

Sacred by Design

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Session One: The Kingdom of Faith

Welcome to our lecture series, Sacred by Design. We're going to be talking about the sacredness of creation, our indissoluble connection with the intricate web of life.

This series will be in two sessions. During the first session, we will discuss the sacredness of creation revealed by many faith traditions, and the revival of interest in passages from the texts of Christian, Jewish, Islamic, Hindu and other traditions that speak to the holiness of creation.

One thing we hope to accomplish here is to show that the texts of faith traditions and the findings of modern science are mirror images of each other – each, in their own way, reveal that God is a master designer Who created an incomparably wondrous world to support all expressions of life, all expressions of God, in all their manifest diversity.

In the second session, we will cross from the kingdom of faith to the kingdom of science, and explore the elegance of our planet's workings, as documented by the findings of specialists in the fields of ecology, conservation biology, atmospheric physics, geochemistry, and other fields, and how our modern industrial society has disrupted those rhythms and patterns. Finally, we will discuss emerging movements to restore our sundered connections with sacred creation – natural capitalism, biomimicry. Those are two of the buzz words that attempt to describe a very exciting movement, one with many facets, to bring our civilization back into

balance, not only as a means of preserving our planetary life support system, but to transcend the conquest and domination mind set that gives rise to all manner of social ills – crime, inequality of women, child poverty, and persistent conflict. Ultimately, by re-connecting with the creation, we will come closer to God throughout the cycles of our lives, from the headwaters to the sea.

Columbia River Pastoral Letter

So, let us begin with a development that was the buzz of religion news writers throughout the Northwest several years ago. On January 8, 2001, a dozen Roman Catholic bishops released an unprecedented pastoral letter that was the culmination of nearly four years of work by bishops in Washington, Oregon, Idaho, Montana, and British Columbia. As you may know, a pastoral letter is a powerful context for teaching in the Catholic tradition. Bishops sweat over every word, because these letters are taken seriously throughout dioceses and parishes as the word of church fathers.

This letter was titled “The Columbia River Watershed: Caring for Creation and the Common Good.” The letter is intended to challenge people everywhere to take care of the Columbia River, the Great River of the West. As you may know, the Columbia is a shadow of the raging waters that astonished Lewis & Clark. There are 14 hydroelectric, irrigation and flood control dams on the river's main stem, which has turned it largely into a series of slow-

¹ Class script for “Sacred by Design” by Jim DiPeso, 2001, updated 2008. Presented in two parts. Shared with permission.

moving pools. The river has been sullied by pollution from heavy industries and chemically-intensive agriculture, and it has been overfished. Its flow patterns, temperatures and chemical balance are out of whack with natural rhythms. The Columbia's great salmon runs, once the largest in the world, have been reduced by nearly 16-fold, and the fish that are left are largely bred artificially in hatcheries.

The Catholic bishops said they wrote the letter to "develop and implement an integrated spiritual, social and ecological vision for our watershed home, a vision that promotes justice for people and stewardship of creation." Quite heady stuff for bishops to be using the language of ecologists, speaking of watersheds as natural boundaries.

The bishops' letter was not written in isolation. Among other faith traditions, lay and clerical leaders are examining environmental issues from moral and theological perspectives that have added a rich dimension to ongoing political and economic debates on these issues. In a 1997 speech in Santa Barbara, His All Holiness Bartholomew I, spiritual leader of the world's Orthodox Christians, said the following: "For humans to cause species to become extinct and to destroy the biological diversity of God's creation, for humans to degrade the integrity of the Earth by stripping the Earth of its natural forests, or destroying its wetlands ... for humans to contaminate the Earth's waters, its land, its air, and its life with poisonous substances... these are sins."

Pretty powerful stuff. But it shouldn't be surprising when you take into account the rich tradition, in many religious texts, of joy and wonder at God's power, as revealed through nature. We are rediscovering these texts, meditating upon them, as the environmental ills we face take on new urgency and sweep.

Let's take a look at meditations about God's creation from different perspectives.

Judaism

Let's start with the beginning of the Christian and Jewish Bible: Genesis 1: "In the beginning, God created the heavens and the Earth." Steven Bouma-Prediger, a religion instructor at Hope College, says the placement of creation at the very beginning of the Bible is immensely significant. God created a home for all expressions of life out of nothing, simply by speaking all into being. God created an ordered home, with waters and land forming templates for a huge variety of living creatures, each fulfilling a purpose, following elegant laws of chemistry and physics, building creation upon the original creation. The soil brings forth grasses and trees. Plants and animals create copies of themselves. People are given dominion over the garden, which in the original Hebrew connotes a profound stewardship responsibility. All creatures were blessed and told to be fruitful and multiply, a blessing for life to flourish, not for one species to consume and dominate to the detriment of all others.

And God pronounced all of it good, connoting harmony, peace, and beneficence. And on the seventh day, God rested from the labor of love.

Let's focus on what Jewish traditions have to say about creation and stewardship. You may ask, what can texts written millennia ago say about today's problems of overpopulation, climate change, persistent toxins, urban sprawl, or the loss of biological diversity. A fair question, says Max Oelschlaeger, author of *Caring for Creation: An Ecumenical Approach to the Environment*. Let's look at perhaps the most famous Biblical passage that speaks to the wonder of creation:

Psalm 104: "O Lord, how manifold are thy works! In wisdom hast thou made them all..." The Psalm gives poetic tribute to the creation of the Earth, waters, mountains, the substrate of creation, and the abundant wildlife – grasses, trees, birds, cattle. The 104th Psalm is, in short, an inspiring ode to the beauty, majesty,

complexity and intricate design of creation, as woven by God, the Master Designer. In Job 12: 7-10, we hear God say, “But ask the animals and they will teach you, or birds of the air and they will tell you; or speak to the Earth and it will teach you, or let the fish of the sea inform you. Which of all these does not know that the hand of the Lord has done this. In his hand is the life of every creature and the breath of all mankind.”

These texts tell us that creation has intrinsic value, beyond any notions of human utility. Wildlife has moral standing, imposing a duty upon humanity to conserve all species.

Reverence for creation is found throughout Jewish thought, from the beginnings to today. In this tradition, we have obligations to carry out the divine will in a God-centered universe. A whole treatise, in fact, was devoted to the concept that people cannot truly own anything, for all belongs to God. There is a principle known as *bal Tashchit* (do not destroy). Talmudic sages derived a general prohibition against waste from that principle, developed extensive regulation against disposal of hazardous waste, and curtailed activities that might pollute the air we all breathe.

One of the most basic Jewish principles is the requirement for concrete action on ideals. The ideal that God owns all leads to the belief that we are lessors of the planet. The type of lease we have is known as a *sho'el*, who may use what he borrows, but must ensure that throughout the lease and at the end of the lease, the property is as valuable as it was at the beginning of the lease.

In Genesis 2:15, we are commanded to “till and tend the Earth.” The Hebrew word for “till” carries a more powerful meaning than our English. It really means to participate in worship of the Divine. Our tilling, then, is service. The Hebrew word for “tend” means to guard, or watch over, reinforcing the notion that we have a trust responsibility over the creation.

All creation is sacred, as we see in the story of Noah’s Ark, where God commanded Noah to save one pair of every species, even those which, from a human perspective, would seem to have little utility. But God knows that all species, no matter how seemingly insignificant, have value. And after the flood, God made a covenant with all creation, not just humanity, to never again wipe all away and start anew.

The concept of Sabbath is critical to understanding Jewish thought on creation. Sabbath requires that we rest, that we cease, on one day of the week, to tinker and to transform. It is a self-imposed limit. More importantly, through the Sabbath, we become “re-ensouled” or *va-yinafash*. Our restraint on the Sabbath re-infuses us with the holy. In this sense, leaving aside land as wilderness, is an act of re-ensoulment.

Christianity

Now, let’s move on to Christian traditions. Much has been said about Christianity actually encouraging the conquest and domination of nature. There is some truth to this. Many Christians view reverence for creation as something akin to paganism. This line of thinking complements that of contemporary economists and political theorists who view nature as something “outside” that, at best, is something nice to have and, at worst, interferes with the ever-onward march of Homo technologicus.

Yet there are many examples throughout Christian history of reverence for creation. St. Francis of Assisi, the saint who gently picked up worms, lest they be trampled, who set out honey for the bees in winter, is only the most famous example. St. Francis taught us that we must be mindful of our place within the created cosmos. That doesn’t mean that humanity is insignificant. But Francis’ vision reminds us that creation is not simply a storehouse of “stuff” to be extracted and depleted to meet our material

needs and wants. Francis helps us to see life as a gift.

Just before the end of his life in 1226, St. Francis wrote his celebrated poem, “Canticle to the Creatures.” If you will indulge me, I will read the poem in its entirety.

*Lord, make me an instrument of thy peace.
Where there is hatred, let me sow love;
Where there is injury, pardon;
Where there is doubt, faith;
Where there is despair, hope;
Where there is darkness, light;
Where there is sadness, joy.*

*O divine Master,
grant that I may not so much seek
To be consoled as to console,
To be understood as to understand,
To be loved as to love.
For it is in giving that we receive;
It is in pardoning that we are pardoned;
It is in dying (to self) that we are born to eternal
life.*

Examine a central tenet of Christian belief, that Jesus was the incarnation of God, the Word made flesh, spirit infusing matter, the stuff of creation. In the Resurrection, we find that Jesus was not merely a resuscitated body, or an incorporeal spirit. He was, out of the grave, flesh infused with spirit, spirit infused with flesh, a transformation still beyond our understanding. This is fundamental to understand. The flesh is holy as it is infused with spirit, spirit is holy as it is infused with flesh.

Jesus often referred to creation as frameworks and backdrops for the lessons in his parables. In Matthew 6:28, during the Sermon on the Mount, Jesus said, “Consider the lilies of the field, how they grow; they neither toil nor spin; yet I tell you, even Solomon in all his glory was not arrayed like one of these.” What a powerful commentary on the elegant power of God’s

design! And, in a deeper sense, it shows that creation is a revelation that in speaking the creation into being, God thought of everything, that our daily needs will be met without need for fear or anxiety.

As written by Dr. Carol Johnson, a Presbyterian minister and teacher of theology and culture at the Christian Theological Seminary in Indiana, Jesus spoke of his mission as one of fulfillment, of redemption, to a restoration of right relations and communion between God and people. In the story of Adam and Eve, the first man and woman who were to till and tend the Garden were turned out when they became separated from God, when they allowed their trust in God to lapse. In a familiar teaching, Jesus is seen as the “second Adam,” who restores the relationship and the vocation of man and woman.

There are many clues revealing that Jesus’ mission to fulfill encompassed all creation. In Mark, Jesus told his disciples to go out into the world to proclaim the good news to all creation. In Luke, Jesus spoke of rebuking the unfaithful steward. “You cannot serve both God and mammon.”

Paul’s letters spoke of Christ’s redemption as encompassing all of creation. In Ephesians, Paul proclaimed God’s intention to “gather up all things in him, things in heaven and things on Earth.”

Later, many Church fathers spoke of creation with reverence. Even St. Augustine chided his readers to put aside their books and look to creation to discover God. “Can you ask for a louder voice than that?” he asked rhetorically. St. Hubertus spoke of going on a hunt for red deer and seeing Christ between the antlers of a great stag. Christ admonished him, why do you only seek out the largest and healthiest animals, for in so doing, he diminished the health of the herd. From that vision, St. Hubertus spoke to the other hunters, they changed their management

practices, and in the 7th century, the hunters were practicing conservation biology more than a millennium before the concept emerged from modern science.

In the Greek tradition, St. Nikephoros of Chios went so far as to say, “if you don’t love trees, you don’t love God.”

Islam

Let us turn briefly to the Islamic tradition. Like the Bible, the Qur’an speaks reverentially about God’s creation. Islam considers creation to be an open book, a guide that strengthens the faith of the observer, and builds an unshakeable faith in the great Creator of existence. The Qur’an says: “In the creation of heavens and the earth, and the difference of night and day, and the ships which run upon the sea with that which is of use to people, and the water which Allah sends down from the sky, thereby reviving the earth after its death, and dispersing all kinds of beasts therein, and the ordinance of the winds, are signs for people who have sense.”

“Praise be Allah who created the heavens and the Earth and made light and darkness,” reads one passage. Another reads, “The seven heavens and the earth and all therein declare His glory: there is not a thing but celebrates His praise.” In Islam, man is the vice regent of God, which grants us a responsibility to serve God, not license to do as we please with God’s creation.

Remember that Islam arose in one of the harshest deserts on Earth, where you learn very quickly that water is the secret of life. In the Qur’an, it is told that God made every living thing of water. Islam absolutely forbids wasting water and usage without benefit. Indeed, the preservation of water for people, animals and plants is considered a form of worship. Mohammed, the Seal of the Prophets, says that any Muslim who plants vegetation will be rewarded by Allah. From this flow Islamic strictures forbidding the cutting of trees without very good reasons.

Throughout Islamic history, there is a strong connection between the study of nature and the metaphysical dimension. The Qu’ran itself reveals the indivisible link between people and nature. Islam has never seen any kind of knowledge as purely secular. The great Islamic physician Avicenna was both doctor and philosopher. Nature is seen as a reflection of Paradise.

Hafiz was a Sufi poet who wrote, “There is no veil between the lover and the Beloved, Thou art thine own veil, O Hafiz, remove thyself.” God is both transcendent and immanent, of this world. Trees support life and are a recurring symbol. Even one day before the end of the world, Islam blesses those who plant trees.

Let us continue eastward, to the traditions of Hinduism, Jainism, Buddhism, and Taoism.

Hinduism

The Vedas are the foundational texts of Hinduism, which teaches that the universe was created out of knowledge of the Vedas, whose truth was verified by seers in transcendental consciousness. The Vedic Hymn to the Earth, the *Prithvi Sukta*, could be the oldest preserved ode to the Earth of any faith tradition.

*Earth in which lie the sea, the river, and other waters,
in which food and cornfields have come to be,
in which lives all that breathes and that moves,
May she confer on us the finest of her yield,
Earth, in which the waters, common to all,
moving on all sides,
flow unfailingly, day and night,
May she pour on us milk in many streams, and
endow us with luster,
May those born of thee, O Earth,
be for our welfare, free from sickness and waste.
Wakeful through a long life, we shall become
bearers of tribute to thee,
Earth, my mother, set me securely with bliss in
full accord with heaven.
O wise one, uphold me in grace and splendor.*

The Earth was regarded by Vedic seers as sacred space. Throughout the Vedas, nature is integral and indispensable to our existence. A fundamental Vedic concept is the *Panchbhootas*, five elements of nature to be revered: earth, water, air, fire and space.

Jainism and Buddhism

A less well-known faith tradition from India is Jainism, in which reverence for life is the foundation of the quest for peace, harmony and rectitude. Compassion and responsibility must be practiced toward all life.

Jainism and Buddhism, perhaps more than any other traditions, do not regard humanity as the exclusive center of existence and reject the notion that other creatures are valuable only to the extent that they have utilitarian value to humanity. In the continuous cycle of birth and rebirth, each being is related to us. In one of the Buddhist sutras, the *Avatamsaka*, it is said that mountains, waters, grass and trees are manifestations of the great teachers, the bodhisattvas, indeed that flowers and bamboo can preach Buddhist teachings.

Buddha said at the time of his enlightenment: How amazing! How amazing! How amazing! All living beings have the potential to become fully awakened. Only their polluted minds and their attachments keep them from doing so. What does that tell us? Selfishness, desire, greed, anger, and so forth cause us to cling to those things that alienate us from our natural enlightened state of being, and in doing so, we influence the world around us in unnatural ways, which leads to the disruptions and distortions in the environment. This is a fundamental insight that Buddhism gives us. The root, the deepest root of our environmental crisis, is the attachments that block us from enlightenment and universal interconnected-ness.

In the Four Noble Truths, we are taught that craving is a cause of our discontent and stress. The Noble Eightfold Path of Theravada

Buddhism gives us a way out: right view, right resolve, right speech, right action, right livelihood, right effort, right mindfulness and right concentration.

A monk from the Theravadan school of Buddhism once observed that maturity in the Buddhist way of life requires equal measures of wisdom and compassion. Compassion for other people leads inevitably to compassion for the environment and other creatures that support our life.

Native American Traditions

The Native American traditions are well known for their stories and legends that illustrate the indissoluble connections in and throughout creation. The Tlingit people, a coastal tribe in southeastern Alaska, see people and animals as relatives who can cross over into each other's worlds. When hunting a bear, a Tlingit hunter must carry out a special ritual, for he is killing a creature whose soul is akin to his.

In the vastly different ecosystem of the southwestern deserts, the Hopi developed elaborate ceremonies for attracting water. This was both an individual and a community responsibility.

The Iroquois of the eastern woodlands organized their society on the animal model. Each Iroquois clan had a clan animal.

And in the vast, open Great Plains, the Lakota turned to the stars for guidance and way showing. They saw animals as equal partners, especially the buffalo.

In these four examples of Native American traditions, we see an intimate connection with creation as a manifestation of spirit, as a guide, as reference points, as the source of sustenance.

We have surveyed a sampling of the world's faith traditions. Throughout, we find a common thread. That we are but one thread in a greater

fabric of life, a holy manifestation of divine will and love. We see interconnection and the loving bounty that flows when we act in harmony with the rhythms and patterns of sacred design.

Next, we will look at the findings of modern, empirical science. From a very different world view, scientists have been discovering and revealing the amazing interconnections, cycles,

and rhythms that make one wonder: is there a higher purpose to such an intricate web of life? Science is not equipped to answer those questions. But what their findings show us is that the workings of the world resonate beautifully with what the sages and seers, rabbis and priests, holy men and medicine men, have told us for many thousands of years.

Session Two: Kingdom of Science

Up until the Renaissance and the Industrial Revolution, our lives were much more in tune with the rhythms and cycles of nature. We rose with the sun, coaxed our crops from the fields amidst the vagaries of weather, then retired after sunset. We planted seeds in the spring, cared for our farms in the summer, harvested in the fall, and went dormant, figuratively, during the winter. In hunting-gathering traditions, we followed the seasons, the wildlife, the settings of seed, and ripenings for our sustenance. We were attuned to natural rhythms because our lives depended on having this knowledge.

With the advent of the steam engine, the electric light, the sailing ship, the railroad, and numerous other ingenious inventions, we detached ourselves from natural rhythms, and, indeed, came to see nature, not as a matrix for life support, but as a mysterious, evil realm to be conquered and dominated. The industrial revolution made reverence for the creation seemingly obsolete. Western churches reinforced the shift by condemning reverence for creation as a Druidic superstition, carrying a dangerous aroma of paganism.

We will take a close look at the consequences of that mental and cultural shift, especially in modern times with our growing population, increasingly powerful technology, and rising consumption. Then, we'll see what we can do about restoring our connections to nature.

Let's start with nine principles for how the creation works, as delineated by Janine Benyus in her landmark book, *Biomimicry*.

- Nature runs on sunlight
- Nature uses only energy it needs
- Nature fits form to function
- Nature recycles everything
- Nature rewards cooperation
- Nature banks on diversity

- Nature demands local expertise
- Nature curbs excesses from within
- Nature taps the power of limits.

Nature runs on sunlight

You and I and every other living creature that is a green plant, eats green plants, or eats animals that eat green plants is solar powered. Green plants, along with certain bacteria, are primary energy producers. Through photosynthesis, green plants use sunlight to produce sugars, a form of stored energy. Green plants produce 300 billion tons of sugar per year. We know generally how photosynthesis works, but the process is so intricately designed that we've never been able to duplicate it completely in the laboratory. The leaf of a plum tree is a far more sophisticated solar energy collector than a photovoltaic solar cell. Very simply, photosynthesis is a chain reaction of energy exchanges taking place at the atomic level. The process creates potential energy, much like stretching a rubber band or winding a clock spring. This potential is used to re-arrange water and carbon dioxide molecules to create sugar. As long as the sun shines, it's a clean, self-sustaining process.

In contrast to life-affirming sunlight, we rely on hydrocarbons as our primary energy sources. We are taking carbon compounds that accumulated below the surface from decaying plant and animal matter over millions of years, and we are releasing a great deal of carbon into the atmosphere in a combustion spasm taking place in, in geological terms, an eye blink of time. In doing so, we are unbalancing the atmosphere in, again speaking in geological terms, an eye blink of time. We are loading the atmosphere with CO₂ and other gases that trap heat. CO₂ levels are at their highest level in at least 450,000 years. Between 1995 and 2006, 11 of those 12 years rank among the 12 warmest years on

record. The Intergovernmental Panel on Climate Change's 4th Assessment, released in 2007, projects global average temperature increases ranging from 1.8 to 4 degrees C by the 2090s. On a global average scale that is a very big deal. Consider that if average temperatures dropped a few degrees, Seattle would be under an ice sheet.

Among the projected impacts are more erratic, more severe weather: longer droughts, harder rains, more violent hurricanes. The atmosphere is a heat engine, and when you put heat into it, it runs faster, like gunning a car's accelerator. With more heat, sea levels would rise from ice melt and thermal expansion, leading to more powerful storm surges and coastal erosion.

Other impacts are: Spread of tropical disease vectors into temperate zones. Dieback of forests unaccustomed to prolonged hot, dry weather. Intrusion of salt water into fresh water.

While some say that extra carbon in the air will actually help plants grow, there is some evidence that plants grown under such conditions are less nutritious. Also, the extra carbon may stimulate the growth of plants, but also stimulate the growth of pathogens carrying plant diseases.

Plus, burning hydrocarbons releases unhealthy air pollutants and hazardous toxins into the environment.

Nature fits form to function

Nature builds elegant structures through a manufacturing process carried out at the molecular level, in which proteins self-assemble themselves into precise configurations to carry out the task assigned by their DNA. DNA itself has a knack for assembling itself, and will rejoin in its precise configuration even if taken apart. It's like taking a car apart, putting the parts into a box, shaking it up, opening it up, and watching the car re-assemble itself.

By contrast, our manufacturing processes are crude in comparison, slamming molecules together with high-temperature furnaces or harsh chemicals that create greenhouse gases, toxic byproducts, and a great deal of material waste.

Examples: Trees produce wood, which can last for centuries, out of water and sugar produced from sunlight. The inner lining of abalone shells is as strong as industrial ceramics. Yet it's produced in cold water through a process of molecular self-assembly that use proteins as templates. Shellfish, like mussels, attach themselves to rocks with an advanced adhesive that is applied and cures underwater, without any surface preparation.

Spiders produce a strand of silk that has a tensile strength greater than steel. They make it without high temperature combustion or hazardous chemicals. The Army has sponsored research to find out how spiders do it, so that it could be replicated for body armor. There is a species of forest beetle that goes looking for forest fires. We don't know why they seek out fires, possibly as a gathering point. But the beetle has infrared sensors on its thorax so sophisticated that the Air Force is studying them.

Scientists are studying these humble creatures as models for nano-technology – self-assembling, molecular sized machines and fibers that are both strong and flexible. Or, we can just let the plants do the self-assembling and use what they produce. Imagine a car made of plastic derived from soybeans. Don't laugh. Long before nano-technology was thought of, Henry Ford experimented with soy-based plastics for body parts.

Plants and animals are the most sophisticated chemical factories in the world. Through millions of years of trial and error, they have perfected sophisticated formulas they use to survive in their ecological niches, which could supply a cornucopia of foods and medicines – if

we have the wisdom to let them. The leech – now there’s a charismatic animal for you. It’s a vampire worm. Its saliva contains an anticoagulant called hirudin that has been isolated and used to treat hemorrhoids, rheumatism and other ailments. The rosy periwinkle, a plant that grows on Madagascar, contains alkaloids useful for treating Hodgkins’ disease and a form of childhood leukemia. Forty percent of our pharmacopeia comes from plants and animals. Yet fewer than 3 percent of the 220,000 species of flowering plants have been examined for alkaloids that could have medical applications.

The same is true of food plants. Only 20 species provide 90 percent of the world’s foods. Perhaps 30,000 plants have edible parts. Many have superior qualities. A West African plant, the serendipity berry, yields a substance 3,000 times sweeter than sucrose. Salicornia is a salt-tolerant Mexican plant that can be irrigated with seawater and can produce a safflower-like oil.

Imagine computers running along biological lines. Today’s computers can crunch numbers at blinding speeds. But they don’t work like our brains work. Our brains excel at pattern recognition and learning. They are much more subtle and complex than electronic computers. Our brains control our bodies’ many physiological functions, process huge quantities of information from multiple senses, and allow us to reason and conceptualize abstract notions, from the most prosaic tools to the most bizarre forms of art.

Electronic computers work with micro-processors that carry out programmed instructions. Our brains compute with molecules that fall into place. Each of the one trillion cells in our brain is a kind of mini-computer wired into a massive network, containing possibly 100 trillion connections, through a messenger system of chemicals looking for the right-shaped molecule to connect to. Lock-and-key biochemistry.

Carbon is perfect for the biochemistry of life because carbon-based molecules can assume many shapes, thus have flexibility to form sturdy bonds with other elements. In our brains, nature builds in redundant connections, which allow for new patterns to accommodate new information, to evolve, to adapt, to learn. That’s how our brains work, that’s how nature works. There is a fascinating hypothesis that our consciousness is a function of two bizarre quantum forces: atoms can be in many energy states simultaneously while they search for the right one, and the second, even more bizarre is “quantum knowing:” subatomic particles can synchronize their movements at great distances, if they have once interacted.

Our silicon computers don’t work like our brains work because they’re not built to do that, because they didn’t emerge in a context of a natural habitat that threw life-threatening challenges at you hour by hour, moment by moment. Salmon are what they are because they arose and evolved in the context of the Northwest’s watersheds. We are what we are because we emerged in the context of the African savanna.

Someday, we may have carbon-based, DNA computers. Conceivably, molecular computers organized along biological principles could execute a quadrillion operations per second, three times faster than the most sophisticated supercomputer available today. Imagine, the design template for the greatest computers we could build has been between our ears the whole time.

Nature uses only energy it needs Nature recycles everything

Look at yourselves: the carbon, calcium, potassium, nitrogen, sulfur, and water in your body. You are made up of compounds that, at one time, may have been part of a tropical rain forest in Africa, grasses on the Asian steppe, a peat bog in Ireland. Perhaps a molecule of oxygen you’re breathing once was breathed by

Moses, St. Francis, or Jesus Christ, or perhaps by Genghis Khan, Ivan the Terrible, or Al Capone.

In a forest, when animals or plants die, countless species of insects, worms, fungi and microbes go to work immediately breaking them down into their constituent molecules for reuse by other animals or plants. Human life could not exist without these tiny creatures performing these services. We would soon run out of food and be buried in dead plant and animal material. Animals exhale CO₂, trees take in CO₂, take out the carbon for themselves, and release the oxygen. Rain falls, soaks into the soil, trees take it up, take what they need, then transpire the remainder back to the sky, where it goes into clouds.

In contrast, we waste a great deal. Nature has an efficient circular economy. One creature's waste is another creature's food. By contrast, we have developed an inefficient linear economy. We dig up resources, manufacture goods using processes that create waste heat and hazardous byproducts, use them, then throw them into airless landfills where they can't break down to serve as food. Imagine if we treated money that way. Mint it, use it once, then throw it away forever.

How much do we waste? Total annual waste generated in the U.S., excluding wastewater, exceeds 25 billion tons per year. Over the course of a decade 250 billion tons of materials are transformed into non-productive solids and gases that have no further use. Every product we consume has a dark history. The amount of waste generated to produce a laptop computer, for example, equals 4,000 times the weight of the computer. To produce one ton of paper requires 98 tons of other resources.

We create large ecological footprints. A couple of Canadian scientists came up with a calculation to determine how many acres of land are needed to support the material and energy

flows that underpin our lifestyle. What it comes down to is that we would need two Earths to support everyone to a U.S. standard of living, giving current consumption patterns. Double the world's population, add three more Earths.

Nature rewards cooperation

In our very bodies, intestinal bacteria break down foods so that our bodies can absorb the nutrients, asking only for a slice of the booty and a safe environment in return. In our gardens, ladybugs, beneficial nematodes, spiders, and many other creatures keep pests at bay.

In the great old forests of the Northwest, enormous trees and other plants are utterly dependent on tiny root fungi that provide them with phosphorus and other nutrients, and on tiny rodents that eat the fungi and spread their spores. In the canopies of old forests are mosses that grow on the foliage and rain nutrients down to the floor. The plant-fungus partnership made possible colonization of dry land by higher plants and animals half a billion years ago, when soils were barren and inhospitable to complex organisms. Certain bacteria convert atmospheric nitrogen into nitrates that plants can use for food.

Our food crops and other plants depend on pollinators – bees, bats, butterflies and birds. Pollinators serve 75 percent of the world's staple crops and 90 percent of the flowering plants. Yet we are losing pollinators to toxic chemicals and habitat loss.

Nature banks on diversity

There are millions of species alive today. How many, no one knows for sure. Scientists have described nearly 2 million, but undoubtedly there are millions more out there that we haven't discovered. Diversity is the key to the strength of the ecosystems that sustain us. With more diversity, there are more ways to move energy and process nutrients. Diverse species produce the air we breathe, the water we drink, and the food we eat. Green plants keep our atmosphere's

gases in balance. We often look down on bugs and worms and ask: what good are they? God knows. Species few of us have ever seen or heard of recycle dead organisms and reintroduce their nutrients into ecological commerce. Bugs and worms build soils that cleanse water, store water, prevent flooding, and nourish forests. Obscure plants and animals are an untapped cornucopia of foods, medicines, fibers, materials, and energy sources.

The more diverse the system is, the more efficiently it processes energy and materials. Compare the economic vitality of a city with its diverse businesses providing numerous services with a depressed rural community that has lost its hardware store, theater, and doctor.

It is diversity that enriches life. Species have spread into the most unusual habitats on Earth – tropical forests where rain falls daily, stony deserts where years pass without rain, high in the mountains above the tree line, tidepools along the seashore. In Antarctica, certain fishes swim in cold bays, their tissues kept liquid by glycopeptide anti-freeze. In permanently dark caves, blind spiders feed on blind mites. At the bottom of the sea, one-celled microbes thrive in boiling water near seabed vents.

Diversity is a source of resilience. A diverse ecosystem is much less susceptible to the vicissitudes of life – storms, disease, pests – because different species have different strengths. You don't have all your eggs in one basket. It's like an investment portfolio, where you hedge your bets by buying stocks in different industries.

Nature demands local expertise

When I was working at Lake Tahoe, one of the environmental problems we were dealing with was lawns. People would move to Lake Tahoe, which is at 6,200 feet, and plant the kinds of lawns they were used to in the lowlands – Kentucky blue grass, for example. What they found was that Kentucky blue grass is adapted

to growing in Kentucky, where the soil is rich and the climate is warm and moist. Left to its own devices, Kentucky blue grass doesn't do well in the thin, dry air of the Sierra characterized by droughty, granitic soils, 20 feet of snowfall in the winter, and almost no precipitation during the summer. So, they helped their lawns along with generous applications of water and fertilizer. Usually, they applied too much fertilizer, and the irrigation water pushed the fertilizer nutrients into the lake, causing algae to grow and impair the world-renowned clarity of Lake Tahoe, which Mark Twain once called the fairest picture the whole Earth affords. (What Twain didn't tell you is that he accidentally started a forest fire at the lake by failing to fully douse a campfire.)

The point of this story is that plants and animals are adapted to their surroundings. They are one with the soils, weather, topography and other forms of life in their habitats. At Lake Tahoe, we tried to encourage people to avoid Kentucky blue grass and plant grasses that were a better fit for the area, certain fescues, for example.

Close to home, we have our famed salmon. Chinook salmon and sockeye spend years in the far reaches of the Pacific Ocean. Yet they use a highly refined sense of smell, which can distinguish among countless scents to pick out the distinct odors that guide them back to the waters where they spawned, even if it's thousands of miles away, in a small mountain creek in eastern Oregon. Each race of salmon is adapted to the unique surroundings of its natal stream. Salmon developed local expertise as a survival strategy. The Northwest is one of the most geographically diverse terrains on the planet, subject to tumultuous weather and geological forces. Salmon have survived by diversifying into numerous races adapted to individual watersheds.

That's why hatchery programs have failed to reduce the decline of wild salmon. Hatcheries have bred one-size-fits-all fish, which is a

survival strategy that doesn't work well in the Northwest.

Nature curbs excesses from within Nature taps the power of limits

Excess doesn't work as a survival strategy. Imagine a forest of deer without wolves. The deer have no enemies, breed freely, and soon eat themselves out of house and home, killing off themselves and forest plants, the primary energy producers, leaving a biologically impoverished ecosystem. Put a few wolves into the equation, and it balances. Wolves cull the herd, make it stronger and reduce pressure on the plant life. Wolves curb the deer's excess and enable the deer to tap the power of limits.

Look at invasive species. Scotch broom and English ivy here. Leafy spurge in the high Plains. Kudzu in the South. Zebra mussels in the Great Lakes. They have no limits because they are in a strange land that had no need to evolve predators to control them. They muscle other creatures out of the way, reduce the ecosystem's diversity and diminish its power to support a rich, healthy array of wildlife.

Limits actually give us power to be more creative and more prosperous. Remember the wisdom of the Sabbath. On the seventh day we rest, we limit ourselves, and become re-ensouled.

Add up everything nature does for us and it's like having a store of capital delivering interest income. In fact, a group of economists took a rough shot at estimating the value of that income. They came up with nearly \$40 trillion per year, given to us, free of charge, by Creation. Yet that figure is misleading because some services cannot be replicated for any price – oxygen production by green plants, or the breakdown of organic waste by insects and microorganisms. Try building a butterfly from scratch and program it to pollinate your garden.

However, our economy's bookkeeping takes no notice of the value of such services. In fact, under our system, we perversely classify depletion as income. As our population grows and as our technology grows ever more powerful, we are placing systemic, interlocking pressures on the ecosystems that deliver these vital services. Nature is very resilient, but can absorb only so much waste, can take only so much pressure on vital ecosystems. This is both a practical and a moral problem.

Species come and go all the time. Most of the species that ever were are extinct. Today there are more species than ever. Yet diversity is eroding at a rate unprecedented in human history. Today, we are in the middle of the sixth great extinction spasm that has taken place since life emerged nearly 4 billion years ago. This is the first spasm that we know of that is being caused by one species. Species are disappearing at a rate 1,000 to 10,000 times greater than normal background rates.

That's because we are eliminating habitat diversity, shrinking, simplifying, and polluting forests, grasslands, wetlands, and other gathering points for wildlife. Today, humans number more than 6 billion. In 50 years, we may well be at 10 billion. We appropriate 40 percent of the planet's primary productivity, its plant life, for our use. In the last half-century, the world has lost at least a third of its forest cover and a fourth of its topsoil. We face the loss of 70 percent of the world's coral reefs, home to one-fourth of marine species. We are putting more CO₂ into the atmosphere than can be absorbed, leading to an imbalance that is disrupting the climate. We are putting persistent toxins into the environment that nature has no experience absorbing, so they build up and tinker with the very chemistry of life.

We could lose a quarter of all the world's species, even millions that have never been studied, in the next 20 years. It's like burning library books, because these species contain

genetic coding that are survival blueprints for the forest, grassland, desert, and other habitats found on our planet. As conservation biologist E.O. Wilson put it: “The flower in the crannied wall – it is a miracle if not in the way Tennyson, the Victorian romantic, bespoke the portent of full knowledge (by which ‘I should know what God and man is’), then certainly a consequence of all we understand from modern biology. Every kind of organism has reached this moment in time by threading one needle after another, throwing up brilliant artifices to survive and reproduce against nearly impossible odds.”

More important is the brilliance of the design – species in combination. Take that flower out of its wall cranny and look at the soil around its roots. As E.O. Wilson writes: “The black earth is alive with a riot of algae, fungi, nematodes, mites, springtails, worms, thousands of species of bacteria. The handful may be only a tiny fragment of one ecosystem, but because of the genetic codes of its residents, it holds more order than can be found on the surfaces of all the planets combined. It is a sample of the living force that runs the earth – and will continue to do so with or without us.”

So, what do we do? The key is to restore our reverence for Creation and our sense of connection, our oneness with our surroundings. Since the Renaissance, we have increasingly frayed our bonds to a dangerous point, dangerous to ourselves and to many of the expressions of life with which we share our world.

In *Natural Capitalism*, Amory and Hunter Lovins propose four steps:

- Radical Resource Productivity
- Biomimicry
- Service and Flow Economy
- Investing in Natural Capital

I would add a fifth, spiritual dimension:

- Restore our Reverence for Creation, a Creation that is Sacred by Design.

What do these mean?

Radical Resource Productivity means, in old-fashioned terms, waste not, want not. Squeeze the waste out of our use of energy, water and materials. Let’s look at paper as an example. Start with the consumer and work back to the forest. Little things add up. Cut 10 percent of paper use through use of electronic media. Cut 50 percent through double-sided printing, scratch paper reuse, and other efficiencies. Upgrade pulp mill processes to increase efficiency 5 percent. Reduce paper basis weight. Supplement wood with non-wood fibers. What does all that yield – 81 percent decrease in paper demand with no decrease in the service paper provides.

Biomimicry: Our manufacturing systems produce huge amounts of waste heat, gases, sludges, and toxic liquids, much of it hazardous and long-lived. By imitating nature’s methods of low-temperature, water-based chemistry, and solar-powered manufacturing, we can produce good products that deliver desired services without all the waste and pollution. Same with farming. The Land Institute in Kansas is experimenting with a new type of farming called perennial polyculture. Instead of planting monocultures of annuals that must be doused with chemical fertilizers and pesticides, you plant multiple species of perennials that create a natural-like ecosystem. Pests keyed to single species would be thwarted by plant diversity. Plants would enrich, rather than deplete soils. Elimination of plowing would protect soils.

Service and Flow: Think of a product as a service. What is a refrigerator? Is it just a metal box that uses electricity to run a compressor and a motor to circulate a heat transfer fluid? No, it’s a platform for providing the service of keeping your food fresh and edible. So, if the refrigerator does just as good a job, but uses

much less electricity and the materials can be recycled at the end of their life, what do you care? In nature, materials circulate round and round, being used again and again to provide services for living creatures. Why not an economy that runs the same way? You lease a car that provides you with mobility and access, then the manufacturer takes it back, rebuilds it or recycles it, and you lease another car, or perhaps buy a package of transportation services that includes car share, electric bicycle rental, and bus-rail passes. No more rebates to sell cars no one ordered, but were built because management had to fill production quotas needed to amortize capital equipment that was never needed in the first place.

Investing in Natural Capital: Taking care of our natural capital – protecting native forests, reforesting cutover lands, restoring depleted soils, protecting wetlands, estuaries, and coral reefs.

Finally, **Renewed Reverence for Life:** The 104th Psalm says it all: “O Lord, how manifold are thy works. In thou wisdom has thou made them all. The Earth is full of thy riches.”