1:17). The world of the future is also His world when the dwelling of God will be with man (Rev. 21:3).

The nature of Jesus is complex, being fully human, but superior to angels, and divine. Hence his nature as well as His position in the cosmos is sharply contrasted with all created entities. Having experienced the trappings of history and visibly entered the natural order which He Himself established, He has emerged as truly master of that order, of time and space - Lord and God everlasting (Heb. 1:1-10).

Assumption about Faith. Faith is not a non-rational act or experience. Nor is it based upon scientific or absolute proof. To have faith in the religious sense of the word is to acknowledge that, as a finite being, one cannot prove in any empirical sense everything that constitutes reality. There are some "things" we cannot see, or hear, or touch; but faith chooses to believe because there is sufficient evidence that appeals to the reason. Faith therefore is not a leap in the dark but a willing movement toward the light. The Bible's description of faith assures us that as one embarks on such a movement the light becomes brighter and brighter. Faith is not incompatible with science, but it can take us beyond science to a larger conception of reality within which scientific pursuits find true validity and their secure home.

Assumption about Design in Nature. The concept of intelligent design in nature is indispensable in establishing rational human attitude and action toward the natural order. Intelligent design, of course, implies an intelligent designer. Not only is the Bible consistent with this view, but thought leaders in science affirm it. In his remarkable book, *Darwin's Black Box*, biochemist Michael Behe (1966) presents solid scientific evidence and arguments in favor of the theory of intelligent design in nature. Summarizing his arguments, he concludes that

> ...the results of cumulative efforts to investigate the cell - to investigate life at the molecular level - is a loud, clear, piercing cry of 'design'. The result is so unambiguous that it must be ranked as one of the greatest achievement in the history of science... as momentous as the observation that the earth goes around the sun... (pp. 232-233).

This theoretical framework is crucial because any responsible form of intervention in nature must be consistent with the design of nature and must keep in view the plan and purpose of the designer.

DEGRADATION IN NATURE:
EARTH IN BONDAGE TO DECAY

Both Scripture and human experience speak without equivocation to the point that degradation is evident at the warp and woof of the natural order. This is seen in general human dysfunction and death and in environmental degradation and decay.

According to the Genesis record, very early in human history on this planet there was a garden, the Garden of Eden; and there was a world outside that garden. Within the garden life at its fullest and most exuberant abounded. The only hint that death and degradation could ever occur was in the warning to the first couple that not only the quality of their lives, but also the quantity of it would be at risk should they violate their Creator's trust. "You will certainly die"(Gen. 2:17 NEB) was the blunt warning. There was something emphatic and inescapable about that assertion.

The declaration does not say, "I will kill you if...." Hence the Creator cannot be regarded as the executioner. Further, the particular act of failure described does not appear to embody the actual mechanism of dying. There is in fact more than a hint that the morally flawed couple could actually have lived forever. According to Genesis 3:22, 23 God reasoned,

> Therefore the Lord God sent him forth from the garden of Eden... He drove out the man. Behold, the man has become like one of us, knowing good and evil; and now, lest he put forth his hand and take also of the tree of life, and eat, and live forever -

The suggestion here seems clear: the mechanism of dying involved exclusion from engagement with the life-giving properties found only within the confines of the garden. Man's exclusion from Eden was so critical that cherubim with flaming swords were stationed to guard and defend the garden from any attempted intrusion. (verse 24).

Death then was certain only outside, not within, the garden, where conditions were drastically different. Pain associated with child-bearing would greatly multiply, the ground would be cursed, toil and sweat would be humanity's lot just to eat bread, and vegetation would be pervaded with undesirable "thorns and thistles". Eventually man would decompose in the ground from whose constituents he was created in the first place.

Theologian Bernard Ramm (1954) goes a great deal further when in acknowledging that "ideal conditions existed only in the Garden" he declares that outside the garden "there was disease and death and bloodshed in Nature long before man sinned" (p. 233). "To think otherwise" he contends, "is to run counter to an immense avalanche of facts. Part of the blessedness of man was that he was spared all of these things in his Paradise, and part of the judgement of man was that he had to forsake such a Paradise and enter the world as it was outside the Garden..." (p. 233).

The Human Condition: A Prototypical Model of Degradation. Many disagree with Ramm on this question of death occurring before man's fall. Believing that the issue is not even debatable , they would affirm the position held by Christians for two thousand years that the relation between sin and death is one of cause and effect. However arguable that question may or may not be, the Genesis account seems clear on this point: the actual experience of human degradation and mortality is associated, not with conditions within the Garden but with conditions in the wide world outside of it. Into this drastically new environment the first couple had been expelled and confined. Paradise was lost, and the new environment was not going to be a perfect rose garden. It is clear, too, that all the generations issuing from the first couple would be born and

raised in those very conditions. The typical outcome for mankind everywhere on the earth and throughout the long trajectory of human history has proved to be predictably and consistently the same -- change and decay.

The model shown in Appendix A is an attempt to visualize the general mechanism of this universal human condition. It proposes seven progressive crises in the pathogenesis and natural history of that condition, namely, crises of (1) Meaning and Purpose; (2) Belonging; (3) Valuing; (4) Relating; (5) Adequacy; (6) Clinical Morbidity; (7) Clinical Mortality. This history of human degradation is, in effect, the uncreating of human beings, one by one, society by society, civilization by civilization.

The following outline briefly explains the model indicating an interplay between what the first couple could have experienced, their legacy through time, and what we think we now know about the fundamental need deficits and stresses of humanity. Note that the seven crises are subsumed under three broad stages in the mechanism of human degradation.

A. Primary Mechanism: "Disease"

1. Generated subjectively and volitionally, involving fundamental moral actions.

2. May occur in the most pristine environment - a garden, a home, a community.

3. Here are experienced the four basic crises: meaning and purpose, belonging, valuing, relating. On this primary level there is fundamental disorientation of the spirit, a free-floating "dis-ease" and lack of trustful security. Practical features of these crises include alienation and estrangement, anxiety and fear, self-disesteem and unstable identity -- the sense of being stranger to one's true or best self and the desperate search for it. The prototype of this was seen in the first couple as they hid from their Creator, became conscious of a certain vulnerability (they knew they were naked) and blamed
others and God for their feeling of shame.

B. Secondary Mechanism: Human Inadequacy

1. New conditions, induced environmentally, involve circumstances fraught with stressors and pitfalls which threaten safety and security.

2. These threats from without, together with the states of free-floating crises from within, test the limits of human capacity and resiliency and produce another crisis — human inadequacy. This includes inadequate knowledge, inadequate experience, inadequate stamina, inadequate skills, and inadequate resources.

3. Such real and perceived threats constantly evoke the General Adaptation Syndrome as recognized and elaborated by Hans Selye — *alarm, resistance,* and *exhaustion*. This mechanism appears to take heavy toll on both the quality and the quantity of human life.

C. Tertiary Mechanism: Disintegration

1. Manifested clinically-- both within the self and within the cells, psychologically and biologically.

2. Produces defined, measurable symptoms and signs of specific pathological changes.

3. Here are experienced the two final crises -- morbidity and mortality. This may be associated with trauma, aging, constitutional exhaustion, and the progressive collapse of multiple systems. It ends in a final cry of separation and grieving.

This model underscores the view that the progressive forces of degradation are inherent in human nature and personhood, but that they always occur in the context of the social and physical or environment. As Andie Knutson points out in *The Individual, Society, and Behavior Change* (1965), "man's existence as an organized unit ... depends upon his being constantly attuned to existential features of that [his] environment - the air, water, food, heat, light, chemicals... Either insufficient or excessive transactions regarding anyone of a wide range of elements directly affects the functioning of man as a physiological organism" (p. 29) . Such degradation is a universal fact on this planet to which neither time nor geography has provided any exceptions. Without some form of constructive intervention human life, then, goes down inexorably.

The Earth Condition: Environmental Degradation. As does the human condition so does earth's environmental condition show evidence of degradation. Much of this may be due to human action or inaction, but there are some indicators which suggest natural degradation independent of human activity. Biblical allusions point to the earth as a time-limited entity, rather than an eternal planet. God alone is immortal and only by His own deliberate act can that quality be conferred on anyone else or anything else. Both Peter and Paul in the New Testament seem to recognize a certain temporality of earth.

Peter, for example, refers to "an inheritance which is imperishable" and "unfading". But that is not a reference to this earth; it is something "kept in heaven" (1 Peter 1:3,4). Philosopher-theologian Paul is unambiguous in asserting that the earth, as we know it, is subject to some form of wearing out, of impermanence and contingency. It is vulnerable to the ravages of time and space, "will grow old like a garment" and, the very One who founded it with such creative splendor in the beginning will fold it up like a threadbare garment (Hebrews 1:10-12). When one ponders the implications of this point, one cannot but recognize an awesome, and somewhat frightening, reality which we hesitate to acknowledge and whose meaning we do not fully comprehend.

Is this wearing out terminal and permanent? In some ironic way, probably not. For we also find in conjunction with the predicted change and decay of the earth the assurance that God "set the earth on its foundations so that it should never be shaken" (Psalms 104:5). We also find the promise of renewal and transformation. Nevertheless, whether one adheres to an old earth theory or a young earth theory, faithfulness to Scripture requires that one accept the concept of some form of degradation of the earth leading to fundamental cosmological changes. There are scientific evidences which point in this same direction as does the Bible.

Before mentioning a few such scientific reasons, it would be useful to form a basic picture of earth's environment. In her book, *Our Global Environment*, Anne Nadakavukaren (2000) vividly outlines some of the main feature of that picture (pp. 7-44). She observes that of all heavenly bodies of which we are sufficiently aware "our planet is neither the largest nor the smallest, the hottest nor the coldest, yet it is extraordinary in one vital respect -- in all the universe Earth is the only planet known to support life." (p. 7). The direct life support component of the earth is confined to what ecologists call the biosphere. This is a narrow film of air and water which envelopes the earth and which extends from deep ocean trenches 36,000 feet below sea level to about 30,000 feet above sea level.

The earth's surface is enveloped by an airy canopy known as the atmosphere, whose existence is crucial in

making possible the vast array of diverse, plant, animal, microbial, and human life forms found on earth. Scientists subdivide the atmosphere -- extending from sea level to an altitude some 50 miles above it -- into three distinct zones based primarily on temperature (See Nadakavukaren, 2000, pp 411-413).

The first of these zones is the *troposphere*, which extends from sea level to an altitude of about 8 miles above it, and in which the temperature steadily decreases as the altitude increases. Almost all life activities and most weather phenomena occur in this atmospheric zone. Second is the *stratosphere*, which extends from the outer margin of the troposphere to an upper boundary of about 30 miles. Here, the characteristic feature of the temperature follows a pattern exactly the opposite of that of the troposphere, steadily increasing as altitude increases until it reaches 32 degrees. Here also is the location of the ozone layer concentration, which acts as a shield protecting the earth from harmful radiation. Third is the *mesosphere* where, once again, temperature decreases as altitude increases. The air is the thinnest in this zone, and it is difficult to precisely demarcate where earth's atmosphere actually ends. However, it is known that, in terms of mass, "99% of earth's atmosphere lies within 18 miles" of earth's surface" (Nadakavukaren, p 413). The point of this is that, in the context of the entire cosmos, when we speak of created life as we know it on earth, we are referring to an extremely thin region that supports the some ten million species of living things.

Scientists have also divided the biosphere into functional units called ecosystems. This division is in recognition of the organized complexity that characterizes the interactions and interdependence of living things with each other and with non-living things, a primary function of such interactions being to process air and nourish themselves. Within such systems there are ecological *dominant* organisms that exert a major modifying influence on the community. There are ecological *niches*, which are the unique positions, space, and behaviors shown by particular species. There is the principle of *competitive exclusion* in which co-existence between or among species endangers the survival of one or more when they are competing for the same limited resource. There is the *Law of the Minimum*, which recognizes that certain limited but necessary resources within an ecosystem are the ones which determine the survivability of a species, not those resources available in abundance. The emphasis here is on the interconnection and interdependence of all things

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Beyond the interdependence of ecological systems on earth is the fact that the earth itself though unique, as we have noted, is not entirely a closed system. The entire planet is subjected to influences that conform it to regular patterns of motion, which are crucial in controlling its climate and weather, its exposure to light, and its biological homeostasis. The very integrity of its complex forms and processes are contingent upon how the earth's position is maintained in relation to other forms and systems outside of itself. The role of the sun, for example, is crucial. Not only is earth's temperature largely controlled by the sun, even slight variations being a threat to life, but we also know that the ultimate source of all energy required to sustain life originates from the sun. We know we cannot eat the sun, yet without the sun we cannot eat! The diagram (Appendix B) showing the reflection and absorption of solar radiation illustrates this crucial fact of earth being, in certain ways, a fundamentally open and contingent system.

As it floats in space the earth is a marvel of interacting natural laws, organized complexity, indescribable life forms and functions, vitality, intriguing subtleties and wonders -- and amazing vulnerability. Its biosphere was so awesome to the Psalmist (as it has been for poets, painters, musicians, and naturalists for ages) that he poured forth his inspired soul in wonder through some of the most compelling poetic images found in the Bible.

> flame they ministers... Thou didst cover it [the earth] with the deep as with a garment; the
> "Bless the Lord, O my Soul! O Lord my God, thou art very great!... who makest the cloud thy

> chariots, who ridest upon the wings of wind, who makest the winds thy messengers, fire and waters stood above the mountains... Thou makest springs gush forth in the valleys'... they give drink to every beast of the field... Thou dost cause the grass to grow for the cattle, and plants for man to cultivate that he may bring forth food from the earth and wine to gladden the heart... Thou hast made the moon to mark the seasons; the sun knows its time for setting. Thou makest darkness, and it is night, when all the beast of the forest creep forth. The young lions roar for their prey, seeking their food from God... Yonder is the sea, great and wide, which teems with things innumerable, living things both small and great... These all look to Thee." (Psalms 104:1-27, RSV)

Yet, for all of this, not only the Bible itself but scientific observations indicate that processes of change and decay appear to be part and parcel of the earth's system. Three examples from scientific observations will be cited briefly to indicate this aspect of the natural order.

First is the possible effect of entropy. According to Nadakavukaren, this concept holds that "all energy is moving toward an ever less available and more dispersed state" (p. 25). This process is expected to continue until all energy has been transformed into heat and distributed uniformly throughout the solar system. The concept is based upon the second law of thermo-dynamics which asserts that usable energy is lost whenever energy transformation occurs.

What this law indicates, ecologists believe, is that energy flows in one direction through earth's ecosystems; unlike minerals and gases, metals cans and plastics, it is not recyclable. This helps explain why we must eat a great deal more than ten pounds of food in any given period of time in order to gain ten pounds of weight. It also helps to explain why we need a continued input of energy in order to maintain ourselves. As illustrated in the food chain pyramid (Appendix C), there is 90% less energy available for use at each step up the food chain. When an organism is at the point where the amount of energy expended to secure food is greater than that obtained from the food itself, the end point for survival is at hand (Nadakavukaren, p. 30). Thus, unless the earth's source of energy is inexhaustible, the viability of its biosphere can only be finite. That is, it will wear down.

A second example of degradation is the massive record of death geologists, palaeontologists and archeologists have discovered embedded in layer after layer of rocks. Precise interpretation of the record certainly has contentious aspects. What is not controversial is how the fossils put into historical perspective the drama of the ghastly and the macabre in the world of nature. Such fossilized remains include ancient animals and biotic communities, vast forests, and ancient civilizations that once vibrated with life and creative energy. As Clyde Webster (1995) put it,

> If we examine carefully the many sedimentary rock strata that cover the Earth, we will soon find that we are actually living on an enormous graveyard. Graveyard?! Yes, graveyard! Almost every sedimentary deposit contains fossilized remains of past life, both plant and animals. (p. 17).

Again, this awesome scientific reality emphasizes the magnitude of what we all know in some measure from personal experience: there is a process of wearing and tearing, of change and decay, that appears to be pervasive in the earth.

A third example is that, in our own time and before our very eyes, earth's environment -- air, water, land, vegetation, and even animals -- is understood to be undergoing ominous changes and degradation. Direct human action or inaction contributing to such change may themselves be generated by pressures inherent in basic human needs and deficits. But regardless of the initial causation, such action or inaction has undesirable

repercussions and often produce vicious cycles that tends to spiral downward toward a possible end point. Well-documented examples would be the continuum of the never-ending industrial revolution. The burning of fossil fuel and urbanization are major contributors to earth's atmospheric and water pollution and increases in certain diseases. The agricultural revolution led to the introduction of dangerous pesticides, which polluted and degraded both the land and the water. Uncontrolled population growth led to poverty and malnutrition, massive migration of peoples, random slashing and burning of virgin territories for food production or mineral exploration, destruction of valuable rain forests and disturbance of weather patterns. These pressures fueled tribal conflicts, human genocides, and international wars with the resultant near collapse of many organized communities, physical and chemical (agent orange) destruction, and ecological catastrophes.

In addition, scientists, politicians, philosophers, and people movements are vigorously debating and taking action on major global environmental issues of our time. There may very well be a great deal of exaggerated conclusions at times, but there appears to be a sufficient consensus to believe that population growth and distribution, desertification, ozone depletion, global warming, and the impact of economic globalization are among a range of critical issues affecting the natural order of creation. The underlying question is one of sustainability. With the enormous pressures being exerted *within* the earth and inflicted *upon* it, how can an acceptable quality of life, or life at all, be sustained?

Both the human condition and the environmental condition, then, appear to provide compelling evidence of earth in struggle and pain as it ages. The life-giving agencies that influence the earth are only partially successful in their encounter with the forces of degradation and decay. That is say, disintegration and death are co-realities in nature along with tendencies toward life and wholeness. There are concerns that, in the end, the former is going to win by uncreating the creation. Paul captures this tension in the cosmos poignantly when he wrote nearly two millennia ago:

> It is plain to anyone with eyes to see that at the present time all created life groans in a sort of universal travail. And it is plain, too, that we who have a foretaste of the Spirit are in a state of painful tension, while we wait for the redemption of our bodies. (Romans 8: 22, 23. Phillips)

We have observed that both human beings and the natural order of earth to be linked together in an inseparable destiny. We have now noted also that both are linked together in a common experience of pain, of change and decay, pursuant to that destiny.

THE DOMINION PRINCIPLE: ENGAGEMENT AND CONSTRUCTIVE INTERVENTION

The key questions, then, must now be these: What does having dominion really mean? Is there now, or has there ever been, a place for constructive intervention in the scheme of things - particularly human intervention? This paper argues, yes. There was and still continues to be a place for sustained human intervention in the natural order. Much depends, though, upon how we define and structure the concept of intervention.

Structuring and Defining Intervention. As noted earlier, the model which describes the human condition indicates three dimensions in the natural history of human pathology, namely, primary, secondary, and tertiary dimensions. If constructive intervention, as has been proposed in this paper, is a moral task required to foster the integrity of the earth and to enhance the quality of life it sustains, then one would expect the pattern for intervention to confront in some way those three dimensions. A useful guide in doing so is the model used in public health. This model indicates that the key to health and wellness is to address various stages of relative

health or illness through primary, secondary, and tertiary intervention modalities.

1. Primary Intervention involves understanding the nature of persons, commitment to certain values, and taking steps that will enable a child, a person, a community to realize their full growth and potentials. It may also involve anticipating possible areas of vulnerability and taking specific pre-emptive action to prevent the development and manifestation of disease.

2. Secondary Intervention involves surveillance, early detection of problems, and prompt treatment. Corrective measures are set in motion before severe or irreversible damage occurs.

3. Tertiary Intervention involves procedures to limit disability. Processes of disease are established in the person or population, significant damage has already been done, and non-intervention could only mean complete disability and death. Tertiary intervention seeks to salvage what powers yet remain in the damaged person or population and to provide a support system that will enable him/her to function and perhaps develop compensatory skills.

The Biblical Principle of Intervention. In the Bible, human intervention is captured in the term dominion, and related words and phrases. This principle envisions humankind's relationship to the earth as an indispensable feature in defining who they are and what the earth should become. The very concept of creating man is expressed in a compound statement in two clauses joined by the conjunction "and". "Let us make man in our image, after our likeness," God said, "***and*** let them have dominion... over all the earth" (Genesis 1:26). Thus the plan was that man would fulfill his nature and destiny as a creature in God's image only in the context of a particular relationship to the earth - the relationship of dominion.

Further, having carried out the idea of creating man, God gave the mandate that man should "fill the earth and subdue it" (Genesis 1:28). Adequate human resources would thereby be provided to make the adventure both collaborative and universally meaningful. They were to do this with God's blessing, not under His curse, the mandate being preceded by "and God blessed them". At some point God then carved out from the vast earth a special habitat -- the Garden of Eden -- and "took the man and put him in the Garden...to keep it." (Genesis 2:15). He was to look to the earth for his daily bread — whether obtained through trees bearing fruit, through herbs of the field, or by the sweat of his brow.

On one level, human beings clearly cannot avoid engagement with the created order of earth. The notion of the environment as that which surrounds us is inadequate to describe this relationship. The fact is that the world that is around us is also within us. We are involved, for better or worse, in the warp and woof of nature. There are intimate transactions between us and our world which are continuous in a relationship that is inseparable and indispensable for existence. Larry L. Rasmussen describes it cogently in the preface to his book, *Earth Community Earth Ethics (1996)*. Referring to the world around us and the intimacy we share, he observes:

> ...We are an expression of it; it is an expression of us. We are made of it; we eat it, drink it, and breathe it. And some day, when dying day comes, we will each return the favor and begin our role as a long, slow meal for a million little critters. Earth is bone of our bone and flesh of our flesh [or vice versa]. This is not "environment" so much as the holy mystery of creation..." Rasmussen, p. xii)

On a second level, however, the earth as a complex physical system and object, is clearly distinguishable from human beings who are complex multi-dimensional personalities. In this context, human engagement with the earth could also be very intimate; however, it is fundamentally a rational and moral one. In this relationship

we must continually ask the question, how shall we relate to this object above us, beneath us, and around us? Is it right to intervene, or is it wrong? And how shall we know?

This is the heart of the matter, and the focus now is to further define what the Genesis account means by the terms it uses to designate the common human vocation: have dominion over the earth, subdue the earth, dress and keep the garden, multiply and fill the earth.

This paper submits that these terms denote the special empowerment and responsibility of human beings given at the very dawn of creation and as an integral part of it. Their role was to secure the integrity of earth's natural order. They were to restrain any tendencies toward degradation, and working together with the Creator Himself, to foster the progressive unfolding of earth's potentials. Simply put, the Creator of all that is singled out human beings specially created in His image, to a vocation of constructive engagement with the vast and profound creation, and thereby with the Creator Himself, who is even now at work in that creation.

Having dominion over something can be interpreted in at least two ways. One is to rule for purposes of self-aggrandizement, like Nebuchadnezzar ruled Babylon and as a thousand autocrats have done in our own day (Daniel 4). This meaning can include to plunder and exploit purely to satisfy one's whim and because one has the power to do so. This is not the meaning in Genesis 1:26, 28. The second interpretation denotes stewardship, trusteeship. A steward is one who has been entrusted with jurisdiction over another's property with the expectation that he will not only keep it safely from robbers and all intruders and secures its integrity, but also that he will improve it to the point where its finest qualities and highest worth are evoked. Jesus tells the stories of the unfaithful steward and of the talents to illustrate this principle. The word translated "subdue" (*kabash*), taken in context of Genesis 1:28. contains a similar principle.

The Hebrew words translated "dress" and "keep", as in the clause to dress and to keep the garden (Genesis 2:15, KJV), are *abad* and *samar*, respectively. *Abad* is best translated "to serve" - to serve the garden. *Samar* literally means "to guard" and is often associated with blessing, as in "the Lord bless you and keep you" (Numbers 6:26). But what does this guarding and keeping mean?

In *Caring for the Creation* (1998), Calvin DeWitt comments that when we pray for God to keep His people we do not mean that He should keep them "like one might keep a museum piece,... but rather that God would keep them in all their vitality, with all their energy and beauty. This keeping is one that would nurture all life-sustaining and life-fulfilling relationships... *Samar* is an extremely rich word with a deeply penetrating meaning" (p. 44). It is precisely this penetrating meaning of the word which informs our attitude toward all creation.

Structuring Dominion. When we apply these understandings of Genesis 1 and 2, it seems clear that the mandate for the first couple and their offspring to have dominion over the whole earth was a calculated act of God, not to relinquish His preeminent role as Creator-Sustainer-Lover of the world, but to entrust to humanity's safe keeping this earth in all its vitality, variety, complexity, and wealth. In the hands of faithful stewards the earth would become everything its designer intended it to become.

1. **Dominion includes Primary Intervention and Control**. Whether the particular injunction was to be procreative and fill the earth with human resources, to guard and serve the garden, to understand and appropriately name the animals, to till the soil for the production of food, or to subdue the earth and exercise dominion over it, the Creator's theme is essentially the same: man is created and called to a vocation of engagement with the earth. He is to assume responsibility to take the new earth, as a mother takes a newborn baby, from its pristine innocence and artistry, protect it from anything that would endanger its integrity,

nurture it, discover its innate tendencies, and unlock the rich potentials that lay hidden within it.

The dynamic engagement such a vocation entailed would require nothing less than humanity's finest powers of thought and creative action. It would require intervention - primary intervention - into the natural order, a certain mastery of its laws and intricate processes. This clearly is a monumental scientific task; but humanity was empowered for just such a task, being made in the image and likeness of the Creator Himself. This empowerment includes the capacity to exercise a degree of control over the forces of nature. Ellen White (1903) makes this point cogently when she describes the quality of God's gift of Himself to humankind:

> He has endowed us with a power not wholly unlike His. To us has been give a degree of control over the forces of nature. As God called forth the earth in its beauty out of chaos, so we can bring order out of confusion. And though all things are now marred with evil, yet in our completed work we feel a joy akin to His, when, looking at the fair earth, he pronounced it "very good" (pp. :214-215).

The Genesis account does not seem to stipulate categorical limits to the task of exercising dominion. Perhaps this is because the earth was designed to hold inexhaustible possibilities -- or at least possibilities inconceivable to us. Thus, the freedom to work with earth's resources in producing understandings, structures and forms that are novel, or that are constructive extensions of what is known, perhaps the opportunity to co-create along with the capacity to procreate need to be considered as part of human-earth engagement. According to White (1958), to the first couple had "unlimited control" over much of the world. Here's how she describes it:

> Unlimited control was given them over every living thing... The mysteries of the visible universe... afforded them an exhaustless source of instruction and delight... They held converse with leaf and flower and tree, gathering from each the secrets of its life. With every living creature, from the mighty leviathan that playeth among the waters to the insect mote that floats in the sunbeam, Adam was familiar. He had given to each its name, and he was acquainted with the nature and habits of all. God's glory in the heavens, the innumerable worlds in their orderly revolution, the "balancing of the clouds', the mysteries of light and sound, of day and night -- all were open to the study of our first parents... and spoke to them of infinite wisdom and power (pp. 50-51).

The availability of nature for human exploration and invention, and the human ability to exercise degrees of control over nature were essential features of the Creator's design.

Dominion includes Secondary Intervention. By definition, secondary intervention involves surveillance, the early detection of potential problems, and promptly setting in motion constructive measures for dealing with them before serious damage is done. If, for example, energy depletion, entropy, atmospheric thinning, quantitative or qualitative shifts in biological or chemical necessities could be envisioned or anticipated, then humanity's resourcefulness could avert such dangers through timely intervention.

The flood catastrophe, it appears, is the most powerful example of the consequences that can ensue through human inaction, ignorance, neglect, or rebellious plunder. The record suggest that the moral task of human intervention could have averted the ecological and human disaster which befell that ancient civilization. The earth always suffers when humanity fails to recognized impending calamity and take timely preventive measures against it. The record also suggests that we are all in it together and that it takes more than a small

group, such as Noah and his family, however dedicated, to reverse dangerous threats to the natural order.

3. Dominion Includes Tertiary Intervention. Tertiary intervention involves limiting disability. Disability is used here in the sense of damage or impairment. It is difficult to contemplate that the Creator could actually have planned that the earth would exist in a state of disability. Yet when He invested human life with moral capacity to be exercised, not in abstraction, but in real relationships with the earth and its inhabitants, He must surly have recognized that possibility. The essential requirement for the moral life is such that immoral conduct will always be possible. That is, in relation to the earth as well as to one another human beings (and possibly other beings) could choose to act in immoral ways that would damage the very earth itself. Such is the power of the moral act!

The very idea of granting dominion to human beings implies a measure of self-limitation of the Creator's will. Free will as a definitive structure in the moral image of God in created beings renders the Creator's will itself permissive. His own will to sustain and preserve the natural order in its ideal state is under a degree of restraint. This self-restraint provides the essential space wherein the choices required of the moral life of created intelligence can be adequately exercised and be truly authentic. The raw and awesome power of the Creator is thereby circumscribed by His awesome goodness and wisdom.

It is in precisely such conditions that a treacherous will may intervene and initiate destructive processes upon this earth. This potential for damage may be inferred from the fact that the first couple were explicitly directed to guard and keep the garden in the first place. It may also be deduced from the fact that cherubim with flaming swords were deployed to protect the entrance to that garden. It does not appear that a similar degree of direct protection was afforded the larger world outside the garden.

It is therefore possible that the condition in which the earth finds itself, as briefly described earlier, may be due to the intervention of an evil will, as well as to human failure to effectively intervene on the primary and secondary levels. When the book of Job is taken into serious account, we are truly brought face to face with a perfidious evil fully capable of wreaking incalculable damage and pain to both human life and earth's environment. When one looks at the history of human conflict with its ingenious production of toxic substances and weapons of mass destruction and its long catalogue of violence to human life and to the earth itself, one senses a perfidious and evil will at work.

One of the most important lessons of the flood story is that the Creator not only allows perverse wills to do serious damage, but that He intervenes to limit the amount of damage such will can do. Under God's restraining and sustaining will the earth might be blooded, but it can be unbowed. The point here is this: the earth may have suffered significant damage through time, but human beings, under God, have some capacity to intervene and work toward limiting the disability. A case in point may be the impact of unregulated population growth and distribution on the ecological systems and the overall quality of life on earth and what human beings have the capacity to do about it — if they have the will.
Through tertiary intervention the earth may yet reveal some of its rich resiliency.

Dominion Includes Collaboration with the Creator. Since the earth is not self-sustaining anymore than it was self-existent, engagement with the earth is engagement with God. Though unseen and above nature, God's presence and power is continually expressed in nature (Romans 1:18-23). This is why "the deepest students of science are constrained to recognize in nature the working of infinite power" (White, 1903:134). In the act of feeding the five thousand with a boy's simple lunch Jesus, the Word in who all things consist, drew "aside the veil from the world of nature" to reveal the fact God is employing his creative energy

constantly in the production of earth's harvest and the feeding of earth's millions (White, 1903:107, 108). To fully engage with and intervene in the natural order therefore is an act of faith. It is to be brought in touch with the Creator in His laboratory and to discover how best to collaborate with Him. Any true scientific endeavor is fundamentally a sacred, not a secular pursuit.

IS THE CAUSE LOST?

As noted earlier, it has been argued by some that death and destruction existed in the natural order, outside Eden, long before sin entered the world. Others have rejected that view, believing that change and decay are the direct consequence of man's doing. This essay does not resolve that dispute. Our thesis has been that human beings are to be not only products of nature but to function as intelligent guardians over nature and that the earth is dependent upon faithful stewardship of humankind for the unfolding of its destiny. By nature and by decree, humanity was elevated into partnership with the Creator in this vocation.

Unfortunately for us and for the earth, that vision of Genesis has not yet been fully realized. In fact that long effort has been fraught with human inadequacy and failure. The processes of degradation together with the damaging effects of perverse wills, it appears, continue to distort our planet. All to often through human history dominion has come to mean domination, subdue to mean subjugation, and keeping and guarding exploitation. And so the earth continues its march through time and space held in bondage to the relentless forces of change and decay.

Is the earth, then, a lost cause? This paper submits, no. Earth still holds artistry and treasures unimaginable, and she continues to unfold them bit by bit to our curiosity and amazement.

Many dedicated men and women have carried out, in the finest sense of the word, the mandate of constructive engagement with the natural order long before and long after, Copernicus, Galileo, Newton, Alexander Flemming, Madame Currie, Edward Jenner, Alexander Graham Bell, John Glenn and Mother Teresa. These helped to restrain the forces of degradation and to nurture nature. They demonstrated a bit of the capacity with which God empowered humanity when He placed the earth in humanity's charge. There are a host of unsung ones as well. In one of the classic passages in his book, *Darwin's Black Box*, Michael Behe (1966) recognizes the work they are quietly doing. He writes:

> Over the past four decades modern biochemistry has uncovered the secrets of the cell. The progress has been hard won. It has required tens of thousands of people to dedicate the better part of their lives to the tedious work of the laboratory... The knowledge we now have of life at the molecular level has been stitched together from innumerable experiments in which proteins were purified, genes cloned, electron micrographs taken, cells cultured, structures determined, sequence compared, parameters varied, and controls done. Papers were published, results checked, reviews written... The results of all these cumulative efforts to investigate the cell -- to investigate life at the molecular level is a loud, clear, piercing cry of "design" (pp. 233-234).

This kind of human activity provides a glimpse of what we have called constructive engagement or intervention into the natural order, and illustrates the Genesis mandate to exercise dominion over the whole earth It holds realistic promise for restraining aspects of change and decay and demonstrates the myriads of

steps that must be taken to help uphold the earth on its course toward its destiny. One can almost hear the Creator of the cell exclaiming "good, very good indeed. That is exactly how it was meant to be, only infinitely more so."

This, together with many other contemporary scientific achievements, is good news; but is it good enough to completely restrain the forces of degradation? Probably not. Probably too much destructive intervention is simultaneously occurring. Probably too much damage, in fact, has already been done in throughout the natural order itself, in humanity's moral fiber, and in how the human vocation is perceived and lived on out earth. Moreover, the principle of constructive engagement, to the extent that it is accepted as a necessity, has been largely detached from faith in the Creator and collaboration with Him. It has therefore lost its compass and that special contact with the larger reality wherein resides its ultimate meaning and purpose.

For people of faith, however, one hopeful sign persists — the sign of divine intervention, the possibility of which was never surrendered when dominion was vouchsafed to man. By His personal engagement with and love for the world, the Creator has, in the second Adam, guaranteed a secure destiny for our broken planet. The Word, whom Christians believe encompasses both the beginning and the end, who brought light out of darkness and cosmos out of chaos, now promises to bring abundant life out of change and decay. His prayer, "thy will be done on earth as it is in heaven", implies that the reign of degradation, death, and an evil will, is but a temporary phenomenon.

No other event in history is more definitive of earth's ultimate rescue from a downward spiral and ultimate degradation than the event celebrated every year at Easter — the resurrection of Jesus from death. There is a sense in which nature itself foreshadows this resurrection when, at springtime, earth bursts forth into life and vigor and creative splendor after a long winter of barrenness and gloom. But nothing is more instructive than Christ's bursting forth in resurrection splendor from the tomb. "We are driven", says DeWitt (1998), to concentrate on the resurrection as the starting point because it tells us of God's vindication of his creation... It might have been possible, we could say, before Christ rose from the dead, for someone to wonder whether creation was a lost cause", but no longer so (p. 39). So then the Paradise lost to man's failed stewardship will be regained when the very Word who, in passing from death unto life, has demonstrated His capacity to subdue evil and reconcile all things to himself, declares: "Behold, I make all things new" (Revelation 21:5).

Until then the inadequate task of human science must go on and on -- the task of constructive engagement with an aging earth and with the Creator who still holds it in His hands. The relationship of moral humanity with this present world will always display the features of an old-fashion marriage in which there is no thought of divorce. We are engaged for better or for worse, in sickness or in health, for richer or for poorer, in autumn and winter or in spring and summer — until we are made whole again. And in spite of the ambiguity of it all the Creator will still say in the end, as he said in the beginning, "it was good, very good".

CONCLUSION AND APPLICATION

This essay attempted to present a rationale for the view that constructive intervention into the natural order of creation is a fundamental responsibility, a moral necessity, and a privilege vouchsafed to humankind by their Creator from the very beginning of time. By suggesting that the authentic science required for such intervention is a sacred enterprise, not a secular one, the essay also attempted to contribute to the monumental task of opening windows through the iron curtain that has separated modern science from

Christian faith. From all that has been explored in this study, a few specific conclusions can be drawn.

1. The idea that human beings are simply to occupy their niche in the natural order and no more, like primates and other species, can be sustained only if the uniqueness of their creation and the specialness of their vocation, as stipulated in the book of Genesis, are disregarded.

2. When human beings, who bear the Creator's image and likeness, are empowered and commissioned to have dominion over the whole earth and to procreate they are given a super-ordinary power, a power akin to that of their Creator. This is a great honor and a great risk.

3. There is a fundamental sense in which the earth has already been created and established. There is another sense in which the earth was and is still being formed; that is, sustained maintained, and enabled to fulfill its potential and destiny. Since earth is not self-sustaining, creative energy is required to do the latter as well as the former. Therefore the presence and power of the Creator must be continuously at work in the natural order.

4. The moral mandate to fill the earth, to subdue it, to exercise dominion over it was an invitation for man to encounter God in the natural order, to collaborate with Him in seeking earth's highest good as well as his own, and to foster *its* destiny which is linked to *his* own.

5. Constructive engagement with the creation and close collaboration with the Creator required scientific skills and creative endeavors to explore and harness the vast resources of earth. Such scientific skills are fundamentally sacred trusts.

6. The command to guard or keep the garden, and the fact that the garden was so heavily fortified, implies that there may very well have been processes of degradation that needed to be held in check and destructive entities that posed a threat to the integrity of the earth and of humanity. What those forces were we are not told, apart from references to a beguiling serpent, to thorns and thistles, to hard manual labor, and to sorrow and pain.

7. How big a risk did the Creator run in empowering humankind to procreate and co-create, to exercise dominion? The only answer we have to this question is found in the extent to which human beings themselves have been responsible for degrading the earth and exploiting its resources for purposes of self-aggrandizement. Science, to a considerable extent, has been prostituted, much of its creative products having been used for ends that are destructive of the earth itself.

8. Scientists who acknowledge the Creator in all their pursuits have a sound basis for constructive intervention in the natural order, even though much of what must now be done must be adapted to the on-going environmental risks to which earth is exposed. The aging earth, groaning in pain, must wait for ultimate intervention and redemption from another source.

9. Christian educators must never put themselves in a position where they are perceived as being in opposition to science and scientific intervention. Their special contribution to scientific thought is to connect it to its faith foundation — a foundation which authentic science does not meaningfully contradict.

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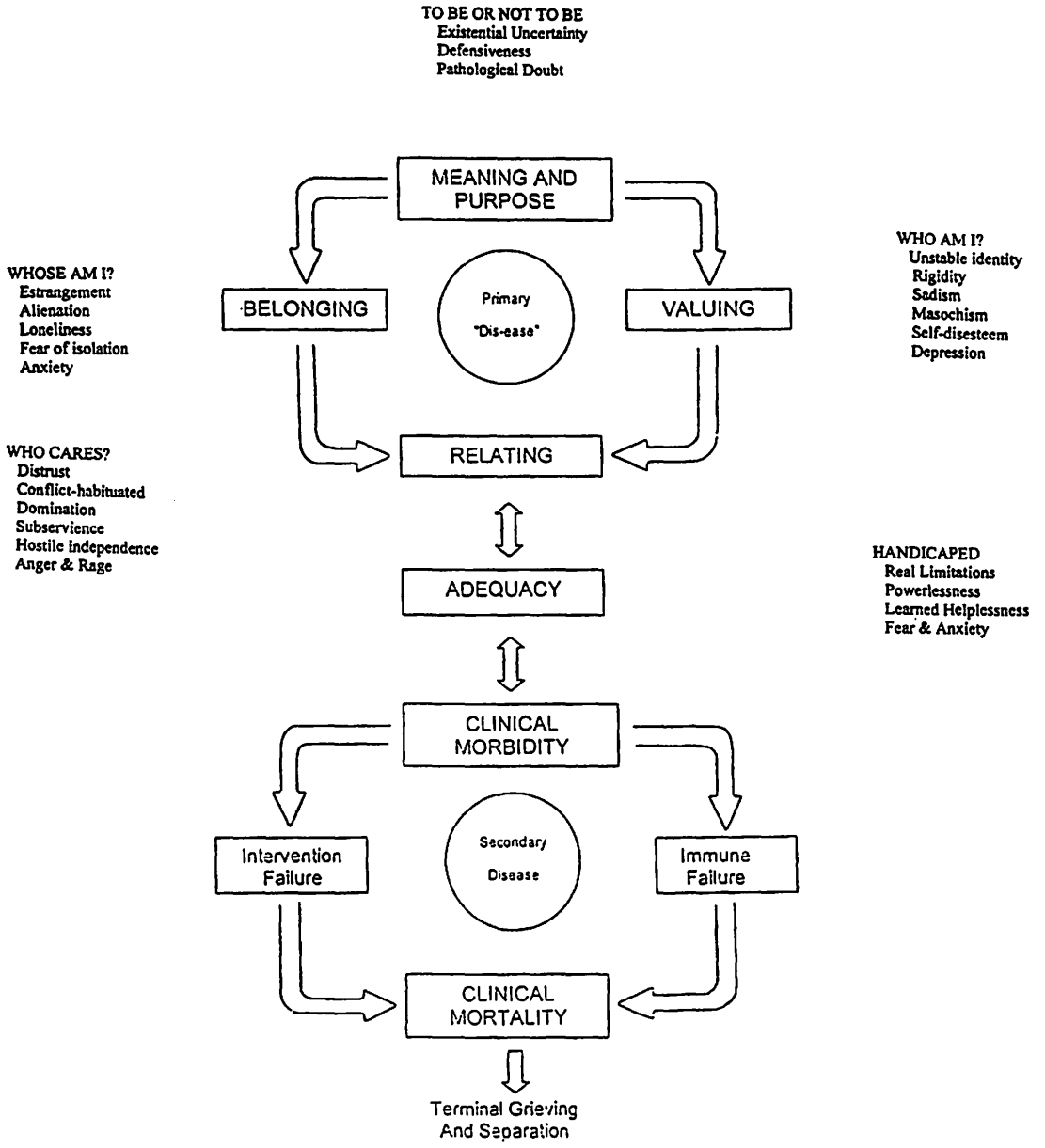
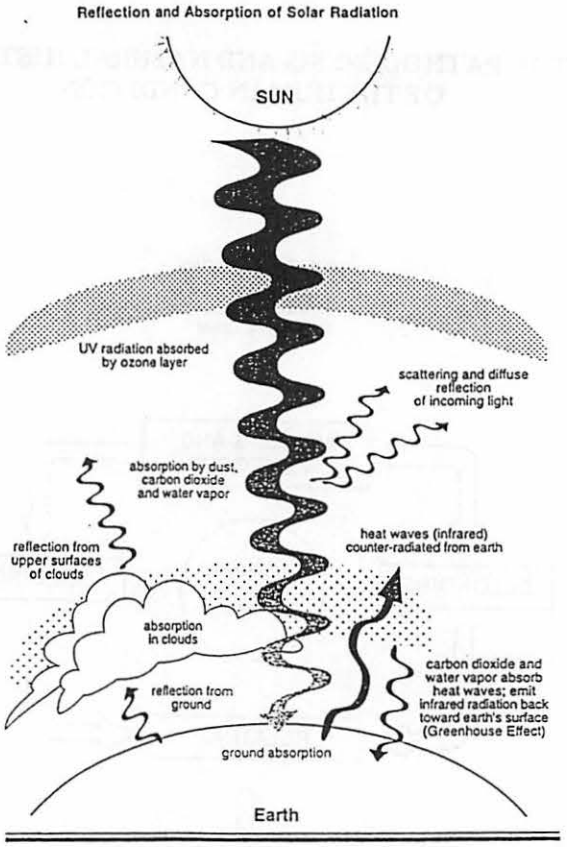
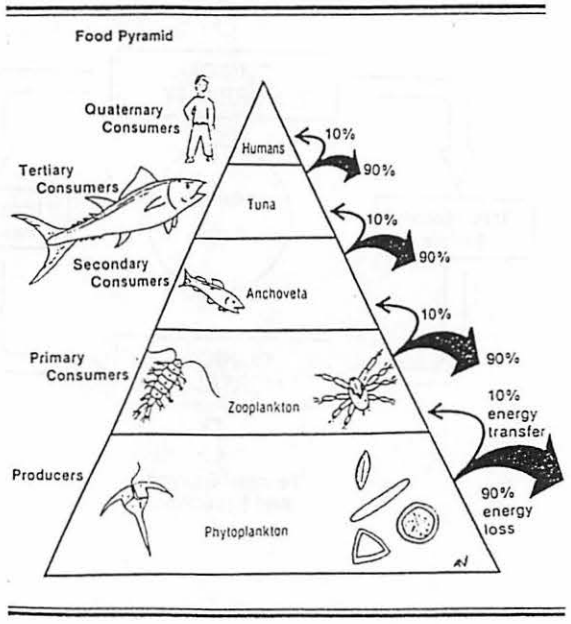
THE PATHOGENESIS AND NATURAL HISTORY OF THE HUMAN CONDITION




Reflection and Absorption of Solar Radiation
SUN
UV radiation absorbed by ozone layer
scattering and diffuse reflection of incoming light
absorption by dust, carbon dioxide and water vapor
reflection from upper surfaces of clouds
heat waves (infrared) counter-radiated from earth
absorption in clouds
reflection from ground
carbon dioxide and water vapor absorb heat waves; emit infrared radiation back toward earth's surface (Greenhouse Effect)
ground absorption
Earth


Food Pyramid
Quaternary Consumers
Humans
10%
90%
Tertiary Consumers
Tuna
10%
90%
Secondary Consumers
Anchoveta
10%
90%
Primary Consumers
Zooplankton
10% energy transfer
90% energy loss
Producers
Phytoplankton