Biosphere - The Fragility of our Natural Heritage

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An Appeal to Save Life on Earth

United Nations International Year
of Biodiversity 2010

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Year of publication - 2010

Other Publications from the Author:

1. Earth-The Lost Paradise of Happiness, 2009.
2. Global Warming - Everything you want to know! 2010.

Published by:
LTD Media,
C4, Velan Appartment, 4th Street,
Railway Colony, Nelson Manickam Road, Chennai - 600 029.

Printed at:
Saravana Graphics, Aayiram Villakku, Chennai - 600 006.

Cover Page Designed by Rayappa A. Kasi
Images of Biodiversity
Courtesy of Google

Explanation of the Jacket Illustration:

Picture on the cover reminds us of millions of species of plants and animals cohabiting in Biosphere, once we get to know them as our close biotic neighbors, become objects of personal concern. All around the world there is an awakening of understanding and compassion, an understanding that reaches out to help the suffering animals in their vanishing Biosphere. This picture symbolizes the fragility of our Natural Heritage.

Price : Rs. 80/-

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Preface

"If You Want to Cultivate Peace, Protect Creation," wrote Pope Benedict XVI. Have you ever considered that the water we drink from our taps may have been purified by a wetland or forest? Did you know that much of the food we eat depends on the services provided by a diversity of pollinating insects and animals? All these services are provided by Biosphere, free of charge. But, Biosphere is wounded and bleeding. We are destroying the very fabric of our life that created and supported all of us in the first place. *Biosphere-The Fragility of our Natural heritage, is a call to action and a prescription for biodiversity conservation in your village, Tamil Nadu, India and around the world*. The author encourages you to borrow ideas and discussions liberally and disseminate the report widely. The report includes an alarming situation of species' extinction in Biosphere and a discussion on what every citizen can do to facilitate biodiversity conservation, and lays out goals for the next decade. This book is an excellent guide for both professional scientists and amateur naturalists. Reading it cover to cover, you may be inspired or surprised with its excellent detail and expertise. I hope this book will shed some light on the unknown location and status of representative threatened species, and above all, what has been done already and must be done in the future to save Indian and International native fauna and flora. *They are, after all, our oldest and least irreplaceable heritage on Planet Earth*. In India, there exists a tremendous variety of plants and animals, natural communities, and ecosystems. Many of these species and natural communities are uncommon and under-protected. Our country has in some cases the largest remaining populations of a species, or the best remaining examples of an entire natural community or ecosystem globally. The focus of this book is on the conservation of these rare, threatened, or vulnerable plants, animals, and exemplary natural communities.

A great deal of harm is being done to the environment, and thus to animals, in the name of "progress," for the economic benefit of those who are already wealthy and have more than they need, but continue to demand more. *Meanwhile, the ever mushrooming human populations place increasing demands on dwindling natural resources. There are more than six billion of us now on the planet.* In some areas, the environment is damaged by those who are desperately poor and struggling to make a living in areas where the land can no longer support their increased numbers. They

cannot afford to buy food from elsewhere, so they cut down the trees to make space for their crops, houses, and livestock. Wild animals are hunted, shot, trapped, and snared, for food, but also by poachers anxious to make extra money by selling animals, or parts of animals, to anyone who will buy them. Unscrupulous and corrupt government leaders in some parts of the developing world, such as India, China, Brazil, pocket large amounts of money, much of which goes into private bank accounts, in exchange for leasing huge areas of virgin rain forest to foreign logging companies. Sometimes these companies are equally unscrupulous and practice clear-cutting, stripping the land and destroying habitats. As a result, deserts are spreading in the tropics and droughts and floods are becoming ever more frequent and more severe. Indeed, flooding as a result of ever increasing deforestation has become a huge annual problem all over the world, from India to Argentina and Bangladesh to South Africa. The accumulation of "greenhouse gases," particularly from the burning of fossil fuels, is almost certainly contributing to the noticeable changes in global climate. This, in turn, affects Biosphere and a whole variety of animals.

Biodiversity refers to the variety of life on Earth. It encompasses the wide array of ecosystems, ecological processes, species and genes that contribute to human health and well-being. *The United Nations declared 2010 as the International Year of Biodiversity to bring greater attention to the importance of biodiversity and efforts to reduce the current rate of biodiversity loss. UN International year 2010 was negotiated in response to the world-wide species' extinctions, including trees, insects, animals, aquatic life and natural organisms. Biodiversity loss is one of the most significant threats facing the global environment.* Citizens of this country are national leaders in the movement to conserve biodiversity. The conservation of this great variety of life is a priority for many, especially those who recognize the many values it offers the country. Residents, conservation organizations, and the legislature have protected biodiversity through model legislation, land acquisition and management, and innovative conservation tools. *Yet some critical components of biodiversity in India, still lack sufficient protection to ensure their survival in perpetuity.* There are plants, animals, and entire natural communities that are not well protected on conservation land. Certain plants and animals continue to decline in numbers and distribution. Some natural communities are also becoming increasingly rare due to a variety of adverse conditions, often caused by humans. More than 75 species that were known to occur in India have been lost. All of the remaining plants, animals, and natural communities in India can be conserved with a more focused approach and a renewed commitment to biodiversity conservation.

I thank Mrs. Francine Bell, Fr. Joseph, Fr. Roy Lazar, Fr. Stephen Pillai, Fr. Joemics, Fr. Lawrence Varam sdb, Fr. Augustine sdb, Fr. Sagayaraj Kasi sdb, Fr. Chinnappa omi, Fr. D.F. Bosco, Fr. Johnson, Fr. Arulsamy, Fr. Christian, Fr. Samuel, Fr. Gnana Jyothi, Fr. Susai Regis, Sr. Amala fma, Sr. May fma, Sr. Auxilia and Leonie, Sr. Baby Victoria, Sr. Veda, Sr. Fatima, Sr. Felix, Sr. Margaret, Sr. Joyce Sherina, for their consistent support and their openness to the ecological problems. I thank in a special way to Mr. Sagayam and Fatima who value ecology and environment as their primary objectives in life and LTD Media for publishing this book. This book recommends that the government and Church develop a Biodiversity Protection Strategy that clearly outlines how all native biodiversity will be conserved. It also identifies and describes number of natural communities we believe require immediate conservation attention because of their vulnerability and the large number of rare species they contain. Many evaluations are presented, including analyses of how effective past land protection efforts have been at conserving biodiversity, the distribution and status of rare plants and animals in India, the success of legal protections and restoration efforts, and the primary threats to biodiversity. *Let us not forget that in most instances we have intruded on other animals, they are not the intruders. And many animals suffer each and every day because of the messes we make. No shark ever came out on our street, begging for food. On the other hand we intrude and exploit their habitats.*

Do we really want to live harmony with nature? Are we truly the people we think we are? These are simple yet extremely challenging questions. If we answer yes to either or both, which not only is politically correct but also ethically and ecologically correct, we are compelled to move forward with grace, humility, respect, compassion, and love. We will need to replace "mindlessness" with "mindfulness" about our interactions with animals and the Earth. Nothing will be lost and much will be gained. We can never be too generous or too kind. Surely, we will come to feel better about ourselves if we know deep in our hearts that we did the best we could and took into account the well-being of the magnificent animals with whom we share Earth, the awesome and magical beings who selflessly make our lives richer, more challenging, and more enjoyable than they would be in the animals' absence. Doesn't it feel good to know that there are animals "out there" whom we have helped even if we cannot see them? Doesn't it feel good to know that we did something to help the Earth even if we do not see the fruits of our labor*? As we attempt to restore nature, we can restore ourselves, our psyches that have been fragmented because of our alienation from animals and other nature*. We often turn toward nature when we're feeling down. We need animals, nature, and wilderness.

We need to wage peace. Caring for others also brings much peace, and this peace can spread rapidly and widely among all peoples. Peace and reconciliation are at the top of the agendas of many world leaders. Peace and calm, and personal happiness, as stressed by His Holiness Pope Benedict XVI and His Holiness the Dalai Lama, are needed to bring individuals into a community in which differences are pushed aside for the common goal of making this a better world for all beings. Let us never avert our eyes from the gaze of the animals who need us and whom we need as much or more. Life without our animal friends would be lonely and miserable. In the grand scheme of things, individuals receive what they give. If love is poured out in abundance, then it will be returned in abundance. There is no need to fear depleting the potent and self-reinforcing feeling of love that continuously can serve as a powerful stimulant for generating compassion, respect, and more love for all life. Each and every individual plays an essential role and that individual's spirit and love are intertwined with the spirit and love of others. *These emergent interrelationships transcending individuals foster a sense of oneness.* These interrelationships can work in harmony to make this a better and more compassionate world for all beings. We must stroll with our kin and not leave them in the wake of our tumultuous, rampant, self-serving destruction.

By minding animals we mind ourselves. Personal transformations will serve us well. We owe it to future generations to transcend the present, to share dreams for a better world, to step lightly, to move cautiously with restraint. We destroy one another when we destroy the Earth. We all can be dreamers and doers. We owe it to ourselves and to other animals, to whom we can, unfortunately, do whatever we choose. We owe it to ourselves to keep in mind the power of love. *As big-brained, omnipresent, powerful, and supposedly omniscient mammals, we are the most powerful beings on Earth.* We really are that powerful, and with that might are inextricably tied innumerable staggering responsibilities to be ethical human beings. Human being is a outcome of compassion and kindness. Human being is designed to love and protect, as he exercises his stewardship on Biosphere – The Fragility of our Natural Heritage.

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14.4.2010
On the Occasion of Tamil New Year
On the Occasion of Catholic International Year of Priests 2010

Biosphere – The Fragility of our Natural Heritage

Enchanted by accounts of the rich Biosphere and its biodiversity of Amazon, the Serengeti* and other far-away places, we too easily forget the riches that live all around our home. The species of Tamil Nadu, India, may be far fewer in number than in rain-forested countries, *but individually they are as spectacular and endearing*. Just a glimpse of a cobra or colorful peacock thrills us; the mongoose, butterflies, frogs, fireflies, birds, once we get to know them as our close biotic neighbors, become objects of personal concern. And consider this general rule of conservation biology: the value of any particular threatened species from Tamil Nadu chosen at random is the same as one from a tropical forest or savanna in potential scientific knowledge, ecological importance, and practical use it offers. *2010 has been designated as the United Nations International year of Biodiversity. Biosphere is the place, such as air, water, land where all living beings live together.* A changing climate endangers whole ecosystems and entire species. Instead of preserving Earth's biodiversity, human actions are advancing its destruction. *Biodiversity is the variety and differences among living organisms from all sources, including terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are a part and this includes genetic diversity within and between species and of ecosystems.* In this book we explore what is known about the plants, animals, and microbes on Earth from the point of view of what they do for us: how they keep us alive, how they feed us, how they sustain our economy, how they are a source of immense wealth and well-being that we are still beginning to understand.

Biosphere supports a whole array of living things. Today, we are still dependent on much of the same variety of animals and plants, both wild and domesticated. When asked to think of useful plant species, most of us can name a whole array: rice, corn, wheat, barley, oats, apples, bananas, plumes, cabbage, broccoli, lettuces, carrots, onions, dates, rubber, quinine, peppers, cinnamon, oregano, roses, daffodils, orchids, oaks, tamarind, neem, raintree, teaks, pines, redwoods, coconuts, breadfruit, potatoes, watercress, lotus, seaweeds, grapes, peas, beans, coffees, teas, olives, peanuts, cotton, sunflowers, pineapples, millet, sugar peaches, bamboo,

**Serengeti is one of the best places in Tanzania and Kenya to see lion, cheetah and 35 other species close up. The vast, open grasslands of the Serengeti are without doubt one of Africa's finest wildlife areas, and being there at the height of the wildebeest migration is a never-to-be-forgotten experience.*

and oranges. Most of us, with a little thought, can add more plants to this list, but how many more? *Animal diversity has also been a major resource for human cultures worldwide*, providing cattle, sheep, pigs, horses, chickens, ducks, turkeys, llamas, alpacas, guinea fowl, reindeer, geese, ducks, turkeys, goats, camels, yaks, buffalo, and a range of fish from sardines to sharks. Animal diversity has also provided more modest but highly valued sources such as honey bees, scallops, oysters, lobsters, and crayfish; and we should not forget that cultures around the world rely on a huge variety of animal foods, including insects such as caterpillars, grasshoppers, ants, and beetles larvae.

Humans have exploited the Biosphere. Human beings have already made use of many thousands of species. In this book we shall show that, one way or another, our dependence on biological diversity is still growing rapidly. Our exploration of the species with which we share the planet is full of surprises as we find that many species on which we depend are unexpected: *new antibiotics from ants and termites; life-saving medicines from leeches and parasitic worms;* construction materials from snails and spiders; robots inspired by insects and earthworms; bacteria, fungi, and mites running major industries and public services. Most people believe that our future depends on electronics, computers, and space-age transportation. But it is Biosphere that we will depend on more. Biosphere is more revealing as it is very mysterious. In fact, that future is equally bound to a host of mostly tiny organisms that we are only beginning to understand. The creatures that live in our soils are worth far more to us than all the products of Silicon Valley. *Before we attempt to go any further, let me make an appeal to save life on Earth.* I am puzzled that so many religious leaders, who spiritually represent a large majority of people around the world, have hesitated to make protection of the creation an important part of their religious and social teachings. Do they believe that human-centered ethics and preparation for the afterlife are the only things that matter? However, religions could play an important role in saving and conserving the species on Earth. I do acknowledge the important roles played by all the major religions in protecting our nature. The following appeal to all the leaders who hold high positions in religions, in a special way to Catholic priests. Catholic Priest symbolizes the universal appeal to all religious beliefs. *Priests are well prepared to present the theological and moral arguments for saving the creation. I am heartened by the movement growing within Christian denominations and other religions to support global conservation.* Today it is but a rivulet. Tomorrow it will be a flood. There can be change, only if all religions can unite in this effort of saving Biosphere.

Year of Priests – An Appeal to Catholic Priests to Save Life on Earth

Psalm 24:1 declares, "The Earth belongs to the Lord and everything in it, the world and all its peoples."

Pope Benedict XVI proclaimed a Year for Priests on the occasion of the 150th anniversary of the death of St. Jean Marie Vianney, the Cure of Ars.* The theme for the year will be "Faithfulness of Christ, Faithfulness of Priests." Pope has declared a "Year for Priests" beginning with the solemnity of the Sacred Heart of Jesus on June 19, 2009. The year will conclude in Rome with an international gathering of priests with the Holy Father on June 19, 2010. Life of a priest is an extraordinary life which touches the depths of people's reality in a privileged way and out them in contact with the things of God in the person of Jesus Christ. Considering priesthood in my life, because Church life has resonated within me, I've grown up with it right from the very start in my village. I've come from a very close knit parish community which has really inspired by love of God and the Church. *The priesthood is certainly a very challenging life. For people who think it's a dull and boring existence, if only they could come and see what it's all about …"* At ordination, a priest becomes another person, commissioned not simply to act in the name of Christ, but to be another Christ, an *"alter Christus."* This teaching was not an original insight of the Second Vatican Council. It is the traditional teaching of the Church. The role of the cross and suffering in the life of a priest is one of the highlights of humanity. Yet the suffering of a priest is tinged with joy because he suffers for the sake of others along with Christ, bolstered by Jesus himself. However, a priest is a link between the society and transcendence. Only a priest has the ability to link religion and politics. Religion and politics are the two most powerful forces in the world today. *If religion and politics could be united on the common ground of biological conservation, the problem would soon be solved.* If there is any moral precept shared by people of all beliefs, it is that we owe ourselves and future generations a beautiful, rich, and healthful environment.

**Saint John Mary Vianney is familiarly known as the Cure of Ars is the patron of all parish priests born in France in 1786 and died in 1859.*

The year of priests tries to respond to the reality of the Church at this time in history. For one thing, the priesthood in the wake of the ecological decline with global warming and climate change needs to play an important leadership for the protection and the conservation of the natural world. *There is compelling environmental and spiritual reasons to be alarmed about pollution and Earth's rapidly declining biological diversity.* It is the same redemption role Jesus played 2000 years ago, we could play right now. Our priesthood allows us to take risks in life, if it is necessary lay down one's life for the sake of humanity. It is my earnest appeal to all my priest friends out there to save life on Earth. Many animals and plants are driven out to extinction, everyday. Human activity has declared war on creation. Politics and other organizations on Earth have failed humanity's hope for action in Copenhagen. *The only option available right now is religion and indeed, religion is a powerful tool to bring out change. Priesthood is another powerful tool, too,* which is definitely powerful enough to save and redeem what has been lost and what is being threatened now in the world. If priests speak the whole parish listens, hence we could use all our authority and service, in bringing the needed awareness to people around us, bringing to their notice the alarming situation, the world is in. *If the two powerful religious or social and political forces can be combined in a mutually respectful alliance, with basic metaphysical differences put aside in the service of real-world goals, some of the greatest problems of the twenty-first century might be solved quickly. Catholic priests could help usher our world, so painfully divided today by culture and politics, into a new era of respect and mutual understanding.* By protecting and conserving the natural world, every priest becomes a "redeemer" and a "hero." "Go and preach the good news to all creation," has been a powerful command to save the lost and give hope for the future.

Every priest plays a redemptive role in the lives of people. Redemption refers to the restoration of humankind and all of creation from the consequences of sin, through the death, resurrection, and ascension into heaven of Jesus Christ. The incarnation of Jesus signifies the taking up into unity with God the whole of humanity as well as the entire visible, natural and material world. *The redemptive act of Jesus extends to all of creation, all of which shares a common destiny. The resurrection of Jesus began the transfiguration of every creature. The work of creation culminates in the greater work of redemption.* John Paul II has said, "Christians believe that the death and resurrection of Christ accomplished the work of reconciling humanity to the Father, who was pleased … through Christ to reconcile to himself all things, whether on Earth or in heaven, making peace by the blood of his cross." Creation was thus made new. Once subjected to the bondage of sin and decay, it has now received new life while we wait for new heavens and

a new Earth in which righteousness dwells. Thus, the Father has made known to us in all wisdom and insight the mystery … which he set forth in Christ as a plan for the fullness of time: *to unite all things in him, all things in heaven and things of Earth.* The first creation finds its meaning and its summit in the new creation in Christ, the splendor of which surpasses that of the first creation. According to John Paul II, "The essential joy of creation is completed by *the "joy of salvation," by the "joy of redemption … The work of redemption is to elevate the work of creation to a new level.* Creation is permeated with a redemptive sanctification, even a divinization. It comes as if drawn to the sphere of the divinity and of the intimate life of God.

In 1990, Pope John Paul II issued his World Day of Peace message, "Peace with God – Peace with all of Creation," in which the Holy Father announced, "There is a growing awareness that world peace is threatened not only by the arms race, regional conflicts, and continued injustice among peoples and nations, but also by a lack of due respect for nature …" Some people believe that the Roman Catholic Church has only recently jumped into the fields of environmental justice, ecology, and conservation. Nothing could be farther from the truth! According to a leading Roman Catholic champion of environmental justice, Sacred Heart of Mary Sr. Marjorie Keenan, "To commit oneself to the promotion of a sound and healthy environment for all is to follow God's plan for creation, a plan entrusted to us from the beginning." Since its inception, the Church has instructed us on the proper dominion and stewardship of Creation. This wisdom is made known to us through sacred scripture, the living tradition of the Church, the message of creation, and the voice of conscience enlightened by God's law. *Then what are we waiting for? Remember we are the stewards! The Creation cries out loud for renewal and obviously, every priest receives this message loud and clear. As image and likeness of God every human being is designed to hear it.* It is a last call and last opportunity to save life on Earth. "And only where God is seen does life truly begin. Only when we meet the living God in Christ do we know what life is. We are not some casual and meaningless product of evolution. Each of us is the result of a thought of God. Each of us is willed, each of us is loved, each of us is necessary. There is nothing more beautiful than to know him and to speak of others of our friendship with him," wrote Benedict XVI.

The Catholic approach to environmental justice is based on the two commandments of Jesus Christ: *to love God above all things and to love our neighbors as ourselves*. Love of God requires respect for God's gifts and for God's will for creation. Love of neighbor requires justice, which prohibits the selfish destruction of the environment without regard for those in need

today or for the needs of future generations. The Catholic attitude toward nature, in a word, is stewardship. Stewardship is the careful and responsible management of something entrusted to one's care. From the first pages of the Bible, we are instructed to "cultivate and care for "God's creation (Genesis 2:15). Created in the image and likeness of God, we are granted dominion over the rest of creation (Genesis 1:26-28). *Dominion means that we have sovereignty over and responsibility for the well-being of God's creation. We resemble God primarily because of this dominion; hence, our dominion must also resemble God's dominion.* We must cultivate and care for the Earth as God does, with love and wisdom. As Catholic priests, we are called in a special way to exercise dominion in ways that allow God's original creative act to be further unfolded. Dominion does not mean that God does not care how we use the material world. From the beginning, God insists that humans are not "little gods" with limitless authority. *Not only does Genesis describe the creation of humankind as "very good," it describes the creation of non-human creation as "good." In other words, nature has its own value, and that value is given by God.* God enables people to be intelligent and free causes in order to complete the work of creation and to perfect its harmony.

A Balanced Appeal to Save Life on Earth - "If the Church's Magisterium (teaching office of the Church) expresses grave misgivings about notions or the environment inspired by ecocentrism and biocentrism, it is because such notions eliminate the difference of identity and worth between the human person and other living things. In the name of a supposedly egalitarian vision of the "dignity" of all living creatures, such notions end up abolishing the distinctiveness and superior role of human beings. They also open the way to a new pantheism tinged with neo-paganism, which would see the source of man's salvation in nature alone, understood in purely naturalistic terms. The Church, for her part, is concerned that the questions be approached in a balanced way, with respect for the "grammar" *which the creator has inscribed in his handiwork by giving man the role of a steward and administrator with responsibility over creation, a role which man must certainly not abuse, but also one which he may not abdicate.*" Here Catholic priesthood and stewardship find common ground in their mission of caring, loving, saving, redeeming and conserving. Stewardship and priesthood involve a lifelong process of study, reflection, prayer, and action. To make stewardship and priesthood a way of life across the world requires a change of heart and a new understanding of what it means to follow Jesus without counting the cost. This conversion of mind and heart will not happen overnight, but, as always, the Holy Spirit is at work in the Church today. A comprehensive approach to stewardship education and formation is essential if parish communities truly wish to make stewardship a way of life for disciples, families, and communities.

The foundation of everything we take on is rooted in the mission Christ has placed before his disciples. Every priest is a steward and not every steward is a priest. Christ has no body now on Earth but you, no hands but yours, yours are the eyes through which he is going about doing good, yours are with which he is to bless people now …" *"Our Earth speaks to us, and we must listen if we want to survive,"* wrote Pope Benedict XVI. *Catholic Priests interact with almost 1 billion people on the planet every Sunday through their sermons and masses. Here is our opportunity to make a difference. No other leaders on Earth have this kind of opportunity.* "Stewardship is a lifestyle, a life of total accountability and responsibility. It is the acknowledgement of God as the Creator and Owner of all. Christian stewards see themselves as the caretakers of all God's gifts. Gratitude of these many gifts is expressed in prayer, worship, offering and action. Stewardship is a way of life. It is a way of thanking God for all our blessings by returning to God a portion of the many gifts that we have been given. It involves the intentional, planned and proportionate giving of all we have" *(St. Theresa of Avila)*. Stewardship encourages everyone to participate in the task of building the kingdom of God. He has given each of us certain things, and we are responsible for caring for them and accountable for what we do with them. Stewardship rejects the notion that we must "have it all" and instead demonstrate the value of giving in love, in service and in justice. Good steward have an "attitude of gratitude." Here are some helpful guidelines to the priests, enabling them to go ahead confidently, after the challenges of saving and conserving the creation.

Seven Themes of Ecological Responsibility

1. *A God-centered and sacramental view of the universe:* In a sacramental view, nature's beauty and diversity reveal something about God. God is present and active in creation, while also transcendent. "Faced with the glory of the Trinity in creation, we must contemplate, sing, and rediscover awe," said John Paul II.

2. *A consistent respect for human life, which extends to respect for all creation:* The Church approaches the care and protection of the environment from the point of view of the human person. Men and women are created in the image and likeness of God. Fostering and protecting human life and dignity, from conception to natural death, lies at the Church's social teachings. We now realize that respect for human life and respect for nature are inextricably linked. Our lack of respect for life extends also to the rest of creation and is an underlying cause of social injustice and environmental destruction.

3. *A world view affirming the ethical significance of global interdependence and the global common good:* Recent ecological concerns have heightened our awareness of just how interdependent our world is. According to John Paul II, "Today the ecological crisis has assumed such proportions as to be the responsibility of everyone … Its various aspects demonstrate the need for concerted efforts aimed at establishing duties and obligations that belong to individuals, peoples, states, and the international community."
4. *An ethics of solidarity promoting cooperation and a just structure of sharing in the world community:* We are all parts of one human family, whatever our national, racial, religious, economic, or ideological differences. Solidarity is a firm and preserving determination to commit oneself to the common good, and a willingness to lose oneself for the sake of others, including future generations. Solidarity must take into consideration not only the needs of all people's but also the protection of the environment in view of the good of all.
5. *An understanding of the universal purpose of created things, which requires equitable use of the Earth's resources:* God has given the fruit of the Earth to sustain the entire human family, including future generations. "The world is given to all, not only to the rich," said Pope Paul VI. It is manifestly unjust that a privileged few should continue to accumulate excess good, squandering available resources, while masses of people are living in conditions of misery at the very lowest level of subsistence. Today, the dramatic threat of ecological breakdown is teaching us the extent to which greed and selfishness, both individual and collective are contrary to the order of creation, an order that is characterized by mutual interdependence.
6. *An option for the poor, which gives passion to the quest for an equitable and sustainable world:* The ecological problem is intimately connected to justice for the poor. The option for the poor embedded in the gospel and the Church's teachings makes us aware that the poor suffer most directly from environmental decline and have the least access to relief from their suffering. *It is important to note that populations of poor people are never the primary cause of ecological destruction; rather, they are its victims.* Our duty is not only to share our wealth, but also to promote the values and institutions that generate wealth: economic freedom, political liberty, private property, the rule of law, and respect for human life and rights. No amount of aid can ever be enough if the leaders of developing countries do not respect their people, open their markets, invest in better health and education, conserve the natural environment, and abide by a legal system that is fair and consistent. Insisting on reform is a challenge, but it is also a work of compassion.

7. *A conception of authentic development, which offers a direction for progress that respects human dignity and the limits of material growth:* Much of the destruction of creation is caused by sin, including the sins of arrogance, greed, and disrespect for life. Add to that human ignorance and error. These lead to rampant consumerism, haphazard development, social injustice, the indiscriminant application of technology, and ultimately violence. Numerous social conditions, including love, health, freedom, economic and material prosperity, and a healthful and beautiful environment, impact our ability to realize our human dignity and reach our full potential. In addition, humankind carefully and wisely develops creation so that the whole creation reaches its full potential, according to God's will. Instead of limiting ourselves to "sustainable development," Catholics strive for more: we strive for "authentic development" for humankind and the whole of creation. *"Development cannot be limited to mere economic growth. In order to be "authentic," it must be complete: integral, that is, it has to promote the good of every person and of the whole person,"* wrote Pope Paul VI, in his "Populorum Progresso, on March 26, 1967.

Top Ten Reasons to Care for Creation

1. God is the Creator of the universe and maintains its existence through an ongoing creative will.
2. God has blessed and called "very good" all that is created.
3. God's plan for Creation is one of harmony and order. Creation forms a whole, a Cosmos.
4. God loves the community of life.
5. God's creatures share a common home.
6. God's presence is discernable in all Creation.
7. God intends the Earth's goods to be equitably shared.
8. Within Creation, the human person enjoys a consummate dignity. Inherent to this dignity is that of exercising a wise and just stewardship over the rest of creation.
9. Sin brought division into the entire world, but not only within and between human persons. The consequences of sin also affect the Earth.
10. In a mysterious way, Christ's redemptive mission extends to all of Creation. The mission continues through the Church's priests.

As the theme of the year of priests goes "Faithfulness of Christ, Faithfulness of Priests," as Christ played his redemptive role faithfully to the will of his Father, so do we play our redemptive roles faithfully to the will of Christ. Above all, recognize God as the origin of life, giver of freedom and source of all things. View limitations as opportunities for growth and thank God for them. Cherish and tend God's gifts responsibly. View priesthood as a way of using God's gifts. Recycle paper, plastic and metals to preserve natural resources. Thank God for talents and share freely with others. Work to strengthen God-given talents through training and education. Recognize and cultivate personal gifts of others and invite others to share. Know that God can never be outdone in generosity. *Encourage the parish as a whole to share their gifts of time, talent and treasure with those outside the parish. Share time and talent with parish and community.* How do we live as stewards of our environment? How good are we as priests and members of our communities, states, nations and global community? We need to be involved, and perhaps even be leaders, in those areas. Letting go of possessions, of time, of all those things in which we feel we have vested interest, is perhaps the most difficult thing for us to do in the midst of a society that seems to honor, reward and emphasize the opposite behavior and goals. Yet, as Catholic priests, we are witnesses daily that all is not at peace, that all is not fully redeemed in time and space. We remain capable of sin, and the rest of creation suffers from it. Moreover, nature itself is not always benign. As Catholic priests, we have a special responsibility toward each other and the rest of creation. Nature is our sister. *As responsible stewards and co-workers with Christ, we are part of creation, not separate from it. We must demonstrate the meaning of Christ's life, death, and resurrection in our treatment of creation.* We are to begin the process of conserving, developing, and restoring creation, a process that will be completed by God, the Creator (Father), Redeemer (Son), and Sanctifier (Holy Spirit) of the whole universe (From Bill Jacobs and the Catholic Conservation Center).

Biosphere is a Relationship with Biodiversity

Taken together, these four elemental, earth, air, fire, and water, make up the Biosphere, the part of the world in which we live. They include the thin film of gases and liquid that coats the surface of our planet. All life in the Biosphere exists on the surface of the Earth, in its air, or in its waters. Yet the Biosphere also is remarkably limited. Only a few miles in

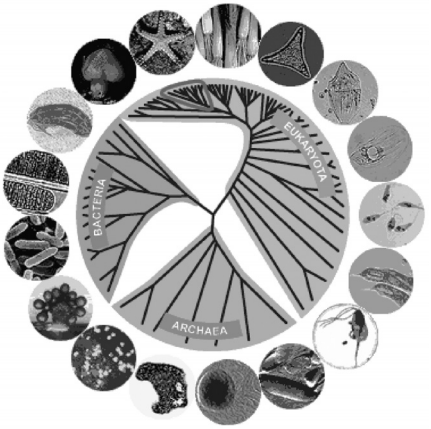
depth, it spreads over the Earth's surface in great disproportion to the rest of the planet. Its depth or size, however, is not as important as life's ability to move laterally at great distances through it. Further, the Biosphere is both a shield and a bank. It allows most sunlight to reach plants and animals, yet it also shields them from harmful radiation from space. *The Biosphere also nourishes life by storing within it the sun's energy.* Were it not for these qualities, there would be no living creatures, no weather, no waves, no sea, nor any of the beauty found on Earth. How did the Earth come to have a Biosphere when the other planets of the solar system appear to have none? How did life come to inhabit it? How does the Biosphere work, how long will it continue to shelter life, what is its future? This book deals with these questions, but does not attempt to answer them all. Indeed, not all the answers are known. Perhaps someday we may be able to answer some of the unsolved mysteries about the living world. *The Biosphere shows, how connected things are in the natural world. If the oxygen concentration drops in one part, it drops in all parts; if ants go crazy in one part, they go crazy in all parts.* Those sequences are pretty obvious. Less obvious to most people is that the entire Biosphere is similarly interconnected. For example, over the period of a few months the entire atmosphere of Earth becomes completely mixed. *If a cow farts in India, the methane added to the atmosphere, by enhancing the greenhouse effect, can help change the climate in Boston.*

Ecologist, John Donne once said, "No man is an island, entire of itself", but he might just as well have written, "No organism is an island, entire of itself." Every living individual is dependent on other individuals for its very existence and for the perpetuation of its kind. The dependence is not just on parents, but on unrelated individuals that are part of the same ecosystem. The HIV virus* must have a primate host in which to survive; an apple tree must have microorganisms in the soil to convert chemicals it cannot use into the nutrients it requires; a fig tree depends on small wasps that pollinate it for its reproduction; coral animals depend on tiny green algae that live within their rocky skeletons to supply them with energy; and termites, butterflies, deer, dogs, lions, chimpanzees, and people need other plants and animals to eat, and often also microbes to help them digest what they have eaten. In short, we and all other living beings are part of a natural internet but, unlike the artificial Internet we surf, our very lives depend on the natural internet's integrity. *All organisms are interconnected by vast global recycling systems known as biogeochemical cycles.* If we separate the word "biogeochemical" into three parts, we see immediately what is

**HIV virus stands for human immunodeficiency virus which causes the disease called AIDS. The initial infection with HIV generally occurs after transfer of body fluids from an infected person to an uninfected one.*

involved: "bio" means living things, "geo" refers to the nonliving parts of the Biosphere such as the soils and the atmosphere, and "chemical" indicates that we are talking about the chemistry of life, especially the fundamentals such as carbon, oxygen, nitrogen, phosphorous, and sulfur. Carbon a basic element of life is an especially benevolent example, since it is tightly tied to the movement of that other critical substance, water.

The Origin of Biosphere – The Engine of Life



The Biosphere was created long ago, so long ago that little of its birth can be described with any accuracy. The events that brought it into being can only be guesses, estimates derived from very recent observations in man's past history. The precise age of the Biosphere is unknown, but it must date to a time after the birth of the sun. The sun is an ordinary star, a second-class star among the many stars in the heavens. It is a part of the Milky Way Galaxy, a great aggregation of billions of stars moving together through space like a giant pin wheel. *The sun is in one of the far reaches of one of the arms of the galaxy, traveling in an orbit which will take 200 million years to complete.* With it travel the Earth, moon, the other seven planets of the solar system, their various satellites, and bits and pieces of broken material called asteroids and meteorites. Except for the eight planets of the solar system, we have no knowledge of any other planets in the universe. None are likely to be discovered in your lifetime. Even if they were, the distances between stars are so great it seems unlikely we will know whether or not they carry life on their surfaces.

It also now seems almost certain no other life will be found on any of the sun's planets, that the Earth and its Biosphere are unique among the world which revolve around the star and that the creatures of Earth may be the only intelligent beings mankind will ever know. All this does not mean that either life or Biosphere is unique in the universe. *It would be presumptuous to believe that the Earth is the only planet capable of sustaining life.* It is far more likely that other planets with life on them do exist, somewhere in space, and one of the great challenges before mankind will be the search to

find them. Until that happens, we must search for the beginnings of the Biosphere on our own Earth and the other planets of the solar system. The Earth's development took place at an ideal location, just the right distance from the sun so that water could be retained on its surface. Had the Earth been closer to the sun, it would have lost most of this precious substance. The Earth also was exposed to the proper amount of radiation from its parent star, enough to make it warm but not too warm. Both this heat and water have proved essential to the development of life on our planet. *Without the proper amount of heat from the sun or without water, life could not have come into being. It is these two requirements that make it unlikely that life either arose or survived on the outer planets of the solar system.* On Venus, so much carbon dioxide remained in the atmosphere that water could not form, and it remained a cloud-shrouded hothouse too hot for life either to begin or to survive. Mars may have been too far from the sun to receive sufficient light for living plants and animals.

Only on Earth was water formed. Exactly how water came to the Earth is as mysterious as the question of what happened to any that may have been on Mars. The Earth probably has not always been as covered with water as it is today, but early in its history the oceans began to appear, spreading across its surface until they occupied three quarters of it. Only a world island remained. This island, later to be broken apart by geologic forces from within the Earth, was at first barren of life. *Not a tree, a blade of grass, an animal, an insect, or a bird existed in the Biosphere. Instead, life, the vital essence which makes the Biosphere of our planet different from all others in the solar system evolved in the seas.* As with the beginning of the Biosphere, life must have been created from the basic, abundant elements on the Earth's surface: oxygen, carbon, hydrogen, nitrogen, phosphorous and other "light" substances. These elements were and still are in the seas or a part of their waters. Some form of radiant energy also had to be added to create life. It may have been the rays of the sun; it may have been cosmic rays from beyond the solar system, or perhaps the continued lightning which bombarded the seas from the clouds above them. *However, energy was transmitted to the oceans, and in them deoxyribonucleic acid (DNA)* was formed, the molecule capable of reproducing itself and the most important ingredient of all living organisms.* Over millions of years the organisms created by reproduction gradually grew more and more complex in structure. At the same time, the Earth's atmosphere and oceans began to change. They became cooler and more stable. The life within the seas seized

**DNA is the "genetic blueprint" for all living things. DNA contains the information that gives living things their traits or characteristics. DNA molecule encodes the information that enables bacteria to grow, reproduce, and cause illness.*

this opportunity to move to land. There were advantages to living on land not present in the oceans, easier movement, for example.

Aquatic plants became the first to realize this possibility. Migrating from shallows along the coasts of the continents, they gradually moved inland to cover the land surface of the Earth. Plants could live and grow by drawing carbon dioxide from the air and energy from the sun. The by-product of this process was the release of oxygen into the atmosphere. As more and more plants reached shore, more and more oxygen was released into the air, gradually making it possible for animals, too, to leave the seas and come to dwell on the continents. The plants already there provided them with energy, and the additional amounts of free oxygen in the air allowed them to breathe. *The first land animals were amphibians, creatures which spent part of their lives in the water and part of it on land. Amphibians must have evolved from fishes and fishes from even more primitive creatures, perhaps those with stony shells or with bodies like the jellyfish of today.* Finally, amphibians abandoned the seas altogether and became the first completely land-dwelling creatures in the Earth's history. They became a part, a key part, of the carbon dioxide, oxygen cycle of today which plants and animals nourish one another. At the same time, plants remain the key to animal survival on Earth. Without their ability to capture the energy of the sun, an ability not shared by animals, there would be no animal life on our planet, perhaps no life at all.

The Wealth of Biosphere

Investing in Biosphere and the environment is perhaps one of the best things we can do right now, literally more profitable than investing in gold or in any other business. Environmental protection could well become a major economic sector in the next decade. Biosphere and the species of Earth are our biological wealth and, like any capital, should not be squandered or thrown away. As this wealth is revealed now, it is prudent to assess whether

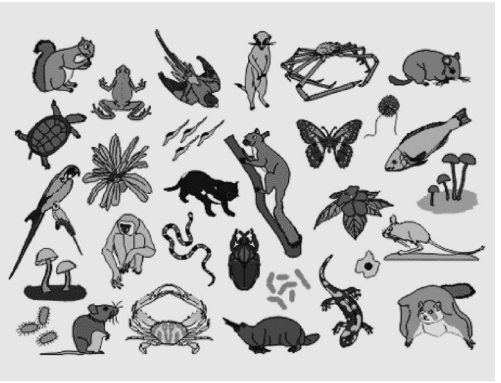
or not we are taking care of it. *If we imagine that the ten to twenty million species on Earth are the equivalent of that many safe deposit boxes in a vast bank called Nature, then most of them remain unopened and we are ignorant of the contents.* As we open more and more of them, the contents will prove to be of immense value to society. More sobering is the thought that large numbers of these boxes are being destroyed before we know the treasures within. We share the world with millions of other species. Most of them are tiny and little known to us. What are their names and what do they do? A new branch of science that studies biological diversity is determining the answers to those questions. Innovative technologies have shown us the enormous and previously unsuspected variety of the biological world. Exploring that natural world is a story of the daily discovery of new species and inventive ways of making a living, and this inquiry will reveal more unknown truths in nature.

Biosphere is like a big engine that runs the fabric of life. Millions of species interact with their environments and with one another in Biosphere, engineering the mechanisms that regulate the air, water, and soils on which we depend. They have evolved technologies, most often at the molecular level, that break down domestic, agricultural, and industrial wastes. They provide the majority of pest control in agriculture, horticulture, and forestry. *All these activities are the basis of human civilization*. We do not claim for one moment that these systems have developed specifically for human use; rather, they are the natural products of the activities of vast numbers of species that have evolved over millions of years and allowed human beings to create the diversity of cultures we know today. The kaleidoscope of populations, species and communities that we know as biological diversity generates, among other things, our food supply and therefore is the foundation of all our food industries, farming, ranching, and fisheries, plus of course the business such as trucking and machinery manufacture as well as the financial institutions associated with them. Forestry is another industry based on biodiversity, not just the trees but the minute organisms that generate soil fertility and pest control. *Tourism, by taking advantages of immense natural collections of species such as those found in national parks and marine reserves, is dependent on biological diversity too. In the last ten years, tourism has become the single largest global industry.* All of this economic activity, involving trillions of rupees annually, starts with the biological diversity that operates the natural systems in which we build our cities and towns.

The exploration of biodiversity leads to discoveries that make our way of life more sustainable; that is, they allow us to lead full and productive lives without jeopardizing the resources and the environments that our children,

and our children's children, will need. Biosphere and its Biological diversity keeps us alive and, beyond that, is the key to a dazzling variety of economic opportunities may be based on obscure, tiny, and often very strange creatures. It is vital that species not go extinct: there is no way of knowing which will turn out to be important. Most people think it is wrong to squander wealth or throw it away. *Biological wealth is no exception,* and conservation efforts are under way in national parks, marine reserves, zoos, botanical gardens, and seed banks around the globe. Industries that are directly dependent on natural ecosystems such as farming, grazing, forestry, fisheries, tourism are searching for ways to preserve the biological wealth, the biological capital, they use. Similarly, human societies, all of which rely on natural ecosystems to dispose of their domestic, industrial, and agricultural wastes, are looking for ways to keep those services intact. To allow extinctions of populations and species is foolish and selfish, foolish because of the lost opportunities, selfish because of the loss to the next generation, if not to ours.

The Precariousness of Biosphere



In light of our dependence on Biosphere and its biodiversity, it is worth thinking about supply. How much is available and if we mess up, where can we get more? We are often careless with things because we know that they can be replaced, or we believe that modern technology will find a source. Instead, with regard to biological diversity, we should ask: Can we make new species, and if not, is there somewhere else we can get them? *In spite of the hype that surrounds biological technology, we are still a long way from being able to create life, let alone make a complex organism such as a bacterium or a tiger.* The scientific reality is that we will not able to achieve this goal in the foreseeable future. So there is little chance of being able to make new species. What about finding them elsewhere? No life has yet been found anywhere else in the universe. And if we did find life on some distant planet, would we dare to bring it home? As far as we know, we and all the other species on Earth are alone. There is no alternative supply; the organisms with which we live and on which we depend are completely

irreplaceable. We cannot create them or obtain them from another source. This stark situation means that exploring, discovering, and understanding the biological diversity of our world is just about the most important task confronting us.

While our approach in this book is pragmatic, we share with most people the simple feeling that the creatures of Earth are absolutely critical to the human spirit. The fact that all over the world people keep pets, cultivate gardens, maintain aquariums, go bird watching, enjoy nature videos, and take vacations in places of natural beauty, reminds us of another suite of values of biodiversity: those that give us peace and contentment. *At the same time, plants remain the key to animal survival on Earth. Without their ability to capture the energy of the sun, an ability not shared by animals, there would be no animal life on our planet, perhaps no life at all.* Thus, the Biosphere is a fragile world, dependent on a number of delicately balanced factors: on the distance of the Earth from the sun; and on the continuing evolution of living systems. For life does not exist in spite of the Biosphere, but because of it. *Life is dependent on the biosphere, just as the biosphere is a complex, highly integrated place, in which each living system has a part.* Though it probably is not unique in the universe, it seems without a duplicate in the solar system.

Evolution and Natural Selection in Biosphere

In short Natural Selection is defined as *"the survival of the fittest."* Known as Darwinian Natural Selection* is the secret code that drives Biosphere and its biodiversity. A herd of cows, a colony of ants, a flock of geese, or any other healthy population is suited to, or adapted to, its environment. A scorpion, for example, is physically adapted to the heat and dryness of the desert. The population could not survive in the Arctic any more than a polar bear could survive in the desert. Over time, the environment changes, as it has ever since Earth formed some 4.5 billion years ago. Ice Ages come and go. New mountains are thrust up and change the local climate. Swamps and inland seas dry up. Glaciers melt. All such changes force new conditions on the plants and animals living there. Sometimes such changes are so severe that no individual members of a population can survive, and the population dies out. In other cases, when the change is less severe, certain individuals that are fitter than the others are able to survive. A bear with a thicker coat

**Charles Darwin was born on 12 February 1809. Darwin proposed a theory called "evolution by natural selection." Natural selection is the engine that drives evolution. The organisms best suited to survive in their particular circumstances have a greater chance of passing their traits on to the next generation.*

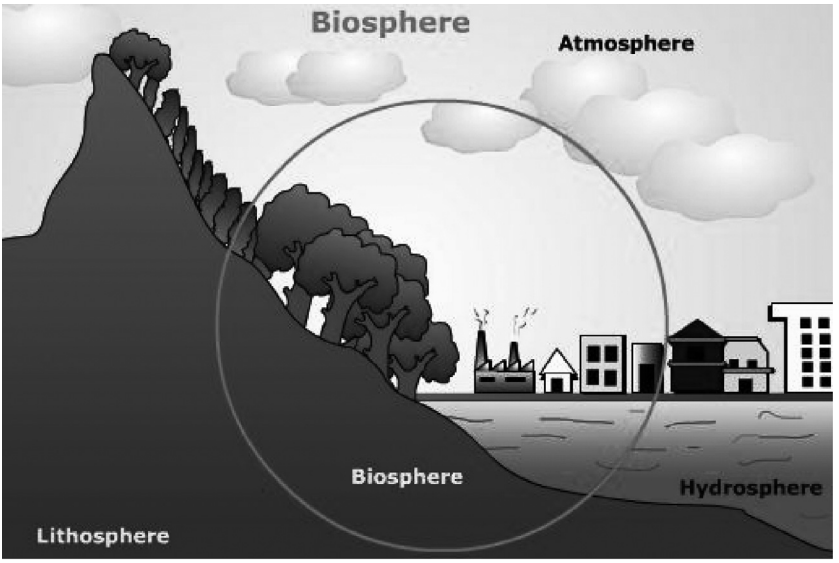
of hair might be better able to survive a series of especially cold winters than a bear with only a thin coat. A moth with wing colors that make it especially hard for birds to find is better protected than moths that are less well camouflaged. *Such "favored" individuals in a population are produced randomly, or by chance, in a process called mutation.*

Mutation is a change in a plant's or an animal's genes that may make the plant or animal different in one or more important ways from its parents. One puppy in a litter may have one brown eye and one blue eye, although all of its brothers and sisters have eyes that are both the same color. X rays and certain other forms of radiation can cause mutations. *Even though most mutations are harmful, occasionally one just happens to turn out beneficial, as in the case of the bear with an especially thick coat of hair.* When that happens, we say that the individual with the mutation is well adapted to the new environment. Those individuals that are well adapted and survive may then pass on their special adaptation to their offspring. Those without the new adaptation are more likely to die before reproducing. Gradually the population rebuilds as its new and fitter individuals produce offspring with the beneficial mutation. Those offspring, like their parents, are different from those that were unable to survive the environmental change. This is basically how the process called evolution changes populations and produces new species of plants and animals that account for the never-ending process of biodiversity.

Ecosystems in Biosphere

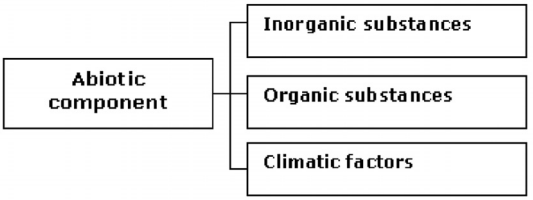
Lithosphere (land), Atmosphere (air), and Hydrosphere (water), all are necessary to the Biosphere that part of the world in which we lie. Each is necessary for the action of the others. *Everything is built on relationships. Without one, the others might well not exist. Certainly without all of them, we could not survive. Instead the Earth would be as lifeless as the surface of the moon or the arid, dust-blown plains of Mars.* The Earth itself, a planet like and yet unlike the others in our solar system, is believed to have been formed when a vast cloud of hydrogen condensed to create the sun. Some of its particles swirled together to make up the planets, the small inner ones and the enormous outer ones, and their atmospheres. Air is an odorless, tasteless, unfeelable gas that we breathe. Every moment of our lives is spent in this gaseous ocean, and without it most living things die. Jet streams, tornadoes and hurricanes, temperature, rain, fog, and snow, all these are phenomena of the air. *The lithosphere, hydrosphere and atmosphere are non-living components of the environment and are known as abiotic. The biotic or living components include plants, animals and microbes living on the Earth.* A

constant interaction between the abiotic and biotic components of the biosphere results in the transfer of food and energy, which makes it a dynamic but stable system. *The biosphere is the biggest biological system, where biodiversity flourish.* It consists of smaller functional units known as ecosystems or ecological systems.



An ecosystem is a self sustaining structural and functional unit of the biosphere. The ecosystem may be large or small. In the biosphere several ecosystems exist. Usually there is exchange of material and energy between adjoining ecosystems. Ecosystems can be natural or artificial. Natural ecosystems may be terrestrial as well as aquatic. Land ecosystems are those that include forests, grasslands, deserts, and hillsides. Aquatic ecosystem includes ponds, rivers, lakes, seacoasts and oceans. Artificial ecosystems that are man-made are croplands, gardens, parks, kitchen gardens and aquariums. All ecosystems consist of two major components, biotic and abiotic. *Abiotic components are; inorganic substances, organic substances, and climate factors.* Inorganic substances found in the ecosystem like carbon, nitrogen, sulfur, phosphorous, oxygen and compounds like carbon dioxide, water etc. A vital balance among these components in the environment should be maintained and nature plays an important role in doing this, for example, carbon cycle, water cycle, nitrogen cycle etc. Inorganic substances are various chemical substances found in the ecosystem but they are organic in nature. They form the greater part of the living organism and form a link between the abiotic compounds and the

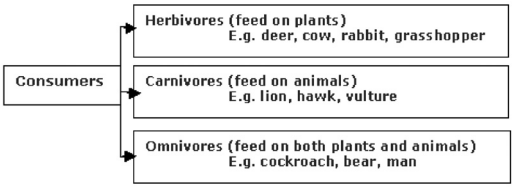
biotic compounds, for example, proteins, carbohydrates, lipids or fats, humic substances, etc. Climate factors are of two types; atmosphere, which means sunlight, temperature, wind, and humidity etc; edaphic, which means the physical and chemical properties of the soil, it's water and air content etc. these factors affect the distribution, number, metabolism and behavior of the organism.



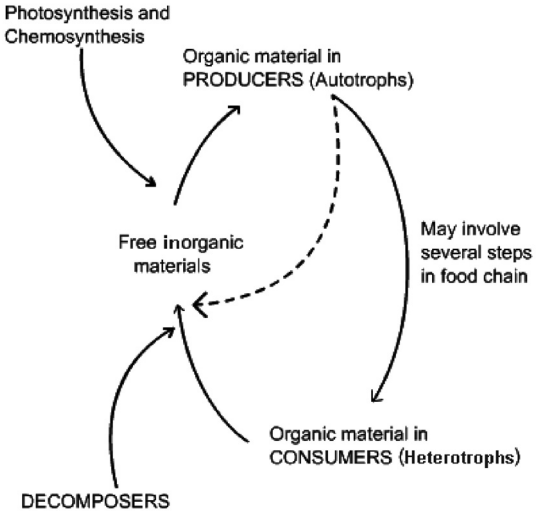
Biotic components – An ecosystem consists of a number of organisms which co-exist and come into regular contact with each other. Some of these organisms may have a special relationship which may profoundly influence its distribution and abundance. In a given ecosystem three types of biotic components may be found which are grouped according to their modes of nutrition: producers, consumers, and decomposers.

Producers – These are autotropic organisms, mainly green plants, so called because they are capable of synthesizing organic food. They contain a special pigment called chlorophyll that absorbs solar energy and converts it into chemical energy during photosynthesis. The end product of photosynthesis is glucose, which is stored in the plant in the form of starch. This group forms the source of food for many organisms.

Consumers – These are heterotropic organisms, mainly animals. They are not capable of synthesizing organic food and so feed on other organisms such as, plants or animals, to meet their food requirement. They may be further classified as follows: Consumers are herbivores that feed on plants such as deer, cow, rabbit, grasshopper; carnivores that feed on animals such as lion, hawk, vulture; omnivores that feed on both plants and animals, such as cockroach, bear, and man. Animals that stalk their prey are called predators and those that line and grow on other organisms and adapt them as their habitat are known as parasites.



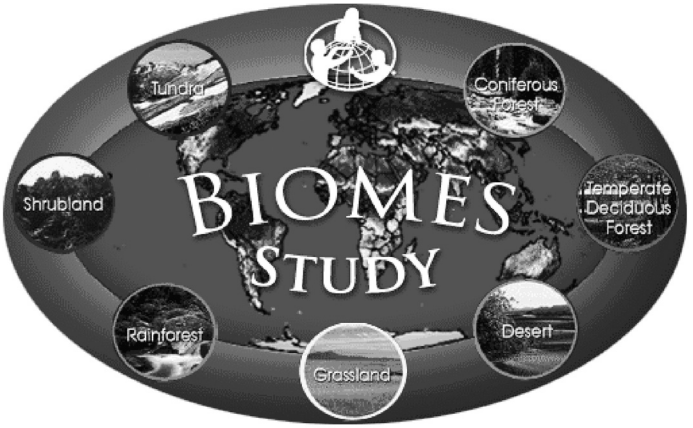
Decomposers – There are saprophytic organisms (mainly bacteria and fungi) that live on dead animals and plants. In terrestrial ecosystem, bacteria act on animal tissue and fungi on plants but they may be exceptions also. This group of organisms plays a vital role in releasing back the biotic components into the environment. By digesting the dead tissue through enzyme secretion, the basic elements of protoplasm are released into the environment, to be made available for reuse by the producers to be built into organic compounds again. So it can be seen that matter circulates in nature, though it constantly changes its form, there is no overall loss or gain. Here is a diagrammatic representation showing the interdependence of producers and consumers in an ecosystem.



Biomes or Major Ecosystems

Over the nearly four billion years since life began on this planet, the chemicals of life have been endlessly reused and exchanged by plants, animals, the soil, the oceans, and the atmosphere. Some of those chemicals are oxygen, nitrogen, carbon, phosphorus, hydrogen, and sulfur. *All the chemicals that make up your body were once part of a dinosaur, a whale, a lump of coal, or some other form of matter, and they will one day in the distant future be used again by still other organisms in ecosystems very different from your own (rebirth in Hinduism).* There are many kinds of ecosystems, each with distinctive communities of organisms living together and depending on one another and their surroundings for nourishment and shelter. Let's consider one ecosystem in some detail and describe some rather interesting adaptations of a few of the plants and animals that live there.

But there are other very different and large-scale ecosystems, called biomes, with still greater arrays of biodiversity. *A biome is a climatically, and geographically defined area of ecologically similar climatic conditions such as communities of as trees, shrubs, and soil organisms, and are often referred to as ecosystems.* Biomes are defined based on factors such as plant structures such as trees, shrubs, and grasses, leaf-types such as broadleaf and needle-leaf, plant spacing forest, woodlands, savanna, and rainforest. Unlike eco-zones, biomes are not defined by genetic, taxonomic, or historical similarities. If you traveled by car from Arctic far north southward to the Equator, you would pass through several biomes and could not help but notice how the land and its animals and plant populations change.



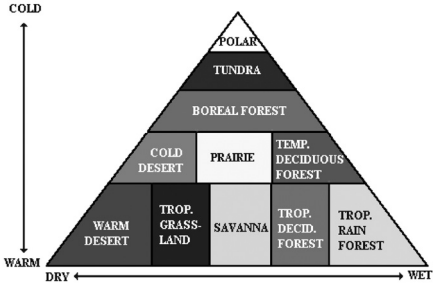
Tundra

The tundra, meaning "marshy plain", around the globe south of the Arctic ice and down to about latitude 60 degrees north, a biome that includes northern Canada, northern Greenland, Iceland, Sweden, Norway, Finland, the northern half of Russia, and nearly all of Alaska. Many regions of tundra lack large trees and instead have widespread lichen growth including reindeer moss, grasses, dwarf trees and shrubs, and spongy and hummocky soil that is poorly drained and under-laid by permanently frozen ground called permafrost. The highest tundra temperatures average 50 degrees F (10 degrees Celsius). The main tundra animals are caribou also called reindeer, musk oxen, arctic hares, voles, and lemmings, all of which are plant eaters. The meat eaters include the arctic fox, and wolves. Reptiles and amphibians are scarce. In summer the mosquitoes and black-flies are fierce. Birds include longspurs, plovers, snow buntings, geese, snowy owls, and horned larks.

Boreal Coniferous Forests

As you continue your drive southward, you enter the great north woods biome, known by ecologists as the boreal, or northern, coniferous forest. *Russians call it the "taiga."* It occupies a band running roughly from 57 degrees north to 45 degrees north, or from southern Alaska southward to Ottawa, Canada. *These trees encircling the globe produce so much oxygen, the atmosphere replenishes itself constantly.* Needle-leaf trees predominate, including different varieties of spruce, fir, and pine. But there are other kinds of trees as well, depending on whether you are west of the Rockies, in the Midwest, or in the region of the Appalachians. One tree type, the jack pine, has a cone that remains tightly closed until there is a forest fire. Although the fire burns and sometimes kills seedlings and mature trees, scorched jack pine cones open, release their seeds, and can give rise to a new generation of pine trees and an entire new community. The eastern part of the biome contains a number of other trees including quaking aspen, balsam poplar, and paper birch. These too are stubborn survivors in the face of fire. New growth sprouts quickly from the destroyed trees' stumps and roots. Mammals in this biome vary with latitude and include moose, bears, deer, wolverines, martens, lynx, sable, wolves, snowshoe hares, voles, chipmunks, shrews, and bats. The biome also supports numerous bird species, including robins, juncos, warblers, and nuthatches. There are only a few snakes and other reptiles and there are amphibians, especially in southern regions. And there are many insects, some of them pests, mosquitoes, black-flies, sawflies, and budworms that attack people and vegetation alike.

Temperate Deciduous Forests

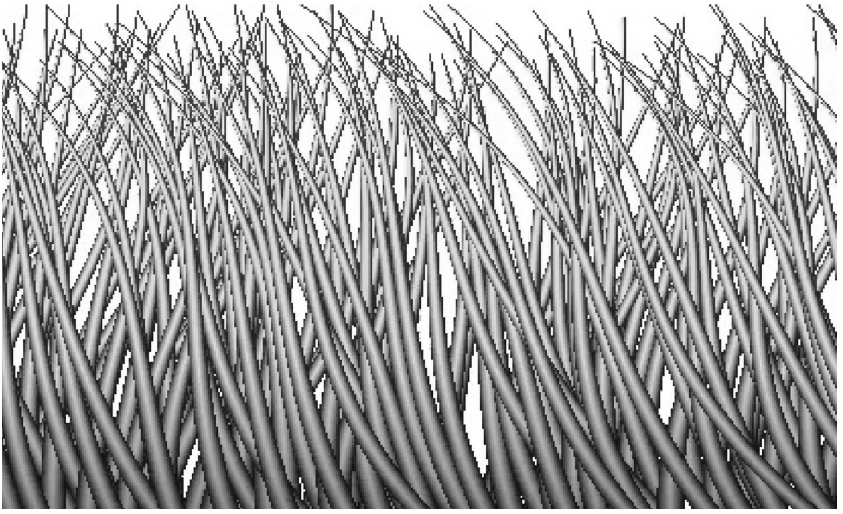


Continuing your drive southward, you will enter the temperate deciduous forest biome. It sprawls southward from the Great Lakes all the way down to Florida and westward near the edge of Texas. This biome covers most of Europe, Japan, and much of Southeast Asia. As you might imagine, climate is milder here than in the northern forests, and there is a much greater variety of trees, *most of which are deciduous, meaning that they shed their leaves seasonally.* Tree types include oak, hickory, basswood, maple, beech, elm, willow, and sycamore. The eastern United States also has areas of white pine

and red pine, both conifers. The ground cover is rich and diverse and includes many flowering plants. Typically, the ground-cover plants bloom quickly in the early spring before the trees come into leaf and keep the ground mostly in shade all summer. Compared with the heavily littered floor of the north woods, the forest floor in this biome is less cluttered with dead wood and other natural litter because of a more rapid rate of decomposition. The largest animals that live in the part of this biome are deer and black bears. There used to be mountain lions and wolves until they were killed off by hunters or driven away. Smaller animals include foxes, bobcats, weasels, raccoons, squirrels, voles, and chipmunks. Birds include various woodpeckers, wild turkeys, grouse, and he red-eyed vireo. As we would expect from the warmer climate in these southern latitudes, many species of amphibians and reptiles are common.

Grasslands or savanna

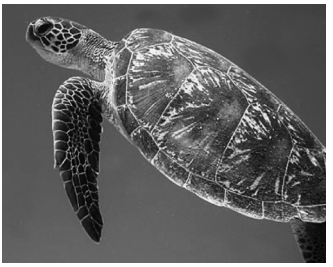
If your biome exploration takes you due west from the Great Lakes and across to the Rocky Mountains, you will pass through miles and miles of the grasslands biome that covers much of central North America. In the eastern region are tall-grass prairies; in the west are the short-grass plains, typical of Nebraska with its buffalo grass. Russia's grasslands are known as "steppes." *In India and Africa, it is known as "savanna."* South Americans call them "pampas." Before agriculture became widespread in the eastern grasslands of North America, the region was densely covered by endless miles of blue-stem grass that grew to heights of 6.5 feet. The soils of the tall-grass prairies are among the richest in the world due to the presence of rapidly decaying



organic matter that collects in the upper layers. Forests, or rather clusters of trees, across the dry grasslands biome are pretty much restricted to valleys and stream-banks. Generally, the climate becomes increasingly dry as you move westward.

Small burrowing mammals, including gophers, prairie dogs, squirrels, and jackrabbits are common and serve as prey for coyotes, wolves, and mountain lions. There also are pronghorn antelope, elk, badgers, ferrets, and bison. Grasslands birds include prairie chickens, longspurs, meadowlarks, hawks, and grasshopper sparrows. Before the waves of settlers swept westward in the 1800s, an estimated 75 million bison grazed the western prairies. By 1888 fewer than a hundred survived the onslaught of human activity. There are even more biomes, some covering smaller regions than those just portrayed, although each one has its own group of animals, bacteria, fungi, and soil nutrients that fuel their energy requirements. Each is a finely woven tapestry of varied life forms and intricate dependencies. Indian and African savannas support millions of life species. Prehistoric humans prolifedrated in savannas, who came out from jungles. The new lifestyle in the savanna prompted our anscestors to go bipedal. Man became Homo erectus.

Oceans – The Dance of Biodiversity



Earth and its Biosphere predominantly is a lush water world. The sun's energy, representing the fire of the ancient world, is what runs the Earth's biospheric engine, moving air and water from place to place, creating life in plants and animals, causing decay and rebirth and the storing of fuel in rocks and minerals. Water covers three fourths of the Earth's surface and is what distinguishes Earth from all other planets. Life began in the sea, and it still swarms there, but the oceans are far more than simply a reservoir of food. Tremendous currents surge through them helping create winds, carrying the warmth of the equator northward and the cold of the poles southward, over the centuries changing the shape of islands and continents alike. Planet Earth lives and moves according to its own laws in an endless cycle of force against force. Stand on a beach and look at the sea. The sky stretches in airy splendor overhead until it meets the horizon. The sea is a restless march of endless waves advancing to crash on the shore. Both sea and sky seem immense and mysterious. Beyond the sky lie the moon, the stars, and space. The ocean is deep and dark, unyielding to most attempts

to see its bottom. *To the ancient Greeks, both sea and sky were parts of the four elements they believed made up the universe: earth, air, fire, and water.* Today we know there are more than one hundred elements in the universe, yet it is still possible to express our world with the four divisions of Greeks. We see the world's land surface as Earth. Water is the ocean, rivers, and lakes. Fire is the sun and oxidation, the burning of combustible materials. Air is the atmosphere we breathe.

One of the major biomes in the world is the ocean. It is very special part of the Earth. Not only is it vast, but much of it remains unexplored. The Earth's last great frontier, it contains an immense variety of life and many different kinds of conditions. Only in the past half century have men learned much about its depths. At times the ecology of the sea seems confusing and changeable, but like the land surfaces of the world, it is as ordered and zoned as the rest of the Biosphere. Levels of life in the upper ocean, the easiest to sample, have been the first to be explored, and some knowledge of the near surface creatures of the sea is now available. Surface life depends on how vertical ocean currents move. During winter months, storms churn the sea, transferring sediments near the bottom of the surface, where they can be consumed by creatures there. Surface life then becomes more abundant. In the spring as storms abate, food begins to sink to the bottom again, and life declines. In the fall, the churning of the ocean begins again, and a new food supply arrives. During the late fall and winter, sunlight reaching the sea is less, however, because of shorter days, and the simple plantlike creatures of the surface grow more slowly because of this. With its perfect choreographed dance, oceans support biodiversity and provide 30% of food to humanity, yet in return humans, unfortunately treat ocean as "trash dump."

Marine Over-harvesting

Over-harvesting is the removal of plants or animals to the point that it is challenging to maintain viable population levels. This unsustainable practice has put a number of threatened and endangered species at risk of extinction. One third of God's creation has been used up in the last 30 years. *The World Wildlife Fund estimates that in 50 years' time, we will need another planet Earth to sustain the world's human population if we keep using resources the way we do today. At least 70% of the world's important fish stocks are over-exploited already.* Over-harvesting can also affect other species as well, as the over-harvesting of horseshoe crabs has lead to a dramatic decline in Red Knot, a small shore bird, populations. *Many marine ecologists believe that the biggest single threat to marine ecosystems today is over-*

fishing. The reality of modern fishing is that the industry is dominated by fishing vessels with technology created over the past 50 years that is able to far out-match the ability of fish to reproduce. Bay of Bengal, Arabian Sea faces a catastrophe of emptiness in their waters. Baby Sharks, baby crabs, baby king fish are the targets of the consumer market. The lack of enforcement of laws in India continues to create great vulnerability for India's oceans. Almost 85 percent of fish species are decimated. Future generations would be able to see all these species of fish, only in museums. Over-fishing has depleted fish populations to the point that large scale commercial fishing, on average around the world is not economically viable without government assistance. The collapse of the cod fishery off Newfoundland and the 1992 decision by Canada to impose an indefinite moratorium on the Grand Banks are dramatic examples of the consequences of over-fishing and the tragedy of the commons. Over-fishing in the Mediterranean Sea has led to the targeting of smaller and smaller fish. Man is called by God to be cautious of over-harvesting.

We read in the Bible, *"If you come on a bird's nest, in any tree or on the ground, with fledglings or eggs, with the mother sitting on the fledglings or on the eggs, you shall not take the mother with the young. Let the mother go, taking only the young for yourself, in order that it may go well with you and you may live long" (Deut 22:6-7)*. We are to leave the mother so that the next generation can continue and the species may continue to exist. What would happen if we continued to consume both the mother and the young? Finally as consumers we can start choosing fish to eat that are not in danger of being over-fished as we all have a responsibility to try and protect these fragile and unique pockets of life in the ocean before they are destroyed forever. Over-fishing is a significant threat to the natural internet. It does more than simply harm fish stocks; it also makes serious alterations to the oceanic part of the internet. The competitive and predatory relationships of the net are changed, frequently in ways that are not entirely understood. For instance, excessive harvesting of the sharks in India caused the stock to crash; it has never recovered, presumably because of changes in the internet. Even more serious are the effects of trawling. Heavy nets are dragged over the ocean floor, in many places more than once a year. The effect is similar to that of clear-cutting a forest but, hidden beneath the ocean waves, the damage does not attract the same attention or publicity. Trawling destroys sponges, corals, bryozoans, and other bottom organisms that feed on materials suspended in the water, and could alter the internet by reducing the productivity of fisheries. Many countries including India use oceans as their "sewage tank." However, by far the most precious and endangered of all these biomes are the tropical rain forests.

Rainforests - A Powerhouse of Biodiversity

Many people think of tropical rainforests as dark, intimidating places as they are so often depicted in movies. But people who explore and study rainforests frequently describe the "symphony of life", "plush vegetation", "magical scents", and "rich eternal rhythms" that are there. Most tropical forests are in the warm, wet areas ten degrees on either side of the equator, where they flourish best. Their year-round temperature averages 27 degrees Celsius. Many people worldwide are aware that tropical rainforests are being destroyed at a rapid rate. Throughout the year, 80 to 90 acres of tropical rainforest are destroyed every minute. An area of forest the size of France disappears each year. *Both temperate and tropical rainforests are vital parts of the Earth's life support systems, supplying oxygen, regulating climate, generating precipitation, conserving soil, and providing ecosystems for multitudes of diverse species of plants and animals and homelands for thousands of indigenous people, those native to the land.* On the global scale, forest experts have classified dozens of different types of forests, and the categories for rainforests vary considerably because they may be classified by such factors as their location, soil type, climate, and whether they have remained in their "natural" state, undisturbed by human activities. Some rainforests cover lowland areas, others grow in mountainous regions, and still others spread across plains that are covered with floodwaters at certain times each year. However, the two main types of rainforests discussed here are tropical and temperate rainforests.* As the terms suggest, the forests are located in either the tropical or temperate zones of the world.

A tropical rainforest may fit one of three basic types: a tropical dry forest, a tropical moist forest, or a true tropical rainforest. Forests in the latter category are closest to the equator and receive more rainfall than the other two categories of rainforests. In fact, calling a tropical dry forest a rainforest may seem a misnomer at times since rain may not fall for months at a time. Generally, a rainforest is defined by the amount of rainfall, from about 80 to 120 inches or more per year. *Tropical rainforests make up 6 percent of the Earth's surface and are located in a 3.4 million-square-mile band on both sides of the equator, including parts of Central and South America, Africa, Asia*

**Temperate rain forests are usually close to the coast, such as Australia, South and North America, maritime influences means narrow temperature fluctuations, mild winters, cool summers dominated by evergreen such as western Hemlock, Douglas fir, Sitka spruce, rich in epiphytes, such as mosses, club mosses, lichens, ferns.*

including Indian Subcontinent, and the United States. Perhaps the most well know of all tropical forests is in Amazonia, the Amazon River Basin. Covering the area almost 3 times of India in size, the forest region stretches from the foothills of the Andes Mountains to the Atlantic seacoast in Brazil. Other tropical rainforests include those in Papua New Guinea, the Congo Basin, Zaire in Africa, Western Ghats of India, the islands of Madagascar, the province of Sarawak in Malaysia, northern Thailand, southeastern Mexico, and parts of Colombia and Ecuador. Nearly all of the original rainforests in temperate zones were destroyed long ago, and because of varying classification methods limited information on the remaining stands of temperate rainforests. But some ecologists have attempted to assess the distribution and status of coastal temperate rainforests, classifying these forests as a subdivision of temperate rainforests.

How Forests Affect Climate, Soil, and the Global Carbon Cycle

Wherever they are located, forests play a major role in generating rain by returning moisture to the atmosphere in a process known as evapo-transpiration. That is, water from trees and plants growing in the forest evaporates and becomes part of the hydrologic, or water, cycle. About half the rainfall over Amazonia returns to the atmosphere through evapo-transpiration. In this process, water also evaporates from oceans and other water bodies. Some of the water vapor then condenses to form clouds or changes into liquid of freezes to form crystals. In other words, it becomes dew, rain, snow, or other forms of precipitation. Moisture in the atmosphere from evaporation affects regional and global climate. For example clouds, that form from moisture in the atmosphere, cool forest regions. In addition, clouds over the tropics are carried by air masses circulating away from the equator to cooler regions of the Earth, transporting solar heat with them to the temperate zone.

Forests in both temperate and tropical zones have elaborate root systems that hold soil in place, preventing erosion. The forest root system also absorbs rainfall, helping to regulate water runoff. Water is stored and slowly released throughout a year's time, replenishing groundwater supplies and maintaining the flow of water in rivers and streams. The soil in tropical rainforests is poor, however. Unlike temperate forests in which trees draw nutrients from the soil, the tropical forest itself holds nutrients and exchanges them within or among vegetation, forest litter, and living organisms. Some tree leaves and branches obtain nutrients from rain as it falls far from plants and algae that grow on trees. When trees are cut, the few nutrients that remain in the soil soon wash out. Some of the soils also contain ironstone, a type of iron ore, and when this soil is exposed to rain it hardens like rock, preventing growth of most plant life. Unlike tropical

forests, the debris on temperate forest floors breaks down and nutrients are stored in the soil. As a result, after logging, fairly rapid re-growth may take place. However, soil erosion may prevent full recovery and the biological diversity of a logged area will not equal that of the original forest.

Forests are crucial in the cycling of the six basic elements, carbon, oxygen, nitrogen, hydrogen, phosphorous, and sulfur, that make up 95 percent of the world's living matter. Since there is a fixed supply of these elements, life on Earth depends on their efficient cycling through the atmosphere and living systems. Carbon, one of the most important chemical elements, usually combines with other elements to form what seems to be an unlimited variety of compounds. All living things are made up of carbon compounds, one of which is carbon dioxide (CO2). Green plants absorb carbon dioxide from the atmosphere in a process known as photosynthesis. *Chlorophyll, the green pigment in plants, captures sunlight and uses solar energy to combine CO2 and water, producing a carbohydrate called glucose, an important source of energy for animal life, including humans.* During photosynthesis, plants also release oxygen needed for survival. When people and other animals oxidize, or use up food, they exhale CO2. Because of this continuous cycle, the supply of CO2 and oxygen remains fairly stable. Carbon dioxide is stored in various reservoirs such as the atmosphere and the oceans, in living plants and animals, and in fossilized forms such as oil, and coal deposits. Driven by physical and biological forces, CO2 circulates naturally among these holding places. But the amount of CO2 held in the various reservoirs is changing because of human activities. *Forests are some of the major reservoirs for CO2*. Cutting down vast numbers of trees, whether in temperate or tropical forests releases CO2 into the atmosphere, adding billions of tons to the buildup of CO2 plus other gases have accumulated in the temperature of the planet. If global warming takes place, it could alter rainfall, wind, and heat patterns around the world.

Biodiversity in Tropical Rainforests

The Pacific Northwest rainforests include stands of ancient forests, sometimes called old-growth forests although foresters and biologists define old-growth forest includes trees that have reached their peak in wood production. Using a broader definition, many people now say and old-growth forest is one in which there are large numbers of old conifers, including Douglas fir at least 300 years old and species of pines ranging from 150 to 3,000 years old. Ancient old-growth forests also contain snags and

many fallen logs, often called nurse logs, which provide homes and food for birds, mammals, and insects. As logs decay they provide nutrients for tree seedlings that may eventually spread their roots and straddle their nurse logs to reach the ground. *An old-growth forest is a complex interdependent system of living things. All parts of the system are interrelated and each organism depends on a part of the system for survival. If one part of the system dies or is damaged, the entire web of life is affected.* Because of the climate, tropical forests contain more diverse plants and animals than any other place on Earth. At least 50 percent and perhaps up to 90 percent of all living species can be found in tropical forests. *An estimated 50 million animal species, including millions of insects, flourish in tropical rainforest areas.* No one knows how many exist because scientists have only recently begun to classify and inventory species in various rainforests locations. An effort initiated in 1989 to categorize species in Costa Rican rainforests resulted in estimates of 500,000 different animals and plant species, among them an estimated 365,000 insect, spider, and tick species.

According to the National Academy of Sciences,* insects in the rainforests are so abundant that a single tree in the rainforests of Panama may be home to more than 1,700 species. In the rainforest of Sarawak, Malaysia, biologists have identified 3,000 species of butterfly and moth. Mammals that make the rainforest their home include various types of cats, deer, wild pigs, monkeys, sloths, marsupials, rats, and mice. *Two-thirds of all known plants grow in tropical forests.* "Of the 250,000 species of plants described by botanists, at least 30,000 are to be found in Amazonia alone", the World Rainforest Movement reported. *Life in tropical rainforest exists in layers of vegetation that form separate habitats, beginning at the forest floor and rising with the trees to well over 100 feet.* Emergent trees push above the canopy, a mass of tree tops intertwined with vines and colorful, flowering plants. The dense top tier of the forest also supports a diverse number of mammals, birds, and insects. Another layer of growth called the understory begins about 50 to 60 feet above the ground, rising to a little more than 80 feet. Since this tier is cooler and more humid than the canopy, fewer plants grow. Although the forest floor is usually bare except for fallen leaves, decaying plants, and some sprouting plants, this part of the forest is, in effect, a recycling center. Fungal enzymes help break down fallen leaves, and an army of ants, beetles, termites, worms, and many other organisms as well as foraging birds clean up the forest floor. At the same time, these creatures help renew the forest by planting seeds or providing nutrients for continued growth.

**Known as NAS, is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare.*

Medicinal Plants

Researchers discovered in 1989 that the bark of ancient Pacific yew trees produces a chemical known as taxol that has shown promise in treating ovarian and breast cancer and may also be effective in treating melanoma and other types of cancer. It takes three mature yew trees, about 150 years old and ten inches in diameter to produce the bark needed to extract the drug for treatment of one patient. By the end of 1991, more than 900,000 pounds of yew bark had been collected on federal lands, yielding enough of the drug to treat 12,000 patients. *The mysterious substance was "curare", the juice of a South American liana, or climbing plant*. In weak doses it is safe to use as a muscle relaxant during certain delicate operations. But in strong doses curare completely relaxes muscled, including the diaphragm and heart, and results in death. In 1541 the Spanish explorer Francisco de Orellana was dumbfounded when one of his men was struck in the finger by an arrow and died within a few minutes. A dose of another drug called physostigmine, which comes from a West African bean plant, quickly reverses the effects of curare, and it is useful for treating the eye disease glaucoma. Brazilian Indians of the Urueu-Wau-Wau tribe tip their arrows and spears with a poisonous sap squeezed from the red bark of the "tiki wha tree." The sap prevents blood from forming clots and causes victims to bleed to death. *Cancer researchers have long been interested in a class of chemicals, called alkaloids, found in tropical rain forest plants*. The National Cancer Institute has identified couple of thousands tropical plants with anticancer properties. Botanists are convinced that there are many more tropical "miracle plants" awaiting discovery, if they can get to the plants before loggers, ranchers, and farmers cut the forests down.

Some of the most important rainforest products are medicinal drugs. Between 80 and 90 percent of indigenous populations in rainforest areas depend on plants for medicinal purposes. *Nearly one-fourth of all pharmaceuticals that Americans use originally derived from tropical plants, which provided the chemicals for processing synthetic drugs.* Quinine, for example, was developed from the bark of the chinchona tree and is used to treat malaria and pneumonia. Diosgenin, a primary ingredient in cortisone, is produced from rainforest plants that thrive in Belize, Guatemala, and Mexico. Drugs that stimulate the heart and respiratory system, anesthetics, tumor inhibitors, contraceptives, and anti-cancer medicines come from tropical rainforests. The Black bean (castanospermum australe) from the Queensland, Australia, is one of the world's great hopes for an AIDS cure. *Scientists have identified more than 2,000 tropical plants and some say the total could go as high as 3,000 that contain substances for treating various types of cancer.* One example is the rosy periwinkle found in the rainforest of

Madagascar, an island off the southeast coast of Africa. The periwinkle's tiny pink flower is the source of a compound for treatment of childhood leukemia and another compound for treatment of Hodgkin's disease. *Madagascar's eastern forest, in fact, is said to be a "biotic treasure house", because 12,000 known plant species and 190,000 known animal species originated there.* But at least half of the original plants and animals have been lost along with a vast portion of the forest, only about 10 percent of the original forest remains.

Practitioners of Indian folk medicine Known as "Ayurveda" have long depended on the use of plants for treating ailments. There are approximately 1,250 Indian medicinal plants. Several of these plants came under the contemporary scientific scrutiny since the middle of the nineteenth century. Here are some of the plant names: vacha, kumaari, Neem, shatvari, brahmi, devadaru, sallakee, kutaja, haridra, sarpagandha, and kairata. A recent study carried out by Jadavpur University in Kolkata* found that plants used in the ancient Ayurvedic therapy may be very efficient and successfully used in the modern therapy, too. *Indian scientists reported excellent results of Ayurvedic traditional herbs against symptoms which are common in Alzheimer's disease, such as decline of mental abilities, poor memory and concentration etc. Ayurvedic plants, including Brahmi,** that prevent the breakdown of neurotransmitter and also boost mental agility and the cognitive function.* Ayurvedic supporters claim that Ayurveda natural method of treating both body and mind is the oldest holistic system of medicine in the world. Literally, Ayurveda is a compound Sanskrit word formed from "ayur" that means "science or knowledge" and "veda" that means "life." The origins of this traditional medicine go back to the period in which Buddha and Lord Brahma lived, while the ancient texts of Vedas provide historical evidence of the existence of Ayurvedic wisdom. So the more we can learn about these marvelously diverse plants, the better off we may be in addressing our own health problems. The tropical rain forests, with their nearly limitless arsenal house of medicines that we are just beginning to discover. *Steroids, penicillin, morphine, and aspirin are only four products of Western medicine that have their origins in the natural world.* From shark's liver to tree bark, the incredible biodiversity of nature offers us medicinal benefits we have never even dreamed of.

**This is a state university located in the state of West Bengal, India. The university is well known for their academics in Ayurvedic medicine and Acupunture. The university has been able to empower all walks of life and rewarded them success and seen their dream come true.*

***Brahmi is a small creeping plant that grows in waterlogged land in the Indian subcontinent. The aerial parts of the plant are used for medicinal purposes.*

Tragedy of the Rain Forests

Tropical rain forests are the planet's oldest, richest, and most diverse biological communities. They trace a green belt around the planet from about 30 degrees north to about 20 degrees south of the Equator. So many and so varied are the designs and behaviors of a tropical rain forests' plant and animal communities, and so bewildering their infinite interactions, that biologists who study the forests can feel overwhelmed. Millions of species make up the world's tropical rain forests. More woody plant species grow on one forested volcano in the Philippines than grow in the entire Europe. Turn up two square feet of tropical rain forest leaf litter and fifty species of ants scurry out. For every human being there are some three-quarters of a ton of termites in the tropical rain forest biome. Amazonia has about 1,170 known bird species, but many more are still undiscovered. The number of species of tropical rain forest insects is unknown. They whir, whine, hum, and buzz with a million different voices. *The world's largest rain forest biomes are South America's Amazon basin, the East Indies, Sumatra, Borneo, and Papua New Guinea, India and Africa's Congo basin.* The global air circulation keeps these forests wet. Biologists are alarmed by the rapid loss and degradation of the rain forests by logging, slash-and-burn agriculture, and ranching, and little is being done to stop the destruction. Although numerous patches of national parks have been established there is, neither enough money nor park rangers to protect them. So, illegal logging and land clearing continue. Biologists are concerned because of the loss of biodiversity. They are also just beginning to learn about the usefulness of rain forest plants as a source of drugs and medicines for a wide assortment of diseases.

In spite of the fact that forests and forest products provide benefits for many people, nearly 40 percent of the original tropical forests have been destroyed, cut or burned. At a snap of the fingers, an acre of tropical rainforest literally disappears. The United Nations Food and Agricultural Organization (FAO) estimated in late 1991 that the world's tropical forests were disappearing at a rate of 42 million acres per year, a rate 83 percent faster than that of forest loss between 1976 and 1980. Rainforests in temperate regions suffer great losses also, and some say temperate forests are disappearing at a more rapid rate than tropical rainforests. If this rate of destruction continues, most rainforests around the world will be gone within this century. *The causes of forest destruction vary by region but include excessive logging, road construction around, urban development, slash-and-burn agricultural methods, mining, and economic policies that encourage exploitation of natural resources.* In some regions all of these factors play a role in massive deforestation. In the non-industrialized nations of the tropics, wood is the primary energy source for millions of poor and landless

rural people. Thus many peasants cut down trees to provide fuel-wood needed for cooking and heating. Fuel-wood harvesting depletes 5 million acres of tropical rainforest every year. However, as in temperate zones, commercial logging has a much more devastating impact.

Timber exports are major sources of income for many nations in tropical regions, and tropical woods have been shipped primarily from Africa and Southeast Asia to Japan, the largest consumer of tropical regions (U.S is second). Japan uses much of its imported tropical timber to make such products as chopsticks, toothpicks, and furniture. The country also uses wood chips to make cardboard packaging for electronic equipment. Originally those chips came from the U.S. but since large quantities of U.S. waste chips are no longer available, Japan has set up its own operations in Papua New Guinea, clearing hundreds of acres of rainforest on the north coast. The timber industry has caused extensive damage and destruction of rainforests around the world not only because trees are cut also because trees left standing are injured. For, every 26 trees cut in Sarawak, Malaysia, for example, 33 trees are damaged and 70 percent eventually die. Hundreds of thousands of square miles of rainforest have been lost due to dam building and flooding for reservoirs that provide hydroelectric power. Governments in countries such as India, Indonesia, and Brazil have encouraged dam building in order to support new industries, including mining activities and foundries, and to provide irrigation. But the dams and industrialization offer few benefits to the rural poor or tribal groups. Because of dam projects, people have been displaced, which in turn destroys cultures and condemns many to life in urban slums.

Effects of Clear-Cutting or Deforestation

Not only does clear-cutting in temperate forests causes soil erosion, but it also leaves the old growth on either side of the clear-cut vulnerable to adverse weather conditions. Wind penetrates the forest and dries out and damages root systems of trees. Deer and elk often feed in clear-cut areas, increasing their populations. When snow covers the open land, the animals enter the forest, where the ground is protected, to look for food. Because the animal population has increased, the forest areas are overgrazed and part of the ecosystem is destroyed. Fragmentation of the forest also splits up ecosystems and sometimes prevents some insect and other species from migrating because they have not been able to cross open areas. Clear-cutting has been a major factor in controversies over the loss of wildlife habitats particularly that of the northern spotted owl, an endangered species. *To many environmentalists, the owl is an indicator species and has been likened to the canary that miners once carried underground to determine*

whether poisonous gases were present in a mine. If the canary died, the miners knew the mine was unsafe. In the case of spotted owls, which need old trees and space for survival, their diminishing numbers warn that the ecosystem is being destroyed. Because no laws specifically safeguard endangered forests, those who want to preserve old-growth ecosystems must rely on laws that protect endangered species.

Almost half the planet's rain forests have been shaved away. Every minute of the day and night nearly 150 acres of rain forest fall to the chain saw or are recklessly destroyed by the bulldozer's blade. Many experts fear that most of the remaining rain forests will be gone by 2040. Thailand lost 45 percent of its rain forests between 1961 and 1985. In the Philippines the acreage of prized tall trees called dipterocarps* shrank from 40 million in 1960 to one-sixteenth that much in the 1900s. In Africa's Ivory Coast 75 percent of the forests were cut or burned over a 30 year period beginning in 1960. In Ghana, more than 80 percent of the forests have been cut or burned. In Brazil slash-and-burn farming has been causing an estimated loss of $2.5 billion a year. *All of the primary rain forests in India, Bangladesh, Sri Lanka, and Haiti have been cut. According to the World Resources Institute, 30 million acres of tropical forest were destroyed in eight countries in 1987 alone.* A combination of logging, slash-and-burn farming, and land clearing by ranchers has brought disaster to the forests of Indonesia and Sabah, Malaysia. Cutting on watershed areas denudes the slopes. Instead of being buffeted by the plant cover and more slowly released into rivers and streams, rain hits the ground directly. The flood of down-slope water then picks up soil, which flows into and clogs irrigation canals and floods inhabited lowland areas, driving people from their homes. Many people who express concern over the rapid disappearance of the world's tropical rain forests suppose that most of the trees are harvested for use as timber. In fact, the reckless use of tractors and other logging equipment destroys 50 to 75 percent of the trees that are not cut.

Slash-and-burn farming has become one of the leading causes of tropical rain forest destruction in the world. Every hour 50 acres of rain forest are destroyed by this practice. The pressure to slash and burn is greatest in those countries where population growth is highest and, therefore, the demand for land greatest. Large numbers of Brazil's rain forest settlers have watched their dreams of becoming independent farmers crumble because

**Dipterocarps are large emergent trees, typically reaching heights of 40-70 meters tall, with the tallest known living specimen over 85 m tall. The species of this tree is of major importance in the timber trade. Their distribution is pantropical, from Indochina and Southeast Asia, also found in the Seychelles, India.*

clearing a tropical forest is hard work, malaria and other parasitic diseases are rampant, and year after year of poor crop production is discouraging many settlers of the virgin forest give up in despair. After only a few years the nutrient-poor forest soil is exhausted. Farmers either, move and clear a new area or they sell their land to wealthy cattle ranchers who live far away in the cities of Sao Paulo and Rio de Janeiro. *In Brazil more than six hundred cattle ranches average more than 50,000 acres each.* But the outlook for pastureland in a cleared forest is just as bleak as it is for farming. The settlers who sell their land often are kept on as paid laborers to further clear the land and plant grass for pasture. *For a few years the grazing is good enough to support the cattle, which are ground up into hamburger meat for America's fast food chains.* After five or so years, weeds take over the pasture. Since clearing the weeds is too expensive, the land is once again abandoned, this time for good. Almost every ranch that was started in the Amazon before 1978 has been abandoned. That land will not see another tropical rain forest for a million years.

Biosphere in India – The Magic of Life

India is often celebrated as a country where the spirituality toward nature, enabled people to respect plants and animals. Indian Biosphere and biodiversity is extraordinary. India is home to thousands of species of plants and animals, some of which have shaped the economic and cultural history of this state and the nation. India provides habitat for some plants and animals, and even entire plant and animal communities, which are globally restricted to or centered around the country. India has done more for the conservation of biodiversity than most other states; this is a true conservation success story. More, however, needs to be done. *India's over-population puts enormous pressure on Biosphere. Unless India slows down its population level, the future Biosphere looks wounded and bleeding.* We encourage conservation-minded people, professional scientists, and amateur naturalists to take part in the conservation of the plant and animal species and exemplary natural communities that remain vulnerable to further degradation or extirpation in India. *The variation in the country's landscape, from its long coast to the hills and valleys bordering China, Tibet, and Pakistan, helps contribute to the variety of species and natural communities.* The Arabian Sea and the Bay of Bengal are largely responsible for shaping coastal India's broad, sandy beaches and bays, which support extensive salt marshes, maritime forests, boggy swales, and shifting dunes. Savanna-like sand-plain grasslands and coastal heathlands hug the salty, windswept shore. Numerous plants, mammals, birds, reptiles, fish, crustaceans, shellfish, and insects make their homes in these varied coastal ponds.

Moving westward beyond Western Ghats, where rivers created and still nourishes lush floodplain forests, marshes on old banyans, rain-trees, and majestic teak and silver wood trees alongside grassy meadows, sandy beaches, and cobble bars. Various kinds of fish, birds, and insects ply the water as eagles and vultures soar above. Observant individuals may also find tigers, elephants, buffaloes, wood turtles, and beetles. The Western Ghats and its river valleys dominate the landscape of southwest. The landscape is dotted with sphagnum bogs that quiver underfoot, seeping fens in the valleys, spruce-and fir-clad rocky summits, and remnant old-growth forests. This is the realm of elephants, king cobras, salamanders, butterflies, and rare orchids. *Biodiversity can be defined as the diversity of life and its many processes. When we preserve biodiversity in India, residents and visitors benefit. When natural resources in the country are sustained, its economic base is strengthened and myriad opportunities for recreation and rejuvenation are retained.* The extraordinary natural biodiversity of plants, animals, and natural communities here confers on us certain responsibilities. Just as we ask, even expect, Brazilians to protect the rainforest and Tanzanians to protect black rhinoceros populations, so too must we conserve natural areas that provide habitat for all of the plants and animals in India. This includes aspects of biodiversity that may not have any cultural worth today. The value of biodiversity in India to the global community, its indirect value in supporting ecosystem functions, such as, nutrient cycling, its potential value to future generations, and its spiritual and amenity value should all be considered during conservation planning.

We know that Indian residents value the conservation of Biosphere and its biodiversity. They have protected millions of acres statewide for biodiversity. Many kings and citizens have placed their family lands in conservation, joined environmental organizations, and lobbied their state legislators to support the passage of statutes that protect biodiversity. With overwhelming public support, the Indian Legislature has appropriated money toward the acquisition, management, and restoration of land, with the expressed intent of protecting Biosphere. State environmental agencies have protected more than thousands of acres, and their regulatory efforts mitigate activities that might otherwise harm biodiversity. The Natural Heritage and Endangered Species Program annually review more than 1,000 development proposals to ensure that they do not adversely affect rare plants and animals. In addition, the legislature has allocated funds to manage and restore species that were adversely affected or eliminated from the state, such as, the Indian White Rhino,* Bengal Tiger, king cobra,

**Unique to India white rhino is naturally armored, the Indian rhinoceros is distinguished from other rhinos by its single horn, the African rhino with two horns.*

mongoose, porcupines and special species of frogs. *Despite these important and substantive measures, key natural communities, habitats, and species in India lack sufficient protection to ensure their conservation in perpetuity. Since European colonization, several animal species have gone extinct, and many more are no longer found in the country.*

Currently, 1500 species of plants and animals are protected under the Indian Endangered Species Act, because of their precarious status in the country. Furthermore, many ecosystems and natural communities have been drastically altered or diminished in size, unless we act now, some of these ecosystems and natural communities and their constituent species could be lost to the planet forever. *The relatively large quantity of currently protected open space in the country is not sufficient to conserve all biodiversity.* Most land acquisition for conservation has not been directed on the basis of biodiversity goals, nor has it resulted in protecting viable examples of all natural community types. *India is one of the mega biodiversity centers in the world and has two of the twenty four "biodiversity hotspots," located in the Western Ghats and in the Western Himalayas.* The forest cover in these areas is very dense and diverse and of pristine beauty, and incredible biodiversity. The sacred groves of India are some of the areas in the country where the richness of biodiversity has been well preserved. The Thar Desert,* Western Ghats and the Himalayas are three regions rich in biodiversity in India. There are 89 national parks and 504 wildlife sanctuaries in the country, the Chilika Lake being one of them. This lake is also an important wetland area, supporting variety of life forms. The country is estimated to have over 45,000 plant species and 81,000 animal species representing 7 percent of the world's flora and 6 percent of its fauna. The latest 2009 figures are 49,219 plant species representing 12.5 percent and 81,251 animal species representing 6.6 percent.

Biodiversity, Extinctions and Conservation

Extinction is the death or disappearance of species. The world is now undergoing the fastest mass extinction in its entire history. Biodiversity loss the planet is now experiencing is more serious than Global Warming or Climate Change. *In recent survey, one out of three of the scientists polled believes that half of all species now on Earth will die out by 2028.* The survey is a "wake-up call" to all of us "that we are facing a serious threat not only to the health of the planet but also to humanity's own well-being and survival",

**Bordering State of Rajasthan, India Thar Desert is expanding in both east and northeast directions, scientists say, and warn that desertification is becoming a more serious challenge to the country. The Thar Desert is a very hot place. In spite of very little water in the desert, you can still find a wide array of desert animals and plants.*

says Ellen V. Futter, an ecologist from US. *What is new is the rate at which numerous plant and animal species are becoming extinct. That rate is called the "background extinction rate."* The actual extinction rate is most likely hundreds or even thousands of times greater. From 1 to 10 species became extinct every year, on average, during the past 65 million years. In 1996 alone an estimated 1,000 to 10,000 species became extinct. *Most of the extinctions today are due to loss of habitats due to human activity as the world population continues to soar.* One way habitats become lost is through a process called "fragmentation." This occurs when forests are cut down for logging, road building, farms, or housing developments. Blocks of forest are made smaller and smaller, with many more barriers to species movement and dispersal. It has been described as an "ecological cancer" that eats away a forest section by section.

The altered habitat conditions threaten both the plants and animals accustomed to moister, cooler, and dimmer conditions. It also kills off or forces species that need large territories for breeding and feeding to move. The resulting edge communities of plant and animals usually are much less diverse than the deep forest communities and can extend up to 1.5 km into the forest interior. So a moist tropical forest need not be hacked to pieces to lose a significant amount of its biodiversity. Fragmentation can do the job nearly as effectively. There is a general rule to estimate species extinctions due to habitat destruction. If 90 percent of a habitat is logged, we can expect 50 percent of its species, from large animals to microscopic organisms to become extinct. But critics of the rule say that there are too many uncertainties for it to be reliable as a species census taker. Some species will survive by migrating out of the area. And there is no way of knowing how long extinction might take: ten years, fifty years, or hundred years? *Causes for biological destruction are: Increasing human population led to increasing consumption levels; Increasing use of natural resources puts pressure on all the ecosystems; Previous two functions are led to overexploitation and manipulation of ecosystems; Trade in wildlife, such as rhino horn, cobra skins, tiger's claws, and other demand for animal products has led to the extinction of species.*

Save Biosphere – Because Life is Good

1. Create a Center for Biological Diversity. The Government of India is setting up Biosphere Reserves in different parts of the country.
2. These are multipurpose protected areas to preserve the Biosphere and its biodiversity and its genetic diversity in different ecosystems.
3. All of us, in a special way those who belong to different religious belief cooperate with the conservation efforts. Do not kill or abuse any animal.

Be kind to them. Recently Pope Benedict XVI and Holiness Dalai Lama have advocated "pro-life." If they show so much of attention to human life, my anguish is, it should be consistent with all life.

4. A number of NGOs are being involved in the program to create awareness

Conservation – Here are Some Ways You can Help

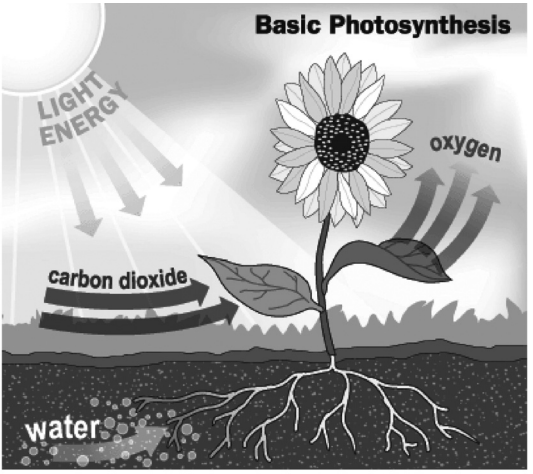
We hope we have convinced you that the conservation of the rich biodiversity of India especially the vulnerable species and under-protected natural communities or ecosystems, should be a high priority for protection. Now you may be wondering what your next step should be. All residents can play an important role in ensuring the conservation of our rare plants, animals, and natural communities.

1. Join in a local conservation group or land trust and advocate that it focus on protecting one of the natural community assemblages or ecosystem types discussed. Encourage the group to manage its own properties in an ecologically appropriate manner that maintains native biodiversity.
2. Encourage your state representative and politician to continue funding for the conservation of biodiversity. Have them allocate more resources to land management, specifically to actions that restore native biodiversity. Remind them of the endangered and threatened species of plants and animals in your areas.
3. Take advantage of the financial and personal rewards of protecting property for plants, animals, and future generations by placing a conservation restriction on your land. Consider placing your land in a charitable remainder trust when planning your estate. So that you and future generations will benefit.
4. Manage your own land for uncommon and threatened plant and animal species by working with a conservation group that manages land to benefit native biodiversity. Number of programs available on Google designed to help you manage biodiversity on your property.
5. Take an active role in local government. Join a conservation commission or become involved in your town's master planning process. Work to make sure that the most biologically important lands in your town are zoned for conservation, and, that biologically important municipal lands are placed into conservation and are appropriately managed for biodiversity.

6. Keep a record of the plant and animal species in your neighborhood and town. Submit written records and photographs of state-listed rare species to the Natural Heritage and Endangered Species Program so that their presence can become part of the official biological inventory in your area. This information is fun to collect and important for conservation planning and regulatory purposes. Your photographs and information about your endemic species could be uploaded in Google for the use of international web users. Besides, a complete list of state-protected rare plants and animals is available from the Natural Heritage Program.
7. Learn what plants are most invasive, and avoid their use in landscaping and gardening. Don't be a vector of non-native plants and animals that may become nuisance weeds or pests. Consider planting native shrubs and flowers in your garden or keep a portion of your land in a natural condition. Don't allow your dog or cat to roam free and disturb wildlife.
8. Support stronger enforcement of environmental regulations. Protect the local wildlife from the abuse of kids.
9. Donate your time or resources to an organization that is focused on protecting, restoring, and managing native biodiversity in your area.
10. Start a group in your village, who will meet once in a month and discuss about the local fauna and flora, where the group could enjoy photographs or home videos on biodiversity of your locale.

Seven Wonders of Biosphere

1. Photosynthesis – The First Wonder of Biosphere



Trees, like all plants and animals, need energy to grow, to build and repair tissue, and to reproduce. This energy is locked in food. Animals oxidize or burn the food they eat to get energy. Trees make it themselves; in fact, plants make more food than they need as living things. Animals consume the rest. Before animals could get a foothold on Earth, or even begin life, there had to be plant food to sustain life. For hundreds of millions of years green plants have been providing food for animals and, later, for people. *Only green plants can manufacture food by trapping the sun's energy;* that leaves out mushrooms and other fungi, molds and most bacteria. In trees, the green leaves are the food makers. The general idea that green plants have the ability to use sunlight in this process dates about two hundred years. But the full details of the complicated reactions in the course of food making have been known for less than two decades.

Leaf is a wonder in nature. The leaf is covered by a transparent waxy coating that protects it from damage by wind and rain, while at the same time protecting it against evaporation of its internal water supply. To some extent this coating also tends to keep chewing insects away. Beneath the waxy cuticle and the single layer of tightly fitting cells that make up the epidermis is the middle leaf layer, consisting of the "green machinery", the photosynthetic cells and the veins. The cells at the top are tall and cylindrical, arranged in rows: these are the palisade cells. Those on the bottom are irregular in shape and form a loosely packed spongy layer with numerous air spaces through which carbon dioxide and oxygen pass in and out. The cells of both these layers are green, containing chlorophyll, the chemical starter for photosynthesis. Between the layers are the veins, of the

two kinds: the xylem above, the phloem below. By now you can guess that the xylem is the duct for water and minerals; the phloem is for carrying manufactured food downward through the flexible leaf stalk (petiole). Both xylem and phloem in each vein connect with the leaf's midrib.

Mainly in the lower epidermis, but also to some extent in the upper epidermis, there are abundant numbers of pores called stomata, plural for stoma, the Greek word for mouth, or stomates. These pores are appropriately named because they are lip-shaped openings. The walls of the stomates are made of two guard cells each. Unlike the other epidermal cells, they contain chlorophyll. *The leaf's food-making machinery is found in the palisade cells, and the essential chemical for photosynthesis is the green pigment which they contain*. In 1817 two French chemists, Pierre Joseph Pelletier and James Bienaime Caventou, isolated the green substance and gave it its name, chlorophyll, from the Greek words meaning "green leaf." Richard Willstatter, a German chemist discovered that chlorophyll contains carbon, hydrogen, oxygen and nitrogen, the four elements to be expected in nearly every substance found in living tissue; but he also found that it also contained magnesium, a silver-white metallic element. A bit of leaf examined under the microscope shows that chlorophyll is distributed unevenly through the palisade cells, being confined to small, roughly round bodies called chloroplasts. A cell may contain 20 to 100 chloroplasts, each with a membrane separating it from the rest of the cytoplasm; each is capable of dividing into two daughter chloroplasts. Within each chloroplast there is a large number of bodies called grana, and it is the grana that contain the chlorophyll. Each granum is an ultra microscopic granule with its own complex structure. It is composed of layers of molecules piled up like stacks of coins. Layers of protein and special fatty substances alternate with layers of chlorophyll. These stacked layers, called lamellae, are suspended in a clear liquid which contains enzymes, dissolved salts, and other substances necessary for the photosynthetic process.

The conversion of the sun's energy into chemical energy has been tracked down to the chloroplasts. They are likened to photoelectric cells because they react to light; this causes the chlorophyll to become activated. It is believed to work somewhat like this: when a photon (an indivisible quantity or "packet" of light) strikes the chloroplast, an electron is ejected in a chlorophyll molecule, activating the pigments called carotenoids, but the enzymes, enzyme helpers, and activators that work together. Chlorophyll by itself cannot carry out photosynthesis. Photosynthesis appears fairly simple, but it is simple only insofar as it concerns the raw materials , carbon dioxide and water, and the end products, oxygen and water, the reaction that requires solar energy and chlorophyll plus (plus chemicals that help to

transfer and store the energy, locked chemically) involves a complicated cycle of two interrelated reactions. One, called the light reaction, occurs only in the presence of light. The other, the dark reaction, may occur either in light or darkness; it does not require light, is independent of it, is much slower than the light reaction, but is necessary to complete the process. The initial and ultimate source of energy for the photosynthesis is, of course, sunlight. However, this radiant energy is converted into chemical energy. In the light reaction, sunlight furnishes the energy for splitting water and releasing oxygen. Without any doubt Photosynthesis is the First Wonder of Biosphere.

2. Natural Selection – The Second Wonder of Biosphere

This is not to say that the doctrine of natural selection was generally accorded, immediately upon its appearance, the status of dogma. In fact, over the last hundred years the thesis of natural selection has been doubted, questioned, derided, ridiculed, and on several occasions buried with considerable pride, pomp, and circumstance. *Nevertheless, over the passage of years the concept has weathered its criticisms and survived its funerals, gathering strength after each successive interment. No serious student of biology today questions the actuality of organic evolution.* Neither is there any disagreement as to the reality of natural selection, although its importance relative to other phenomena responsible for descent with modification may be in dispute. Even those considered to be militant foes of the view that natural selection is of primary significance in all phases of the evolutionary process.

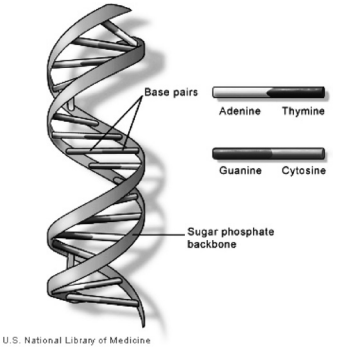
It may be appropriate at this point to define natural selection. Darwin himself did so in a number of ways. Thus quoting from the sixth edition of "The Origin of Species", he says*, "As many more individuals of each species are born than can possibly survive; and as, consequently, there is a frequently recurring struggle for existence, it follows that any being, if it vary however slightly in any manner profitable to itself, under the complex and sometimes varying conditions of life, will have a better chance of surviving, and thus be naturally selected. From the strong principle of inheritance, any selected variety will tend to propagate its new and modified form."* Elsewhere we read: "This preservation of favorable individual differences and variations, and the destruction of those which are injurious, *I have called Natural Selection, or the Survival of the Fittest*." Some exegesis of the operative words in these passages is called for. In particular, three questions may be asked. Is Darwin's term selection synonymous with choice? Is survival to be taken in the precise meaning of the word or is it used figuratively, including the

ability to reproduce? What does the term fittest which Darwin adopted from Herbert Spencer, signify in the context of the rest of the definition? Darwin's description of natural selection can be paraphrased to say: *that in nature, individuals differ among themselves; that their differences are in part determined by heredity; that, therefore, whenever these differences are correlated with fitness, that is, success in leaving offspring, the properties of the more fit individuals will be represented in succeeding generations to an increasing extent*. Thus, changes in make-up of successive generations are determined in a measure by the inequalities between the reproductive rates of individuals differing in heredity endowment, that is to say, by different genotypes. More concisely, natural selection then is the differential reproduction of genotypes. The carriers of various genetic constitutions have phenotypes (to wit, somatic properties whether or not they happen to be apparent to the human observer) which differ in their capacity to produce surviving progeny in their particular environment. The genotypic composition of the next generation is then modified, and changes in phenotypes are produced to the degree to which phenotypes are genetically determined. Natural Selection is indeed, the Second Wonder of Biosphere.

3. Deoxyribonucleic Acid (DNA) – The Third Wonder of Biosphere

Biological evolution requires three elements:

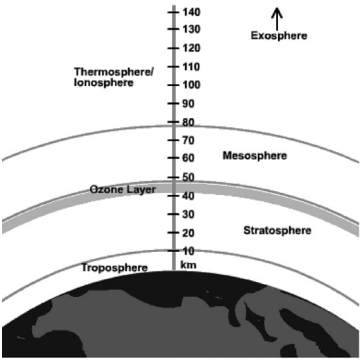
- *Inheritance* – Inheritable genes for each individual that tend to determine physical traits of the individual.
- *Variation* – Variations of the genes determine biological diversity.
- *Selection* –Physical traits or behaviors of different individuals that tend to lead to varying success in helping these individuals survive, reproduce, or assists others with the same traits. The traits of individuals that help them survive, reproduce, or assist others with the same traits, their phenotypes, succeed if they increase their share within the population. The genes of the individuals, their genotypes that promote these traits increase their share in the gene pool. The form that their genes take, their alleles, are passed on to the succeeding generation in greater frequency than other alleles that lead to less successful traits. After many generations, the most successful alleles dominate the gene pool.



U.S. National Library of Medicine

DNA, or deoxyribonucleic acid, is the hereditary material in humans and almost all other organisms. Nearly every cell in a person's body has the same DNA. Most DNA is located in the cell nucleus, but a small amount of DNA can also be found in the mitochondria. *The information in DNA is stored as a code made up of four chemical bases: adenine (A), guanine (G), cytosine (C), and thymine (T).* Human DNA consists of about 3 billion bases, and more than 99 percent of those are the same in all people. The order, or sequence, of these bases determine the information available for building and maintaining an organism, similar to the way in which letters of the alphabet appear in a certain order to form words and sentences. DNA bases pair up with each other, A with T and C with G, to form units called base pairs. Each base is also attached to a sugar molecule and a phosphate molecule. Together, a base, sugar, and phosphate are called a nucleotide. *Nucleotides are arranged in two long strands that form a spiral called a double helix. The structure of the double helix is somewhat like a ladder, with the base pairs forming the ladder's rungs and the sugar and phosphate molecules forming the vertical sidepieces of the ladder.* An important property of DNA is that it can replicate, or make copies of itself. Each strand of DNA in the double helix can serve as a pattern for duplicating the sequence of bases. This is critical when cells divide because each new cell needs to have an exact copy of the DNA present in the old cell. DNA drives life and be called the Third Wonder of Biosphere.

4. Atmosphere – The Fourth Wonder of Biosphere



Wrapped around the Earth is a thin blanket of gases referred to as the atmosphere. Without this blanket, our planet would be as lifeless as the moon. The atmosphere gives us the air we need to breathe, provides us with clean water to drink, traps the sun's warmth, and protects us from harmful ultraviolet rays. The atmosphere has a distinct vertical structure comprising four broad layers, each with its own characteristics. Each layer is warmed by different portions of the sun's radiation, so the temperature of the atmosphere varies between layers. *The lowest layer, the troposphere, is the layer in which we live. It gets its warmth from the ground, which is heated by the sun.* Temperatures in the troposphere decrease steadily with distance from the ground. The rate of cooling, known

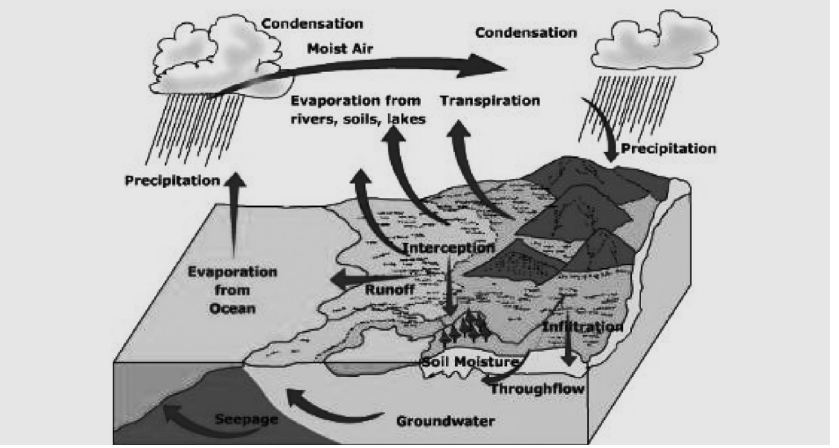
as the environmental lapse rate, is remarkably even at around 6 degrees Celsius per 1,000 meters. The troposphere contains 75 percent of the atmosphere's gas. It also holds huge amounts of dust and water vapor, and is often dense with clouds and mist. Air pressure is greatest in the troposphere, because gravity pulls the atmosphere towards the Earth, squeezing most of its weight into this lowest layer.

The boundary that separates the troposphere from the stratosphere is called the tropopause. The height of this boundary varies between about 15 kilometers at the Equator and 8 kilometers at the North and South poles. In the stratosphere, temperatures begin to rise. *This is due to the presence of the ozone layer, which absorbs the sun's ultraviolet light and, at the same time, protects the Earth from the dangerous effects of UV rays.* The ozone actually soaks up so much UV light that the stratosphere gets quite warm towards the top. Since the air gets warmer beyond the tropospause, moisture evaporated from the sea can never rise into the stratosphere, because it is carried by colder, denser air in the troposphere. Because the air in the stratosphere contains little moisture, and is heated from above as ozone absorbs UV light, the stratosphere is still and calm, which is why jet airliners climb up to this level for long distance flights. The only clouds are faint noctilucent (nightshining) clouds and mother-of-pearl clouds. The stratosphere contains 19 percent of the atmosphere's gas. Higher still, the mesosphere is heated as oxygen and nitrogen are warmed by extreme ultraviolet light, but temperatures begin to drop with height as the gases get thinner and thinner. The air is the mesosphere is very thin, but thick enough to slow down meteorites, which burn up as they hurtle into it, leaving fiery trails in the night sky. The mesopause is the boundary that separates the mesosphere from the fourth layer of the atmosphere. Gases in the thermosphere are even thinner than those in the mesosphere, but because they are exposed to the full glare of the sun, temperatures soar to 2,000 degrees Celsius. However, because there is so little gas, there is very little real heat.

The upper part of the mesosphere and the lower part of the thermosphere are together referred to as the ionosphere, since this layer contains many electrically charged particles called ions. Ions are atoms or molecules that have lost or gained one or more negatively charged electron. Ions in the atmosphere are formed when gas molecules, such as nitrogen and oxygen, are energized by ultraviolet rays from the sun to such an extent that they lose one or more of their electrons. Because ions are electrically charged, they are capable of reflecting radio signals. During the day, the sun's ultraviolet rays turn more and more atoms into ions, and so the ionosphere

is most highly charged just after sunset. By dawn, the ionosphere is much weaker because the electrons slowly recombine with ions during the night. The outer layer of the atmosphere, the exosphere, lies more than 483 kilometers above the ground. At this height, gases become so rarified that they drift off into space. *Even further out are indistinct regions called the heliosphere and protonosphere.* In the heliosphere, the atmosphere has thinned out to a near vacuum, but slight frictional drag on spacecraft indicates that gas is present mostly helium, which is why it is called the heliosphere. The protonosphere, which stretches out more than 60,000 kilometers above the Earth, is even more rarefied, and probably consists of a sparse scattering of charged hydrogen particles, known as protons, hence the name. Atmosphere is very important requirement for life. Without atmosphere there is no oxygen or nitrogen and absolutely no any kind of protection from the hostility of space. Atmosphere is a unique concept on planet Earth and be called the Fourth Wonder of Biosphere.

5. Hydrologic Cycle – The Fifth Wonder of Biosphere



One of the most important things is water. Water has already been considered as a major part of the Biosphere, but it is the way in which water is constantly being recycled through the Biosphere which adds to its importance. Water is a unique substance. It may appear in the Biosphere as a liquid, as it does in oceans, rivers, and lakes. It may be a solid, as it is in ice and snow. Or it may be a gas, water vapor. Water also is absorbed and fixed, that is, temporarily stored in the bodies of animals and in plants. Evaporation from the ground and from plants, a process known as transpiration, removes water to the atmosphere, while precipitation,

generally as rain and snow, supplies it to the land. The difference between precipitation and evaporation defines the amount of fresh water available for lakes, streams, and other reserves on land. This "runoff", which is mostly returned to the oceans through rivers, adds up to about 24 cubic miles globally per day. *In deserts, evaporation is about equal to precipitation and it essentially ends up as runoff, and most of this finds its way into the great Amazon River, which delivers an awesome one-fifth of the total freshwater input to the global oceans.* The various cogs of the hydrological cycle turn at a wide range of speeds. Rainfall in a river's upland source region can take weeks to reach the sea, while water vapor evaporated from the sea surface typically takes about ten days to fall again as rain. For water locked up as ice in the so called Cryosphere,* that cogs may grind slowly indeed. The water at the base of the polar ice sheets has typically been frozen for hundreds of thousands of years. Most mountain glaciers melt and recede by several miles every decade under present-day conditions, while the sea ice in the polar sea expands and retreats seasonally.

The very existence of a hydrologic cycle is a consequence of water's unique ability to exist in more than one physical state, solid, liquid, or gas, under the conditions that prevail at the surface of the planet. Volcanic areas excepted, the Earth's surface never gets hot enough to boil water; but it evaporates readily nonetheless, since the amount of water vapor in the air is generally well below the "saturated vapor pressure", the maximum humidity of air before water droplets start to condense. That's why the oceans are, to a greater or lesser degree, always "steaming." When moist air cools, the water vapor may condense back to the liquid state, producing the pearly billows of clouds or the dank blankets of mountain mist. This cycle of evaporation and condensation has come to seem so perfectly natural that we never think to remark on why no other substances display such transformations. Almost all of the non-aqueous fabric of our planet remains in the same physical state. The oxygen and nitrogen of the air do not condense; the rocks, sands, and soils do not melt or evaporate. If these substances are transformed at all, it is often through the agency of water which will dissolve many gases and minerals alike. The freezing of water, meanwhile, can send it on a millennia-long detour from the cycle of evaporation and precipitation. Yet the ability of water to enter the solid state is also a crucial aspect of the overall cycle. When water is frozen during the ice ages, the world's seas recede, the climate becomes drier, deserts expand, and ecosystems may be utterly transformed.

**The Cryosphere addresses observations of snow, solid precipitation, lake and river ice, sea ice, glaciers, ice caps, ice sheets, permafrost, and seasonally frozen ground. In short, Cryosphere is the world of ice.*

The hydrologic cycle emphasizes the dynamic nature of the Earth's environment: it is constantly repeating and renewing itself. Substances other than water are cycled be geological and biological processes too. Carbon from atmospheric carbon dioxide gets woven into the fabric of plants, may be thence consumed by animals, settles as dead organic debris to the ocean floor, is carried into the deep Earth at the convergence of tectonic plates, and is recycled into the atmosphere by volcanic emission of gases. Nitrogen from the air is converted back to the nitrogen molecules of air by other microbes feeding off dead organic matter. *These cyclic sequences of chemical and biological transformation of the elements are called biogeochemical cycles. Water is the lubricant for biogeochemical cycling.* Because it is such a superb solvent, and because it is itself in constant flux, it helps to convey other substances hither and thither, between different ecosystems and different climates. Carbon dioxide in the atmosphere dissolves in the surface waters of the sea to provide a carbon source for marine photosynthesis, and in turn the biological growth in the ocean's upper layer drives the rest of the ocean's carbon cycle. Essential nutrients pervade the seas in soluble form: nitrate, phosphate, sulfate, and metals such as iron. The swift churning of the hydrological cycle helps to drive the cycling of these other substances: rain and rivers flush inorganic nutrients out of the minerals of the rocky Earth and carry them to the sea. There is little exaggeration in saying that it is water, in the end, that makes the world go round. Water the giver of life can be baptized as the Fifth Wonder of Biosphere.

6. Global Conveyer Belt – The Sixth Wonder of Biosphere

Invisible to us creatures, an underwater current, circles the globe with a force 16 times as strong as all the rivers combined. This deep water current is known as the Global Conveyor Belt and is driven by density are also known as thermohaline circulation because water density depends on its temperature (thermo) and salinity (haline). Density refers to an object's mass per unit volume, or how compact it is. A heavy, compact bowling ball is obviously going to be denser than an air-filled beach ball. With water, colder and saltier equals denser. At the Earth's poles, when water freezes, the salt doesn't necessarily freeze with it, so a large volume of dense cold, salt water is left behind. When this dense water sinks to the ocean floor, more water moves in to replace it, creating a current. The new water also gets cold and sinks, continuing the cycle. Incredibly this process drives a current of water around the globe.

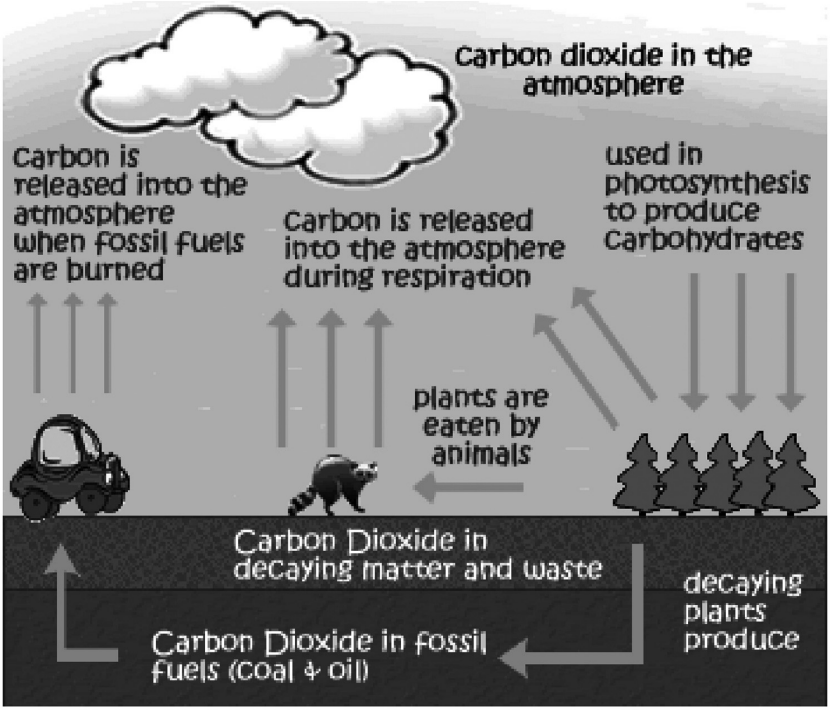
The Global Conveyer Belt begins with the cold water near the North Pole and heads south between South America and Africa toward Antarctica, partly directed by the landmasses it encounters. In Antarctica it gets

recharged with more cold water and then splits in two directions: one section heads to the Indian Ocean and the other to the Pacific Ocean. As the two sections near the equator, they warm up and rise to the surface in what you may remember as "upwelling." When they can't go any further, the two sections loop back to the South Atlantic Ocean and finally to the North Atlantic Ocean, where the cycle starts again. The Global Conveyer Belt moves much more slowly than surface currents: a few centimeters per second, compared to tens or hundreds of centimeters per second. Scientists estimate that it takes one section of the belt 1,000 years to complete one full circuit of the globe. However slow it is, though, it moves a vast amount of water, more than 100 times the flow of the Amazon River. The Global Conveyer Belt is crucial to the base of the world's food chain. As it transports water around the globe, it enriches carbon dioxide-poor, nutrient-depleted surface waters be carrying them through the ocean's deeper layers where those elements are abundant. The nutrients and carbon dioxide from the bottom layers that are distributed through the upper layers enable the growth of algae and seaweed that ultimately support all forms of life.

The belt also helps to regulate temperatures. It brings warmth to Europe otherwise they would be locked in a permanent Ice Age. A well-known density-driven current occurs where the saltier Mediterranean Sea empties into the Atlantic Ocean. During World War II, submarines used this current to enter and leave the Mediterranean without even turning on their engines! Many scientists fear that global warming could affect the Global Conveyer Belt. If global warming leads to increased rain, as some believe it might, the added fresh water could decrease the salinity levels at the poles. Melting ice, another possibility of global warming would also decrease salinity levels. Regardless of the means, the end scenario is the same. Warmer, less dense water won't be dense enough to sink, and the Global Conveyor Belt could stop and trigger Ice Age, having far-reaching and devastating consequences. Global Conveyer Belt can be rightfully called, the Fifth Wonder of Biosphere.

7. Carbon Cycle – The Seventh Wonder of Biosphere

Carbon cycle is extreme, but here is an outline of what goes on. The process of photosynthesis is carried out in the bodies of green plants, algae (mostly microscopic, single celled organisms), and some microorganisms, and if fundamental to the cycling of both carbon and oxygen. Plants in effect find themselves by taking carbon dioxide (CO_2) from the atmosphere and combining it with water in a complex process driven by solar energy. The end products are energy-rich carbohydrates such as glucose, plus new



water molecules and free oxygen. *When plants are eaten by animals or die, their bodies are broken down in a process that is the reverse of photosynthesis, a sort of slow burning called respiration.* In organism seeking to retrieve solar energy from plant (or animal) tissues, oxygen from the atmosphere does the "burning", just as it does the burning when a house goes up in flames. It combines with the carbohydrates to produce carbon dioxide and water, with a release of energy. This breakdown may occur in the digestive system of the plant eater, or that of a microorganism living on dead plant material. When an animal eats a plant, it uses the energy released from respiration of the plant chemicals it has taken in. in the case of predators, respiration releases energy that was originally acquired from plants by herbivores. Animals use that energy to build their bodies and maintain their life processes.

The carbon cycle is the process in which carbon atoms are recycled over and over again on Earth. Carbon recycling takes place within Earth's biosphere and between living things and the nonliving environment. Since a continual supply of carbon is essential for living organisms, the carbon cycle is the name given to the different processes that move carbon from

one to another. The complete cycle is made up of "sources" that put carbon back into the environment and "sinks" that absorb and stored carbon. Earth's biosphere can be thought of as a sealed container into which nothing new is ever added except the energy from the sun. *Since new matter can never be created, it is essential that living things be able to reuse the existing matter again and again. For the world to work as it does, everything has to be constantly recycled.* The carbon cycle is just one of several recycling processes, but it may be the most important process since carbon is known to be a basic building block of life. As the foundation atop which a huge family of chemical substances called organic substances are formed, carbon is the basis of carbohydrates, proteins, lipids, and nucleic acids, all of which form the basis of life on Earth.

Since all living things contain the element carbon, it is one of the most abundant elements of Earth. The total amount of carbon on Earth, whether we are able to measure it accurately or not, always remains the same, although the carbon regularly changes its form. *A particular carbon atom located in someone's eyelash may have at one time been part of some now-extinct species, like a dinosaur. Since the dinosaur died and decomposed millions of years ago, its carbon atoms have seen many forms before ending up as part of a human being.* It may have been part of several plants and trees, free-floating in the air as carbon dioxide, locked away in the shell of a sea creature and then buried at the ocean bottom, or even part of a volcanic eruption. Carbon is found in great quantities in Earth's crust, its surface waters, the atmosphere, and the mass of green plants. It is also found in many different chemical combinations, including carbon dioxide (CO2) and calcium carbonate (CaCO3), as well as in a huge variety of organic compounds such as hydrocarbons (like coal, petroleum, and natural gas). Carbon Cycle is certainly the Seventh Wonder of Biosphere.

Seven Wonders of Biodiversity

1.The Great Barrier Reef - Biggest Structure Built by Smallest Organisms

When we think of the Australia we immediately think about kangaroo, Steve Irwin, and koalas. But there is much more to the Land Down Under than just what the myths and storybooks have told us! The Great Barrier Reef is living work in progress, believed to be over 18,000 years old and over 500 meters thick in some places. It reaches north from just off Bundaberg in central Queensland to the very tip of Australia, the Cape York Peninsula. Coral will only develop in water that is clear and salty, above 68 degrees and less than 90 feet deep. It is formed by the marine polyp, a primitive animal closely related to anemones and jellyfish. *These are the smallest organisms on Earth, responsible of building inch by inch a largest structure in the world.* The marine polyp is distinctive in forming a hard surface by producing lime. As polyps die, their "coral skeletons" remain, gradually forming the reef. New polyps grow on the coral remains of their predecessors, continually contributing to the reef.

The Great Barrier Reef is the only living organism large enough to be seen from space. The reef itself is the world's largest coral reef, made up of about 900 islands and 3000 coral reefs. It stretches 2,000 kilometers off the coast of Queensland, Australia. In 1770 James Cook became the first European to encounter the Natural Wonder, which is believed to have been growing the past 18,000 years. In more recent years, international guests have been enjoying the beauty of the reef right along side the locals through a variety of activities. Amongst the reef, there are hundreds of smaller islands ripe for exploring. This is the largest marine preserve in the world. Naturally, it is hoe to a plethora of 500 species of beautifully colored coral, 4,000 kinds of shellfish, 500 species of sea-birds, and 1,500 different fish species. The reef was one of the most diverse and remarkable ecosystems in the world, and populations of almost all marine species were still large. But some ecologically important species, such as dugongs, marine turtles, seabirds, black teatfish and some sharks had declined significantly, while coral diseases and pest outbreaks like crown-of-thorns starfish appeared to be increasing and becoming more serious. Crown-of-thorns starfish eats corals. Recently, the scientists have found ocean temperatures on northern parts of the reef had been a degree above average through winter, pointing to a bad year for coral bleaching. It followed a report last year which found agricultural run-off was killing the reef, with some sections already irreversibly damaged. But still the Australian Great Barrier Reef is truly one of the most gorgeous sites in the world.

Australia's Great Barrier Reef has only a 50 percent chance of survival if global CO2 emissions are not reduced at least 25 percent by 2020. Many scientists say that even deeper cuts of up to 90 percent by 2050 would necessary if the reef was to survive future coral bleaching and coral death caused by rising ocean temperatures. Climate Change is already impacting the Great Barrier Reef. I have seen with my own eyes in November 2006. Australia, one of the world's biggest CO2 emitters per capita, has only pledged to cut its emissions by 5 percent from 2000 levels to 2020. It has said it would go further, with a 25 percent cut, if a tough international climate agreement is reached at U.N. climate talks in Copenhagen in December 2009, but this is looking increasingly unlikely with legally binding targets now off the agenda. "This is our Barrier Reef. If Australia doesn't show leadership by reducing emissions to save the reef, who will?" asked scientist Ken Baldwin, in calling for Australia to lead the way in cutting emissions. But the Australian government is struggling to have a hostile Senate pass its planned emission trading scheme. The World Heritage-protected Great Barrier Reef sprawls for more than 345,000 square kilometers off Australia's east coast.

The Australian scientists said more than 100 nations had endorsed a goal of limiting average global warming to no more than two degrees Celsius above pre-industrial temperatures, but even that rise would endanger coral reefs. The scientists said global warming was already threatening the economic value of the Great Barrier Reef which contributes a $5.4 billion to the Australian economy each year from fishing, recreational usage and tourism. The U.N. Intergovernmental Panel on Climate Change has concluded that the Great Barrier Reef could be "functionally extinct" within decades, with deadly coral bleaching likely to be an annual occurrence by 2030. Bleaching occurs when the tiny plant-like coral organisms die, often because of higher temperatures, and leave behind only a white limestone reef skeleton. Supporting millions of species, the Great Barrier Reef is one of the Wonders of Biodiversity on planet Earth.

2. The Himalayas and Mt. Everest – The Roof of the World

Years ago I had a dream to one day climb Mt. Everest. I realize now that dream will never happen because let's face it. I am not in that good shape to climb the mountain. I do however, still dream of standing at the bottom of this huge mountain and look up at her and see her beautiful wonder face to face. Ever since I can remember, I've had a fascination with Mount Everest. I don't know why. But I do. I remember reading a book about the

conquest of Everest by Hillary and Tenzing,* when I was a kid. In my opinion climbing is not about "conquering mountains." It is true that many climbers do in fact posses this mentality. I personally believe that the true beauty in climbing is the experience both in appreciating nature's wonder while challenging yourself physically in new ways and to your personal limits. While reaching the top of mountains can be an exhilarating experience, irrational obsession with summiting (often called Summit Fever) can be deadly. Climbing Mt. Everest is no joke. It is of course the world's tallest mountain and the risk of death is significant. However, since discovering its mighty height men have thrown themselves at the mountain like moths at a flame. While a successful summit is admirable, there are several reasons why it is a foolish pursuit for most people. Besides the outrageous cost of $50,000, over 200 people have lost their lives on Mt. Everest, including several of the best climbers in the world. While some would argue that climbing Everest is "safer" than in the past, people still die on the mountain every year.

In 2006, 11 people died on the mountain in just one season, which spans about a month and over 150 frozen bodies still litter the slopes of Everest. More than ever, less experienced climbers are attempting to climb Everest. It has become the "Disneyland" of high altitude climbs, where some people seek to purchase a story to tell their friends. Inexperienced climbers not only risk their own lives, but everyone else on the mountain as well. Everest has become a place where personal triumph trumps the lives of others. More than once in recent years, climbers heading up the mountain have left other climbers in distress (but still alive) for dead rather risk their own summit attempt. In 2006, David Sharp of England dies when over 40 climbers passed by and left him to die next to the main trail. Unfortunately he could not find a Good Samaritan in time. Weather plays a large role in whether or not you will have the opportunity to summit successfully, and it is something over which you have absolutely no control. Complicating matters further, the deaths of 11 climbers, including Rob Hall and Scott Fisher, two of the world's celebrated and accomplished high altitude climbers. In this hostile and forbidden landscape, one can only be a visitor, not a conqueror.

Up in the Himalayas the Kali Gandaki River flows through the deepest valley in the world. As you stand in Nepal beside its roaring milky waters,

** Sir Edmund Hillary from New Zealand and Tenzing Norgay, the Indian Sherpa who accompanied Hillary to Everest's 29,035 feet summit on May 28, 1953. Hillary would become the first human to stand atop the world's highest mountain, with Tenzing joining him seconds later. Tenzing Norgay died on 9 May 1986. The New Zealand adventurer died on January 11, 2008. He was 88.*

looking upstream towards the main range of the Himalayas, the river seems to spring from a cluster of immense snow-capped, ice-girt peaks. The tallest of them, Dhaulagiri, is over 8000 meters tall, the fifth highest mountain in the world. The summit of its immediate neighbor, Annapurna, is only 35km away and only a few meters lower. You might well suppose that the source of the river lay on the nearside, southern flanks of this immense barrier of rock and ice. The Kali Gandaki flows between the two mountains, its bed a good 6 vertical kilometers below the peaks. The people of Nepal have, for many centuries, known that the valley is a highway that leads right through the Himalayas and up into Tibet. Everyday, throughout the summer, trains of mules plod up the winding stony tracks, red horsehair plumes bobbing on their withers, red pompoms on long strings swinging from their pack saddles, carrying huge loads of barley and buckwheat, tea and cloth, up to Tibet to be traded for bales of wool and cakes of salt. Himalayas is rich in Biodiversity.

Wild animals are very scarce indeed up here. It is too cold for any lizards. Nor is there enough food to sustain langur monkeys. Indeed, you may walk all day without seeing any living creature, except for a flight of choughs or ravens and, high above, patrolling the hillsides, griffon vultures. Their presence, however, is a sure sign that other animals are here somewhere, for without them the vultures would starve. So somewhere among the rocks there must be rodents, marmots or picas, cautiously nibbling the grass and the cushion plants that grow, here and there, on the rubbly slopes. But the grazing is so poor that it can only sustain a very small number of individual animals, and those species that do manage to survive here are all scarce. Among them are tahr, neither true sheep nor true goats but equally related to both groups. *Rarer still is the animal that preys on them, the snow leopard. One of the loveliest of the cats, it has a thick creamy coat, rosetted with grey, and cushions of hair on the soles of its paws which protect them from the rough stones and from the cold.* During the winter it retreats to the forests below, but during the summer it may wander as high as 5000 meters.

The lowest reaches of the valley are so warm and humid that the people can grow bananas. The forest has all the luxuriance of a tropical jungle. Rhinoceros munch the lush vegetation and big cats prowl through the bamboo thickets. But as you ascend into the valley proper, the plants change. By the time you reach an altitude of 1000 meters, rhododendrons have begun to appear, rather scraggy trees, some 10 meters high, with broad glossy leaves. In April, they are hung with cascades of scarlet blossoms, sipping nectar and obligingly spreading pollen from tree to tree. Langur monkeys some too, but they are pillagers, grabbing handfuls of flowers and cramming them into their mouths. On the ground grow orchids

and iris, trumpet-shaped arums and primulas. Where the sun's ray penetrates the canopy and warms a boulder, you may see a little lizard, basking. And in the depths of the forest, foraging on the ground or roosting in the trees, you may catch a glimpse of one of the most glorious birds in the world, a tragopan, a pheasant the size of a turkey, with ultramarine wattles and crimson feathers marvelously decorated with chains of white spots.

Once, between the great continental mass of India to the south and Asia to the north, there lay a wide sea. In its waters lived the ammonites. Rivers flowing from the two continents brought down layer upon layer of sediments. As the ammonites died, so their shells fell to the bottom of the sea and were covered by fresh deposits of mud and sand. But the sea was becoming narrower and narrower for, year after year and century after century, India was moving closer to Asia. As it neared, the sediments on the sea floor began to ruck and crumple so that the sea became increasingly shallow. But still the continent of India advanced. The sediments, now compacted into sandstones, limestones and mudstones, rose to form hills. Their elevation was infinitesimally slow. Nonetheless, some of the rivers that had been flowing south from Asia were unable to maintain their course over the slopes that were rising in front of them. Their waters were diverted eastwards and avoided the infant Himalayas by running round their eastern end, eventually joining the Bramaputra. But the Kali Gandaki had enough strength to cut through the soft rocks as fast as they rose so that they formed the great cliffs of crumpled strata that can now be seen on either side of its valley.

The process continued for millions of years. Tibet, which before the collision of the continents had been a well-watered plain along the southern edge of Asia, was not only pushed upwards but gradually deprived of its rainfall by the young mountains and so changed into the high cold desert that it is today; the upper reaches of the kali Gandaki lost much of the rain that had given the river its initial erosive power and shrank inside its vast valley; and on the site of the ancient sea there now stood the highest and newest mountains in the world containing, within their fabric, the remains of ammonites. Nor has this process stopped. *India is still moving north at the rate of about 5 centimeters a year, and each year the rocky summits of the Himalayas are a millimeter higher. This transformation of sea into land began some 65 million years ago.* Though this seems inconceivably distant to us, a species that has only been in existence for less than half a million years, in terms of the history of life as a whole it was a comparatively recent event. It was, after all, some 600 million years since amphibians and reptiles invaded the land. Birds developed feathers and wings and took to the air a few million years afterwards and mammals evolved fur and warm

blood around the same time. Sixty five million years ago, the reptiles fell into their still-mysterious decline and mammals assumed the dominance of the land which they still hold today.

So 50 million years ago, as the island continent of India approached Asia, all the major groups of animals and plants that we know today, and indeed almost all the large families within those groups, were already in existence. Each of the continents had its own multitudinous complement of inhabitants, though India, having been isolated as an immense island since just after the decline of the reptiles, was undoubtedly much poorer in advanced groups of animals than Asia. When the two eventually met and the new mountains began to rise some 40 million years ago, the animals and plants from the two old continents began to spread into the new un-colonized extension to their territory. The story of the building of the Himalayas and their subsequent colonization by animals and plants is only one example of the many changes that are proceeding continuously all over the planet. Mountains are not only being built but simultaneously worn down by glaciers and rivers. Rivers themselves clog and change their courses. Lakes fill with sediments and become swamps and eventually plains. Nor is India the only continent to drift over the face of the globe. All have done so to some degree. As they change their positions, moving towards the equator or up to the poles, so jungle may turn to tundra and grasslands bake into desert.

Each of these physical changes, in sunshine and altitude, in rainfall and temperature, demands a response from the community of plants and animals undergoing it. Some organisms will adapt and survive. Others will fail to do so and disappear. Similar environments will call for similar adaptations and produce animals in different parts of the world which come from quite different ancestors, but which bear a marked resemblance to one another. So there are small, brilliantly colored birds feeding from large blossoms on the slopes of the Andes which look very like the sunbirds of the Himalayas, but which belong to a quite different family of birds, and the heavy-fleeced sure-footed beast of burden that the Andean people use is the llama, a kind of camel and not a kind of cow like the Himalayan yak. Only two major environments have remained physically unchanged over vast periods of time, the jungle and the sea. *Recently, over 350 species including the world's smallest deer, a "flying frog" and a 100 million-year gecko have been discovered in the Eastern Himalayas, a biological treasure trove now threatened by climate change. I wonder how many more species are yet to be discovered? How many will disappear unnoticed because of global warming and our foolishness?* Even here, the biological conditions have gradually altered as evolution, within or outside their frontiers, has produced new

kinds of organisms and therefore presented their older inhabitants with new problems of survival. So, almost every corner of the planet, from the highest to the lowest, the warmest to the coldest, above water and below, has acquired its population of interdependent plants and animals. It is the nature of these adaptations that have enabled living organisms to spread so widely through our varied parts of the world and make Himalayas one of the Wonders of Biodiversity on planet Earth.

3. The Serengeti – African Sanctuary of Biodiversity

Serengeti National Park is the largest park in Tanzania and Africa. The park covers 14,760 square kilometers of wilderness between Tanzania border with Kenya, Lake Victoria and Great Rift Valley. The Serengeti Park owes its name from Masai people, in the Masai language it means "endless wilderness plain." Serengeti is one of the best and largest known wildlife animal sanctuary in the world. It is also known for its famous annual migration of millions of wildebeest, zebra and other countless large heads on early June in search of water and green grass. Serengeti National Park has been listed by UNESCO as one of the world heritage site. *Serengeti provides to the world the best collection of African wildlife animals which cannot be found anywhere else in the world today,* this include; lions, leopards, cheetahs, elephants, cape buffalo, wildebeest, rhinoceroses, hyenas, zebras, giraffes, elands, reedbucks, jackals, and many other countless large heads of antelopes. As if this is not enough there is over 450 different species of birds. Serengeti Park is situated in northern Tanzania, about 321 kilometers north of Arusha town. The best time to visit the park are between May to November just before rain season begin.

The only one of the great grasslands of the world that still retains its populations of large grazing animals almost intact is the savannas of eastern Africa. The survival of the herds there is due largely to the fact that the land is not as well-watered as the prairie, the veldt or the pampas and therefore not suitable either for man's domesticated creatures, which are all descended from temperate species, or for growing his domesticated grasses. These lands today support the largest concentrations of big wild mammals in existence. The savanna country forms a vast horseshoe around the West African jungle about a million square kilometers in extent. It is much more varied in character than the other great grasslands. Low thorny bushes are common in many parts of it. In some places, huge baobab trees stand, their bloated trunks serving to store water soaked up during infrequent rains. Elsewhere low rock hills stud the landscape. Many of the

**Continental Drift is the concept that the Earth's Continents have not always been where they are now, that they have moved over the Earth's surface throughout time.*

rivers are flanked by long galleries of forest, for water soaks through the soil on either side of their beds and allow trees to grow. But almost everywhere there is grass. In parts it grows higher than a man. Elsewhere it is low and so sparse that great areas of red dusty soil show between the clumps.

There are big herbivores that are the large grass-feeders, nearly all of them ruminants that dominate the African plain. And there are the non-ruminating giants, rhinoceros and elephant. Here herds still assemble in numbers that recall the tales brought back by travelers from the veldt and the prairie 150 ago. Some species even still migrate in vast numbers to find better pasture when the seasons change, just as saiga and springbok and bison did in the past. The most famous of these journeys is that of the wildebeest. Rain does not fall uniformly across the Serengeti: the southeast section dries out rather more quickly than the northwest. By May its grass has been cropped low, so its inhabitants have to move. A million wildebeest accompanied by zebras and gazelles begin a long trek, plodding in columns many miles long up towards the northwest. They plunge across rivers in stampedes and in such numbers and concentrations that many of them drown. More are forced into the water by the press of the multitude coming from behind. Lions and crocodiles ambush them and pick off exhausted travelers with ease. So they march day after day until, after 200 kilometers or so, they reach the still lush pastures of the Mara in southern Kenya. There they will stay and feed. But in November these plains too are beginning to fail and down in the Serengeti rain is beginning to fall once more. So once more the wildebeests must set out on their long journey back to Serengeti where food is assured and make Serengeti one of the Wonders of Biodiversity on planet Earth.

4. The Amazon – The Lungs of the World

The Amazon rainforest is a critical influence on South American climate and one of the world's most important carbon sinks. Covering almost as much land as the contiguous USA, the Amazon is home to 20 percent of the planet's animal and plant species and stores the equivalent amount of carbon as a decade of global fossil fuel emissions in its trees. It plays a crucial role in the precipitation cycle of South America and pumps oxygen into the atmosphere, earning it the nickname, the "Lungs of the World." Home to 200 indigenous cultures and 30 million

people, the Amazon rainforest is under increasing pressure to provide subsistence and prosperity, leading to deforestation. Each year an area of forest slightly larger than Tamil Nadu is cut down, releasing global warming pollution in the form of carbon dioxide and methane from burning and decaying vegetation. The Amazon is an important repository of carbon and water. Deforestation disrupts the water cycle by allowing water to runoff directly to rivers rather than being trapped in soil and vegetation and slowly released throughout the year. This makes the forest more vulnerable to drought and the further loss of trees and release of global warming pollution. This shrinking of the Amazon rainforest is a major reason why scientists predict that vegetation will shift from its current state as a carbon sink to a carbon source by the middle of the century.

Amazon River means for many people something fantastic, something over natural. Fact is, Amazon River is magic, irresistible and attractive. One fifth of the total water reserves of the Earth flow through Amazonia. It is by far the river, with the biggest volume worldwide, and its volume is bigger than the combined volume of the following eight world's big rivers. Amazon is also the world's longest river, with a length of 6240 km. the mouths of Amazon are amazing and incredible: almost 300 km wide, you must see that, is impossible to describe. The Brazilian Amazon is vanishing at the rate of 20,000 miles a year, mostly by the illegal logging of timber by Brazilian ranchers (grileiros) for purposes of International Trade. These grileiros exploit Amazonian Land used by local peasants for sustainable agriculture and residence. The case study will cover in depth the repercussions of the illegal logging of timber in Para, Brazil, including the never-ending disputes over the Amazonian land between the grileiros and the peasants who reside in the area. For the past 20 years more than 1,400 peasants, rural workers, and activists have been murdered fighting for the land. The United States is responsible for over 60 percent of all the global mahogany exports, mostly from Brazil, Bolivia, and Peru. Several links have been established between illegal mahogany trade from Brazil to US and EU ports. Great Britain proposed an initiative to prevent trade of illegal logged timber. Initially, the reaction of the G8* environmental ministers was favorable; they agreed to some steps to stop the trade and support policies by the countries where the logging is taking place. Nonetheless, the Unites States did not sign all of the measures, which seems to imply their intention to promote the trade of illegal timber. Whether love or not, the Amazon loves us and it is one of the Wonders of Biodiversity on planet Earth.

**G8 countries are USA, Russia, Japan, Germany, France, United Kingdom, Italy, and Canada.*

5. The Western Ghats – The Maharaja of Biodiversity

With tropical and deciduous rainforest, grasslands, and scrub forests, the Western Ghats in India, is consisted with one of the richest collections of flora and fauna on this planet Earth, and is regarded as one of the world's twenty four bio-diversity hotspots. The Western Ghats or Shayadari Mountains, contain more than 330 species of butterflies, 1800 species of plants, 100 species of frogs and more than ten species of bats, comprising rarely found wroughton's free-tailed bat, the false vampire bat, Indian flying fox, the painted bat the short nosed fruit bat. If you are really a true nature lover, the Western Ghats are loaded with natural beauty where you can find the rarest things, which can hardly ever be seen somewhere. The Western Ghats run along the western tip of India's Deccan Plateau, untying it from a narrow coastal plain all along the Arabian Sea. The range begins from south of the Tapti River close to the border of Gujarat and Maharashtra, and runs about 1600 km via the states of Maharashtra, Goa, Karnataka, Kerala, and Tamil Nadu, to the southern point of the Indian peninsula and comes to an end in close proximity to Swamithoppe in Marunthuvazh Malai in Tamil Nadu. The highest elevation is approximately 900 meters.

The Western Ghats are the watershed of South India's main eastward-flowing rivers, the Godavari, Krishna, and Kaveri. Short, steep westward flowing streams supply hydroelectricity to west-coast cities. Historically the Western Ghats were well covered in dense forests. In the south, they have the only rainforests of south India. These forests are home to an attention-grabbing diverse fauna and flora however they are more and more threatened by human activity. A number of national parks and other protected areas come within the range, however it is estimated that only a small fraction of the Western Ghats is in untouched condition. The Silent Valley National Park in Kerala is regarded by loads of to be the final tracts of virgin tropical evergreen forest in India. Highest peaks comes by in the northern section of the range in Maharashtra, remarkably Kalsubai (5427 ft), Mahabaleswar (4710 ft), and Harischandragarh (4691 ft); in southwest Karnataka, markedly Kudremukh at (6,109 ft) and Mullayanagiri (6,317 ft); and in the southern part of the range, with Anai Mudi in Kerala at (8,842 ft) getting the highest peak in the Western Ghats, Chembra Peak in Kerala at 2100 m, Banasura Peak in Kerala at 2073 m and Vellarimala in Kerala at 2200 meters.

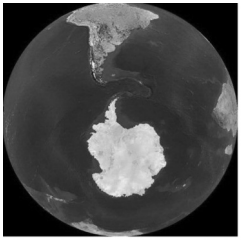
The Goa gap, between Maharashtra and Karnataka sections, and the Palghat Gap that joins Tamil Nadu to Kerala are the only single main gaps in the range. Smaller ranges, comprising the Nilgiri Hills with Doddabetta, the highest peak at 2623 meters of northwestern Tamil Nadu and Biligirirangans

southeast of Mysore in Karnataks, meet up the Shevaroys, Servarayan range, and Tirumala range farthest east, connecting the Western Ghats to the Eastern Ghats. These ranges of hills are considered significant wildlife corridor, letting species such as elephants to move between the ranges. Bio-geographers have long given importance to the unique animal and plants communities of the Western Ghats. A lot of these faunal and floral elements cannot be seen anywhere else in India apart from in parts of northeastern India. The Western Ghats are also meant for a home to countless common species, and the endemism is chiefly high in the reptilian fauna and amphibian. The snake family Uropeltidae is virtually diversified and restricted in this region of the world. A few Western Ghats streams are home to a freshwater puffer fish Tetraodon travacoria besides marine forms such as Chelonodon patoca.

King Cobra – The King Cobra, endemic to Western Ghats, is the world's longest venomous snake, with a length that can be as large as 6.7 m (22 ft). This species is widespread throughout Southeast Asia and in Western Ghats in India, but found mostly in forested areas. Its genus name, Ophipphagus, literally means "snake-eater," and its diet primarily consists of other snakes, including sizeable pythons and even smaller members of its own species. The venom of the King Cobra is primarily neurotoxic, and the snake is fully capable of killing a human with a single bite. The mortality rate from a bite can be as high as 75 percent. The skin is either olive-green, tan, or black and it has faint, pale yellow cross bands down the length of the body. The belly is cream or pale yellow, and the scales are smooth. The head of a mature snake can be quite massive and bulky in appearance, though like all snakes, they can expand their jaws to swallow large prey items. It has proteroglyph dentition, meaning it has two short, fixed fangs in the front of the mouth which channel venom into the prey like hypodermic needles. The male is larger and thicker than the female. The average lifespan of a King Cobra is about 20 years. Widespread, but not common, across India and southeast Asia, it lives in dense highland forests. The snake has a preference for living in areas dotted with lakes and streams. King Cobra populations have dropped in some areas of its range due to the destruction of forests, but despite this, the snake is not listed by the IUCN as in danger of becoming extinct. The King Cobra's venom primarily attacks the victim's central nervous system and quickly induces

severe pain, blurred vision, vertigo, drowsiness, and paralysis. In one or two minutes, cardiovascular collapse occurs, and the victim falls into a coma. Death soon follows due to respiratory failure. Despite the King Cobra's fearsome reputation and deadly bite, it is a shy and reclusive animal, avoiding confrontation as often as possible. If you see a King Cobra in the wild, consider yourself as a privileged one. Indeed, India's Maharaja is one of the Wonders of Biodiversity on planet Earth.

6. The Antarctica – The Land of the Emperor (Penguins)



The area around the North Pole is called the Arctic. It is covered by the Arctic Ocean. The ocean is frozen at the surface. The area around the South Pole is called Antarctica. It means "opposite of the Arctic." Antarctica is covered by ice and snow all the time. Therefore we call it the frozen continent. Beneath this cover of ice there are huge mountains, valleys and plains, even volcanoes. Ronald Amundsen from Norway and his team were the first people to reach the South Pole in the year 1911. And no humans live on Antarctica permanently. However, several countries have established research stations on the continent. And their scientists work on these stations or bases. Some tourists visit the continent occasionally. Antarctica is surrounded by the Antarctic Ocean. The land on Antarctica does not support much of life due to its harsh climate. *The ocean however, supports a wide variety of plants and animals. Fish and squid are found in large numbers.* Seals, whales and birds like penguins and albatross are also abundantly found. Six different kinds of penguins live in Antarctica. Penguins mostly live in the ocean but come on land to mate and lay eggs. Penguin colonies known as "rookeries" can be found on Antarctica. Antarctica, unlike any other continent, was postulated to exist long before it was actually discovered. The ancient Greeks, beginning with Pythagoras in 530 B.C believed the Earth to be round, an idea Aristotle supported and refined further, suggesting that the symmetry of a sphere demanded that the Earth's inhabited northern region should be balanced by an equally inhabited southern region.

The idea of Earthly balance gave rise to the name Antarktos, or Antarctica, which means "opposite Artkos" the constellation in the northern sky, also meaning "opposite to the Arctic." Fifth largest of the Earth's seven continents, Antarctica is the southernmost, coldest, windiest, driest, highest and most remote continent. Despite early Greek theory, it was the last continent to be discovered in the early 19th century. If anything, exploration proved the disexistence of Antarctica, with many expeditions sailing

entirely past Antarctica. However, the Greek historian Herodotus recorded as early as 700 BC a Phoenician fleet sailed from the Red Sea south along the African coast and around Cape Agulthas to the Straits of Gibraltar; and in 650 AD, according to Rarotongan legend, a Polynesian navigator named Ui-te-Rangiora sailed so far south that he reached a place where the sea was frozen. Scientific expeditions and seal hunters had explored only fragments of Antarctica's coast by the end of the 19th century, while the interior remained unknown. Explorers first reached the South Pole in 1911, and the first permanent settlements "scientific stations" were established in early 1940s, with many more established during the International Geographical Year 1957-58. Seven nations Argentina, Australia, Britain, Chile, France, New Zealand, and Norway claimed territory in Antarctica. *Also India can rightfully claim its territory, since India was part of Antarctica before it fragmented and drifted away to north some 40 million years ago.* Since 1961, the continent has been administered under the "Antarctic Treaty," an international agreement to preserve the continent for peaceful scientific study.

About 1 percent of the continent's ice-free areas have been surveyed for minerals, and evidence indicates that Antarctica contains rich mineral deposits. It is also believed that deposits of petroleum and natural gas exist in the continental shelf regions, such as the area under the Ross Sea. The signatory nations of the Antarctic Treaty agreed to a 50 year moratorium on commercial mining activity. Antarctic tourism began in 1958 and has been steadily growing since. In the late 1990s about 10,000 tourists visited Antarctica annually between November and March. Antarctica lies 1,000 km south of South America, it's nearest neighbor, 4,000 km from Africa, and 2,500 km from Australia. With an area of 14 million sq km, Antarctica is larger than either Europe or Australia. It's average elevation of more than 2,000 m is over twice that of Asia, the next highest continent. However, much of this mass is ice. Remove the ice and East Antarctica has a landmass about the size of Australia and West Antarctica becomes a collection of islands. The rocks of East Antarctica are at least 3 billion years old, and the rocks of West Antarctica are relatively new, only 700 million years old. Much of Antarctica's geologic history remains unknown as the rock record, required to decipher the history, is hidden beneath the continent's ice blanket. Drilling projects, including ANDRILL, aim to recover rock core from beneath the ice to help uncover the story of Antarctica's evolution through deep time.

The Antarctic ice has formed through the accumulation of snow over millions of years, although the amount of snow deposited in any one year is relatively low. Antarctica is a desert, and is the driest continent on Earth. Because the snow was deposited over many years without melting, different chemicals and gasses that were mixed into the snow and trapped

in the ice, providing a natural archive for glaciologists and climatologists to study evidence of past environments and climatic changes. By drilling through the ice sheet and analyzing the ice and air trapped in the bubbles, scientists are able to access an archive of past climate change. Mean temperature in the Antarctic interior range from minus 40 to minus 70 degrees Celsius during coldest months. Antarctica experiences the strongest winds on the planet: the katabatics, which can achieve velocities of up to 320 km/h. Antarctic blizzards are quite common. During a typical blizzard, very little if any snow actually falls, but rather snow is picked up and blown along the surface by the wind, many times resulting in complete "whiteouts." *Some 350 species of lichen, 100 species of mosses and hundreds of species of algae, including 20 species of snow of algae, which form colorful patches of pink, red, yellow or green on areas of permanent snow, live in Antarctica.* There are no trees or shrubs and just two species of indigenous vascular plants: Antarctic hairgrass and Antarctic perlwort. The Subantarctic Islands have many more diverse floras.

Antarctica's native animals are all invertebrates, with nearly all terrestrial macrofauna belonging to the phylum Anthropda, including mites, lice springtails, midges and fleas, many of which are parasites of seals and birds. Approximately 45 species of birds breed south of the Antarctic Convergence, a line encircling Antarctica where the cold, northward-flowing Antarctic waters sink beneath the relatively warmer waters of the Subantarctic. This line is actually a zone approximately 20 to 30 miles wide, varying somewhat in latitude in different longitudes, extending across the Atlantic, Pacific, and Indian oceans between the 48^{th} and 61^{st} parallels of South latitude. The precise location at any given place and time is made evident by the sudden change in surface temperature, which averages 2.8 to 5.5 degrees Celsius. Although the zone is a mobile one, it usually does not stray more than a half degree of latitude from its mean position. *It not only separates the two hydrological regions, but also separates areas of distinctive marine life associations and of different climates, including 7 of the 17 living species of penguins.* Just a few bird species breed in Antarctica, among them Emperor, Adelie and Gentoo penguins, snow petrels, Antarctic Petrels and South Polar Skuas. The Southern Ocean, by contrast, teems with life. Supporting a wealth of fish, seal, whale and seabird species. Antarctica is certainly alive and be called one of the Wonders of Biodiversity on planet Earth.

7. Madagascar – The Magic Kingdom of Biodiversity

Madagascar is an island country off the coast of southeastern Africa in the Indian Ocean, located about 500 km east of Mozambique. Madagascar is

the fourth largest island in the world. It covers an area of 587,040 sq km. Madagascar generally has a tropical climate. Antananarivo is the capital of Madagascar and the largest city in Madagascar. The name Antananarivo means "The City of Thousands." The high-altitude city was founded in the 1600s as a walled citadel. Antananarivo is located in the central highlands; its altitude is 1,468 meters above sea level. People first traveled to Madagascar in boats from continental Africa about 2,000 years ago. The people of Madagascar today are a mixture of Asian (Austronesian) and African, with some people from the Middle East. The population of Madagascar is about 18 million and an inhabitant of Madagascar is called a Malagasy. Madagascar is a very poor country. Fishing and forestry are major sources of income. Madagascar has gold, phosphates, kaolin, salt, limestone, uranium, and hydropower. Most of the people in Madagascar make their living by farming and fishing. Madagascar is a mountainous island with some high plateaus; it is ringed by a narrow coastal plain. Madagascar has rainforests that are home to many unusual animals.

About 165 million years ago, Madagascar was connected to Africa. Continental Drift* caused it to move away from Africa. It is now about 500 km off the coast of Africa. The isolated island is home to many unique animals which have been separated from their ancestors for millions of years. Some Malagasy animals include lemurs, which are prosimians or primitive monkeys that are found only in Madagascar; indris are the largest lemurs. Aye-Ayes, flying fox bats, fossa, fanaloka, tenrec, ploughshare tortoises, Madagascar hissing cockroaches, over 300 species of frogs, many chameleons, lizards, and over 250 species of birds, including bee-eaters and couas. No large mammals are native to Madagascar except the dwarf hippopotamus, which probably swam or floated to Madagascar from Africa during the Tertiary Era, from about 65 million to 2 million years ago. There were elephant birds were enormous flightless birds whose eggs weighed about 10 kilos. These birds were killed off by egg-eating cats and dogs that were brought to Madagascar by humans. Other recently extinct animals are many species of lemurs, giant tortoises, and the giant aye-aye. Many dinosaur fossils found in Madagascar. The isolated island is home to many unusual plants including huge palms, 8 species of baobab trees, and many orchids. The national tree of Madagascar is the baobab tree. This magic kingdom could be called one of the Wonders of Biodiversity on planet Earth.

**Continental Drift is the concept that the Earth's Continents have not always been where they are now, that they have moved over the Earth's surface throughout time.*

Ten Heroes of Biosphere

1. The Sun – The First Hero of Biosphere

Helios, the sun god of the ancient Greeks; Ra, sun god of Egyptians; Surya, sun god of Aryans; represented the sun to be the giver of life. Egyptian sun god Ra appeared in many myths and legends, and stories about him varied. As the sun god, he rode across the sky in a golden ship, bringing light and warmth to all creatures living on Earth. When the sun sets in the evening, he descended to the underworld and brought light and air to the people who dwelled there. Each evening Ra's servants helped him battle his eternal enemy, the mighty snake Apep, known also as Apophis, who tried to swallow. According to one series of myths, Ra first ruled during a golden age. Everything he saw was perfect, and the sight of such wonders brought tears to his eyes. The tears fell to Earth and grew into human beings. The chief center for Ra's cult in ancient Egypt was the city of Heliopolis the city of the Sun. As worship of Ra grew it challenged the supremacy of all other cults and eventually became a part of them. Ra remained the principal god throughout the history of ancient Egypt, and Egyptian kings claimed to be the sons of Ra in order to link themselves to him. In ancient art, the god is commonly shown with the head of a falcon wearing a shining disk on its head.

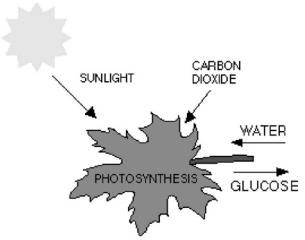
The Sun Temple of Konark, India is dedicated to the Sun God or Surya. It is a masterpiece of India's medieval architecture. The temple is a brilliant chronicle in stone, with thousands of images including deities, heavenly damsels, dancers, lovers, and different scenes from Indian country life. Sun Temple has been declared a world heritage site by UNESCO. The Konark temple is widely known not only for its architectural grandeur but also for the intricacy and profusion of sculptural work. The entire temple has been conceived as a chariot of the sun god with 24 wheels, each about 10 feet in diameter, with a set of spokes and elaborate carvings. Seven horses drag the temple. Two lions guard the entrance, crushing elephants. Konark was one of the earliest centers of sun worshipping in India. Konark was once a bustling port of Kalinga and had good maritime trade relations with Southeast Asian countries. The present Sun Temple was probably built by King Narashimadev I (AD 1238-64) of the Ganga Dynasty to celebrate his victory over the enemies.

We all know that the sun is overwhelmingly important to life on Earth, but few of us have been given a good description of our star and its variations. The sun is an average star, similar to millions of others in the

universe. It is a prodigious energy machine, manufacturing about 3.8 into 1023 kilowatt of energy (or kilojoules/sec). *In other word, if the total output of the sun was gathered for one second it would provide India with enough energy, at its current usage rate, for the next 9,000,000 years.* The basic energy source for the sun is nuclear fusion, which uses the high temperatures and densities within the core to fuse hydrogen, producing energy and creating helium as a byproduct. The sun has been producing its radiant and thermal energies for the past four or five billion years. It has enough hydrogen to continue producing for another five billion years.

The outer solar atmosphere, the corona, is structured by strong magnetic field. Where these fields are closed, often above sunspot groups, the confined solar atmosphere can suddenly and violently release bubbles or tongues of gas and magnetic fields called coronal mass ejections. A large CME can contain 1016 grams (a billion tons) of matter that can be accelerated to several million miles per hour in a spectacular explosion. Solar material streaks out through the interplanetary medium, impacting any planet or spacecraft in its path. Sun is a powerful object in the sky making his presence felt by everyone and every second. The time light takes to reach Earth from the sun is: 8.43 minutes. Sun's distance from Earth is 147,500,000 km. From this distance, sun checks on us every time. It brings us winds, magnetic particles, warmth and radiation. We know sun creates life, protects life, destroys life, and demands we keep our distance. Obviously, sun is the hero number One.

2. The Leaf – The Second Hero of Biosphere



Leaves provide trees with all their food because they turn sunlight into food energy. The form of leaves is related with all their functions and the environment. In addition to photosynthesis, the leaf also carries out all the other exchanges with the atmosphere. *It is through the leaf that the plant "breathes" and transpires. Only leaf can produce food and he is known as "primary producer."* Photosynthesis is how plants use light and water to make sugar. Sugar is created in the green parts of a plant and every animal on Earth depends on it. Without leaf and plant, we would have no food to eat or oxygen to breathe. *There are three main parts of the leaf:* the base which is the point at which the leaf is joined to the stem; the stalk or petiole is the thin section joining the base to the lamina, it is generally cylindrical or semicircular in

form; the lamina or leaf blade is the wide part of the leaf. *Leaves can be of many different shapes*: primarily, leaves are divided into simple, a single leaf blade with a bud at the base of the leaf-stem; or compound, a leaf with more than one blade. All blades are attached to a single leaf-stem. Where the leaf-stem attaches to the twig there is a bud. Leaves may be arranged on the stem either in an alternate arrangement, leaves that are staggered or not placed directly across from each other on the twig; or in an opposite arrangement, 2 or 3 leaves that are directly across from each other on the same twig.

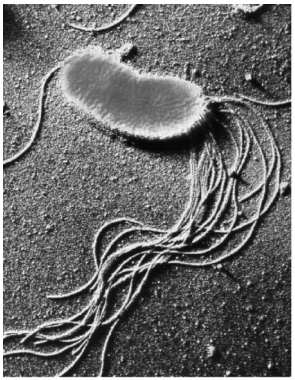
The margin or the edge of a leaf may be entire, singly-toothed, doubly-toothed, or lobed. Compound leaves may be palmate, having the leaflets arranged round a single point like fingers on the palm of a hand; or pinnate, when the leaves are joined on the two sides of the stalk, like the vanes of a feather. *The inside of a leaf is like a small factory.* It contains everything it needs to convert sunlight, carbon dioxide and water into oxygen and sugar. Sunlight shines through the top of the leaf and reaches the next layer of cells. Inside the leaf there is chlorophyll. This chlorophyll captures the sun's light. Chlorophyll is also what gives the leaves a green color. This chemical energy is stored in the chloroplasts. The chloroplasts use the chemical energy to make food. The sunlight is converted into chemical energy which is necessary to continue the process of photosynthesis. When this chemical energy is introduced to the carbon dioxide and the water, glucose (sugar) and oxygen are created. A very simple way to put this is:

Carbon Dioxide + Water + Chlorophyll and Sunlight = Oxygen + Sugar

There are different parts of the leaf that makes this process possible. There are stomata, which are pores on the underside of leaves. These pores let air enter the leaf and then at night the pores release oxygen and they allow water to evaporate. In the spring and the summer you will notice that the leaves on trees are green. This is because photosynthesis is taking place. In order for photosynthesis to occur, the leaf takes in certain materials that will help with the process. A leaf needs to take a gas CO2. Carbon dioxide comes from animals when they breathe. Leaves also need water, which they get from their roots taking it out of the ground. The third thing that a leaf needs to start photosynthesis is the light from the sun. Once the season of fall starts, you will notice a change in the color of the leaves. The leaves no longer stay green, but turn red, brown, orange, yellow, just to name a few. There is reason for this. During the fall there isn't enough sunlight or water for photosynthesis to take place. The green chlorophyll disappears because there isn't the sunlight to convert to chemical energy. This allows for the

bright colors that have been hidden all summer by the green color to show through. Just so you know, the red color in a leaf occurs because there is food, carbohydrates, trapped in the leaf. The leaf that has a brown color has waste that is trapped in the leaf. Only, leaf has the ability to produces food, and can nourish life. Indeed, leaf is one of the great heroes of Biosphere.

3. The Soil – Detritus – The Third Hero of Biosphere



All the time, everywhere, all the species in the world are turning resources into waste, and that was has to go somewhere. In fact, as we all know, it invariably ends up in the environment: in the soil, in a river or lake, in the sea, or on the atmosphere. The truth is that waste materials, whether they come from an ant colony, a clump of trees, a coral reef, a refrigerator factory, or our kitchen, ends up in the back yard of some other organism. For hundreds of millions of years, natural wastes have been dumped on the land and in the sea and, for the same period, organisms that use those wastes for food have evolved and proliferated. Those organisms known as detritus are immensely successful and come in a bewildering array of shapes, sizes, and abilities. By abilities we mean the different ways of converting wastes into resources that other creatures can use. Consider the wastes of a forest, dead leaves and flowers, logs, branches, twigs, and roots, generated all year long for thousands of centuries. *Without the waste-eaters, technically known as decomposers, all that trash would have piled up and suffocated the forest long ago.* The waste from modern human societies is a vast addition to the Biosphere. Then too, it contains a variety of highly toxic substances and materials strongly resistant to degradation. Decomposers or detritus in the form of bacteria are attacking the waste, but it is going to take a very long time to get through all these materials, such as electronic waste. Furthermore, as many are the products of very recent sophisticated manufacturing process, they are new to the planet and thus create a sudden and daunting challenge to waste-eaters that have never encountered them before.

Most of us think seldom, if at all, about decomposers, yet their activities keep wastes, both natural and manmade, from crushing us all. All food chains end up the same way because, sooner or later, the natural decomposers take over. Imagine a food chain with the following links: a

grass seed. Some seed is eaten by a mouse, which in turn is eaten by a snake. Then a hawk, out hunting, captures and consumes the snake, bones and all. Now visualize another kind of food chain in the ocean: microscopic algae each consisting of a single cell, float on the current only to be eaten by a tiny shrimp as it filters the water for food particles. The shrimp is eaten by a small fish, which is later swallowed by a larger fish, which in turn is hunted down by a seal. Finally, the seal becomes the prey of a killer whale. So far, there has been no mention of decomposers. But, eventually the hawk and the killer whale will die, possibly of disease or certainly of old age. *Enter the decomposers, an army of them: bacteria, fungi, and a variety of small animals that use the corpses as food. They keep some of the materials to build their own bodies and release the rest into the environment, where they are ultimately recycled as food by new generations of organisms. Decomposers convert materials that have been used to materials that can be used again, in other words, they are recyclers.* Transforming the waste of the world is a task accomplished by a vast number of individual organisms that belong to a huge variety of decomposer species. To understand this world that cannot be seen with the naked eye, these decomposers that live in soils, help producing organic soil. They are probably the best understood, in that their activities are crucial to agriculture, horticulture, forestry, and gardening. *Without these unseen heroes, this world would rot.* These heroes would be responsible, disposing of our own bodies after death, turning our dead-body-matter into new life-giving-nutrients. Ultimately, only they can tell whether we are good or bad. Indeed, detritus is a hero.

4. The Rock – The Fourth Hero of Biosphere

Rocks are any solid aggregation of minerals. The type of rock in a given region affects soil characteristics and, therefore, influences the region's plant community. A mineral is any naturally occurring solid element or inorganic compound with a crystal structure, a specific chemical composition, and distinct physical properties. Rock cycle is a process in which rock and minerals are heated, melted, cooled and broken down, and takes years to be complete, in a way that mineral resources become nonrenewable on human time scales, therefore, we should try to minimize and mitigate the many environmental and social impacts of our mining operations. Rocks of every sort and shape are worn away over time. Weathering is the process which breaks rocks into smaller bits. There are three main types:

- *Physical weathering is a physical action which breaks up rocks:* An example of this is called freeze-thaw weathering when water gets into tiny cracks in rocks. When the water freezes it expands, if this repeated the crack

grows and bits eventually break off. These particles are rich in minerals and when it combines with the soil, it becomes organic.

- *Chemical weathering is when the rock is chemically attacked:* an example of this is the breakdown of limestone by acid rain. Besides, rocks are known to hold great amount of carbon dioxide. In fact rock is a "carbon sink." Rocks also interact with atmosphere with their heat radiation, influencing the hydrologic cycle in the formation of clouds.
- *Biological weathering*: is when rocks are weakened and broken down by animals and plants. An example would be a tree root system slowly splitting rocks. Erosion is a type of physical weathering which involves wearing down rocks. The rock cycle goes round and round, taking hundreds of millions of years. Once the rock has been broken down into smaller bits it's got to somehow move. Streams and rivers carry the small bits towards the sea. Some soil becomes alluvial plains and its nutrients and minerals support wide variety of plants, trees and animals. Big rivers like Nile, Indus, and Amazon carry millions of tons of sediments out to sea each year. Rock can be called a true hero.

5. The Grass – A Remarkable Endurance – The Fifth Hero of Biosphere

Grass supports wide variety of species as a food source and grass is the spice of biodiversity. Without grass 90 percent of life would perish on Earth. The name grass covers a multiplicity of plants. Indeed, the grass family is one of the largest in the plant kingdom containing, worldwide, about 10,000 different species. Grasses are not, as you might suppose from the simple character of their leaves, primitive plants, but highly evolved ones. Their flowers are often not recognized as such. Grasses, rely on the wind to distribute their pollen. Since they do not need to attract animal pollinators, their flowers have no need to be conspicuous or brightly colored. Instead, they are small and drab, with tiny scales instead of petals, and grow in clusters on special tall stems that lift them into the path of the wind. The one condition that grasses require is good light. They cannot grow in the deep shade of the forest. But they can tolerate many other hardships that would cripple or kill other kinds of plants. They can withstand not only low rainfall but also scorching sunshine. They can survive fire, for even though the flames sweeping over them may burn the leaves, the root stock lying close to the surface of the soil is seldom damaged. They can even tolerate regular mutilation by grazing teeth or the blades of a lawn-mower.

This remarkable endurance comes from the particular way in which grasses grow. The leaves of most other plants spring from buds on a stem develop a branching network of veins to carry their sap, and quickly expand to their final shape. Their growth then stops. If they are damaged, they can

seal off their broken veins to prevent the leakage of sap, but they cannot repair themselves further. The leaf of a grass is different. Its veins form, not a network, but a row of straight un-branched lines that run up the length of the leaf. The growing point is at the base of the leaf and it remains active throughout the life of the plant. If the upper section of the leaf is damaged or cropped, then it grows at the base to restore its original length. Furthermore, the grass plant itself spreads not only by means of seeds, but by putting out horizontal stems along the surface of the ground, and each joint of these is able to sprout leaves and roots. The roots of grass plants are fibrous and grow so profusely that they create a mattered tangle that extends for several centimeters below the surface. This turf holds the soil together even during the prolonged drought, preventing it from blowing away, and when rain does eventually fall, green leaves can be produced within a day or so.

Ruminants are today the most successful of the large grass-eaters. They have far outstripped their only major competitors, the horses, in both the variety of their species and their absolute numbers, even now when their populations have been so heavily reduced by man. The shape of their bodies has been largely determined by the particular character of grass. The openness of the plains on which grass grows requires that those that live there shall be able to run swiftly to escape predators. Over many generations, the ancestral ruminants acquired that ability. They rose up on their toes and so developed longer legs. The lateral toes dwindled, the central ones strengthened and the nails at the tip thickened and provided durable shock-absorbing hooves. The seasonal sprouting of the grass, caused by the irregular rainfall which occurs on so many plains, necessitated long journeys to find pasture throughout the year and the animals, if they were to survive, had to be of a big enough stature to undertake them. Their stomachs changed into the large many-chambered kind that is able to digest grass efficiently, and their teeth too altered. Since grass grows close to the ground, those that eat it can hardly avoid taking into their mouths a certain amount of grit and sand. That, coupled with the intrinsic toughness of the grass leaves, causes heavy wear on the teeth and ruminants have developed very large grinding molars with open roots to them that can therefore grow throughout the animal's life.

But the influence has not all been one way. The ruminants have also affected the spread and extent of grass. If fire destroys the woodland in well-watered country, or man cuts down the trees, grass may establish itself. But seedlings also sprout, and within a year or so could create shade, the one condition that grass cannot tolerate. So woodland would soon displace grass and reclaim its own territory. With the help of ruminants, however, the

grass's invasion can become a permanent occupation, for the animals will graze and trample the young tree seedlings and kill them. *Only grass can survive such punishments*. But even grass requires some rain. As you continue north through the African savannas, the rainfall diminishes and the land is drier. The thorny bush becomes more and more scattered and the grass thins. No more can you hope to see great herds of antelope. Even animal tracks in the dry sand at your feet are rare. *Rice, wheat, barley, corn, and millet all these belong to the family of grass. The miracle plant supports hundreds and thousands species of our Biosphere, including man. If some disease causes grass to disappear, surely man and other mammals will disappear with the grass.* This remarkable survivor has been supporting a wide array of life in the past 40 million years and it will continue to nourish life many more millions of years.

These efficient, persistent plants evolved many million years ago. They were not in existence when the dinosaurs were alive, so those creatures had to survive on the rather coarser fare of ferns, cycads and conifers. *Only long after the age of reptiles, some 25 million years ago, when the mammals were launched on their great expansion, did grasses begin to colonize the plains. Today, grass plants cover about a quarter of the surface of the land.* Each country has given its grassland its own name, the pampas and the campo in the southern part of South America, the llanos on the plains around the Orinoco in the north; the prairie in North America and the steppes in central Asia; the veldt in the south of Africa and the savanna in India. These are areas of great fertility. Individual grass plants may live only a few years before being replaced by new seedlings. Their dead leaves build up a mat of decaying vegetable matter that lightens and enriches the soil beneath, making it crumbly and well-aerated. Among the grass plants and, to some extent, shaded and protected by them, grow many small flowering plants, *vetches which fix nitrogen in nodules on their roots,* daisies and dandelions with flowers made up of a mass of tiny florets, and plants from other families which store food in bulbs and swollen roots. The eternally springing grass, surviving drought and flood, grazing and burning, is lush and sappy in moister regions, dry and tough but nonetheless edible in drier parts, and *presents an easily-gathered banquet for a multitude of animals.* Indeed, a hectare of grassland is capable of supporting a greater weight of living flesh than any other kind of country and grass has earned its name to be called a hero.

6. The Frog – The Sixth Hero of Biosphere

Our passion for the environment drives everything we do. It is about having a conscience when it comes to protecting our planet. When it comes to protection, frogs need the most of it right now. Brilliant orange, bright

blue, dazzling red, frogs come in an astonishing array of colors. This vivid assortment of hues hints at the remarkable diversity that exists among the frog species inhabiting the globe. From lush rainforests to parched deserts, frogs are found nearly in every environment on Earth, and their survival strategies range from surprising to bizarre. *Some 365 million years ago, finned, aquatic animals evolved into tetrapods, the first four-legged vertebrates.* Over time this new animal group moved onto land and gave rise to amphibians, reptiles, birds, and mammals. Today frogs and other amphibians live in all but the harshest land environments, but many remain tied to water for development of their eggs and tadpoles. *There is evidence that frogs have roamed the Earth for more than 200 million years, at least as long as the dinosaurs.* While the life spans of frogs in the wild are unknown, frogs in captivity have been known to live more than 20 years. There are 4,900 species of frogs worldwide. Scientists continue to search for new ones and estimate that more than 1,000 frog species have yet to be described. Toads are frogs the word "toad" is usually used for frogs that have wart and dry skin, and shorter hind legs.

Frogs live near lakes, ponds, and streams. This habitat helps their skin moist, which is necessary to their survival. Otherwise, oxygen can't pass easily through it and the frog suffocates. Frog skin secrets a mucus that helps keep it moist. Toads' skin doesn't lose moisture as quickly, so they can live farther from water than most frogs. About once a week, frogs shed their skin. The process begins with the frog doing a lot of twisting, bending, and stretching to loosen the old skin. Then the frog pulls the skin over its head like a sweater and usually eats it. *Frogs are carnivores. They eat other animals, typically bugs and worms which are harmful to humans. In this process frogs keep diseases down.* Except for an occasional blink, the hunting frog sits almost motionless. It waits for a meal to fly by then snares it with a long, sticky tongue. They come out on rainy days or nights to forage. During extensive periods of heat or drought, frogs can enter a period of dormancy similar to hibernation called estivation.* Frogs like sun. This behavior is called basking. When temperatures are cool, frogs need to bask in sunshine to warm up enough to be able to move. That's because they are cold-blooded, and their body temperature changes with the external temperature. Frogs eat insects, and other small and terrestrial animals. In turn they provide food for fish, some large insects, snakes, lizards, larger frogs, birds, and small carnivorous and omnivorous mammals.

**Frogs and snails are usually active in summer, but if it goes too warm or too dry for them, they enter a period of inactivity known as estivation.*

Over the past 20 years scientists have recorded major declines in frog populations around the world. A few species have vanished completely. Many frog die-offs are the result of local human activity, but the epidemic has also reached remote areas. Is there a global cause? Scientists continue to search for answers. Frogs with extra or missing legs, eyes, and toes have been found in many places since 1996. Possible causes include parasites, pollution, and ultraviolet light grew into malformed adults, while eggs with no exposure developed into normal adults. Major causes of frog declines are:

1. Habitat Destruction
2. Introduced Species
3. Chemical Pollution'
4. Climate Changes
5. Over-collection
6. Epidemic diseases

Everybody interacts with these fascinating animals. You may love them or be creeped out by them, and if you have a lone toad croaking forlornly from the pond outside your bedroom, you might even be coming pretty close to hating them. Even though frogs are some of the most accessible wildlife out there, surprisingly little was known about their status from a conservation perspective before 2004, when the first-ever global study was conducted to look at the state of amphibians. The research uncovered a silent, previously unknown crisis. One in three amphibians (32%) is now threatened with extinction, a rate that is higher than any other known vertebrate group. For the sake of comparison, 12% of birds and 23% of mammals are threatened globally. For the last four years, scientists and conservationists have been in a huddle trying to figure out how to save this incredibly vulnerable and bio-diverse vertebrate group. The result is a comprehensive action plan that will cost nearly $100 million a year to implement. What frogs need is some attention, funding and political champions. By eating harmful bugs and larvae which are otherwise hazardous to all life, frogs help keep healthy ecosystems. Frogs do matter and every frog is a true hero in the Biosphere.

7. The Bee – The Seventh Hero of Biosphere

It's a question that has baffled the worlds of agriculture and science. What is it that has caused the mysterious deaths of honey bees all over the world in the last five years? *Bees have been on this Earth for about 25 million years and are ideally adapted to their natural environment.*

Without bees the environment would be dramatically diminished. Honeybees are a part of our folklore and are one of only two insect species that are managed to provide us with essential services. Honeybees are the pollinating agents and U.N is gearing up to protect the bees as their project for the international year of biodiversity 2010. *Indeed, bees are threatened in many ways, from pesticides to habitat loss and degradation.* Nearly $27 million will be allocated to prevent the collapse of these species, which are most important to our very survival. Nothing evokes the sense of an organic garden like the hum of bees buzzing amongst summer flowers. *Honey bees are important for pollination of all our fruits and berries and many of our vegetable crops. They don't need us but we certainly need them.* By maintaining a bee-friendly garden, you can play a small, but important role in helping to restore the hard-hit wild honeybee populations, and help bee-pollinated crops. Bees pollinate numerous crops and scientists have expressed alarm over their mysterious and rapid decline. *Experts have warned that a drop in the bee population could harm agriculture.* If we continue to neglect the global bee population, then this will have a dramatic effect on our already strained world food supplies. In India, agriculture is marked by three stages: planting, weeding, and reaping, all done by laborers. With the disappearance of bees, one more work load is added, that is pollinating by humans between weeding and reaping.

Why are honeybee colonies collapsing? Colony collapse disorder is characterized by a sudden decline in a bee colony's population and the inexplicable absence of dead bees. One hypothesis is that bees are bringing into their hives traces of pesticides called neonicotinoids, whose use has expanded greatly in the past few years. Some scientists believe that these damage the development of the bee larvae, and inhibit the queen's production of eggs. As a result, these pesticides have already been withdrawn from sale in many countries. Other theories point out the parasitic diseases caused by the "varroa mite" and the link between these diseases and the quality of pollen and nectar that the bees are feeding on. The collapse of honeybee colonies is a phenomenon that, while it was not unknown in the past, has recently been occurring all over the world at an alarmingly increased rate, for reasons that are not entirely understood. Colony collapse occurs when a critical proportion of bees in a hive die early, making the colony unable to sustain itself. Millions of colonies have collapsed in India in the past year, and billions of bees have died. Until a cause is found, the beekeeping industry and scientists in general face a serious threat to their well-being. The buzz about the alarming disappearance of bees has been all about the food production. *If the tireless apian workers didn't fly from one flower to the next, depositing pollen grains so*

that fruit trees can bloom world could well be asking where its next meal would come from. Last year, world's beekeepers watched in horror as more than a quarter of their 2.4 million colonies collapsed, killing billions of nature's little fertilizers. Climate change is the culprit. All the explanation that bees become disoriented by cell-phone radiation, or this, that and the other thing, there is zero evidence for any of it. All we know is we lost the worker population and they died away from the hive. What's unusual is they died over a short time period. In the summer, bees go through a six-week life cycle: three inside the hive, three outside it as foragers. Then they die of old age. When bees are coming to the end of their life for whatever reason, they just fly off and don't come back. Bee can be called a hero.

8. The Cell – The Eight Hero of Biosphere

In 1665, a physicist named Robert Hooke used one of the first microscopes to look more closely at the living world. A slice of cork caught his eye. Looking at thousands of tiny chambers, *Hooke termed these structures cells because they reminded him of the rooms in a monastery.* Subsequent observations built upon Hooke's work and led to what is known as the cell theory. *The cell theory states the following: all living things are made of cells; cells are the basic units of structures and function in living things; all cells are produced from existing cells.* An organism may be characterized as having different levels of organization built around the cell. Unicellular organisms are made up of only one cell, while some multi-cellular organisms are comprised of trillions of cells. In multi-cellular organisms, groups of cells are sharing similar structure from tissues that carry out a specialized function. Different tissue layers form organs. And separate organs often work together to carry out major bodily functions, such as digestion or circulation. These "teams" of organs are referred to as organ systems. Growth of an organism is the result of an increase in cell size and, in multi-cellular organisms, an increase in the number of cells. At first it might seem that the cells of such dissimilar creatures as the tiniest bacterium and a great blue whale would be very different.

The cells of any organism, however, demonstrate all the characteristics of life: a life span that includes a living beginning, growth, development, reproduction, and death; the constant use of matter and energy; response to changing internal and external conditions; and the presence of DNA.

Although multi-cellular organisms can have diverse cell types, all cells have certain parts in common. *All cells are bound by a cell membrane and contain cytoplasm, which is where the cell parts lie. The nucleus of the cell contains the heredity molecule DNA, which is also found in all cells.* And, all cells contain ribosomes (RNA), which are so tiny that they can't be seen in the cell. *Ribosomes are structures that are responsible for constructing proteins, the molecules that carry out the instructions contained in DNA.* All living organisms are composed of one or more cells. *The cell is the unit of organization of life.* Most cells are very small. Ostrich egg is the largest cell. Nerve cell in a leg of a giraffe may be as long as 3m, but is very thin. A cell is a small packet or bag or liquid. The liquid is cytoplasm or cytosol, which is essentially salty water with various organic molecules suspended in it. The cytoplasm is contained within a cell membrane. Cell membrane is a phospholypid bilayer, this means that it is composed that it is composed of two layers of tightly packed molecules of fat. Within the membrane, proteins are embedded into the bilipid layer and are more or less free to move around within the membrane. These proteins are important for the communication between the inside and outside of the cell. The cell membrane is one of the organelles of a cell. Mammalian cells contain a nucleus surrounded by a nuclear membrane and the cytoplasm surrounded by a cell membrane. The cell membrane determines what can enter or leave the cell. Not all molecules can enter or leave cells. Thus, cell membranes are known as selectively permeable or semi-permeable membranes.

Cytoplasm is a jelly-like mixture of chemicals inside a cell. It contains organelles and many chemical reactions take place here. Mitochondria (singular, mitochondrion) are oblong shaped organelles that are found in the cytoplasm of every eukaryotic cell. They occur in varying numbers, depending on the cell and its function. *These organelles are the power generators of the cell, converting oxygen and nutrients into ATP (adenosine triphosphate). ATP is the chemical energy "currency" of the cell that powers the cell's metabolic activities. This process is called aerobic respiration and is the reason animals breathe oxygen.* Mitochondrion is different from other organelles because it has its own DNA and reproduces independently of the cell in which it is found; an apparent case of endosymbiosis. The two organisms, cell and mitochondrion developed a symbiotic relationship over time, the larger organism providing the smaller with ample nutrients and the smaller organism providing ATP molecules to the larger one. Eventually, the larger organism developed into the eukaryotic cell, the smaller organism into the mitochondrion. *Mitochondrial DNA can be used study different aspects of inheritance. In most animal species, mitochondria are inherited through the maternal lineage.* A sperm carries mitochondria in its

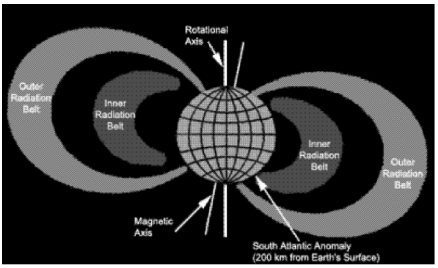
tail as an energy source for its long journey to the egg. When it attaches to the egg during fertilization, the tail falls off. Consequently, the only mitochondria the new organism gets are from the egg its mother provided. *Unlike nuclear DNA, mitochondrial DNA doesn't get shuffled every generation, so it is presumed to change at a slower rate*. The fact is being used to study human evolution and suggests that modern humans descended from a small group of hominids in Africa around 200,000 years ago. Mitochondrial DNA is also being used in forensic science, as a tool for identifying corpses or body parts, and has been implicated in a number of genetic diseases such as Alzheimer's disease and diabetes. On the outside of the membrane, some cells may have additional structure, such as hair-like cilia on the surface or long whip-like flagella at one end as in sperm cells. Both of these structures allow the cell to move utilizing its own energy. This hero runs life and extinguishes life. Cell is a hero.

9. The Ozone Layer – The Ninth Hero of Biosphere

In the late 1980s, there was a sense of the new about the greenhouse effect, even though scientists had been positing since the 1890s that heat-trapping gases, particularly carbon dioxide released by burning coal and other focal fuels could raise global temperatures. A combination of observations and computer stimulations seemed finally to be giving a face to theory, which made it easy to sell as a cover story in Time magazine or to Science Digest, Discover, the Washington Post, or the New York Times. At that time, there was also a newly perceived global atmospheric threat, the damage to the ozone layer from chlorofluorocarbons (CFCs) and other synthetic compounds and an international solution in a treaty that banned the chemicals. But eliminating a handful of chemicals produced by a handful of companies is a very different challenge than eliminating emissions from almost every activity of modern life, from turning on a lamp to driving a car. Another difference between global warming and ozone damage was the iconic nature of the ozone problem. It was an issue with an emblem, the stark, seasonal "hole" that was discovered in the protective atmospheric veil over Antarctica. *If a picture is worth a thousand words, a satellite image of a giant purple bruise-like gap in the planet's radiation shield must be worth 10,000*. Indeed, according to many surveys, the ozone hole still resonates in the popular imagination, incorrectly, as a cause of global warming simply because it is so memorable and has something to do with the changing atmosphere. The ozone hole also resonated with the public because it was directly linked with an issue that concerns everyone, their health, through the possible risk of increased rates of skin cancer.

The Ozone layer is a deep layer in the stratosphere, encircling the Earth that has large amounts of ozone in it. The layer shields the entire Earth from much of the harmful ultraviolet radiation that comes from the sun. Interestingly, it is also this ultraviolet radiation that forms the ozone in the first place. *Ozone is a special form of oxygen, made up of three oxygen atoms rather than the usual two oxygen atoms. It is usually forms when some type of radiation or electrical discharge separates the two atoms in an oxygen molecule (O2), which can then individually recombine with other oxygen molecules to form ozone (O3)*. The ozone layer becomes more widely appreciated when it was realized that certain chemicals mankind manufactures, called chlorofluorocarbons, find their way up into the stratosphere where, through a complex series of chemical reactions, they destroy some of the ozone. As a result of this discovery, an international treaty was signed and the manufacture of these chemicals was stopped. The ozone layer has since begun to recover as a result of these efforts. *The stratospheric ozone, which protects us from the sun, is good. There is also ozone produced near the ground, from sunlight interacting with atmospheric pollution in cities that is bad*. It causes breathing problems for some people, and usually occurs in the summertime when the pollution over a city builds up during stagnant air conditions associated with high pressure areas. Still, human contributions to the greenhouse effect have remained a perennial issue. Specialized reporters have tracked the developments in climate science and the policy debated over the implications of that science. We have only one ozone layer and he is a hero.

10. The Magnetic Field – The Tenth Hero of Biosphere



The magnetic field of the Earth is generated in its molten iron core. As the Earth gradually cools down, slowly moving convection currents keep stirring the core, and this motion is sufficient to generate the geomagnetic field by dynamo action. This is possible because the iron core of the Earth is electrically conducting. As the convection currents in the core circulate, they move the magnetic field around, and these changes called the secular variation, are now continually monitored by satellites orbiting the Earth. Hot fluid does not simply rise, it can travel in a spiral motion, and this type of motion is particularly good at generating magnetic fields. The magnetic

field of the Earth also undergoes reversal that is the field collapses and then rebuilds itself with the opposite polarity. This has happened many times in the past, as can be measured by studying the magnetic properties of rocks laid down in the distant past known as paleo-magnetism. The large scale field only changes slowly, on a thousand year time-scale, but the fieldstrenght has fallen substantially over the last few thousand years, so another reversal may be certainly immanent.

The world is a giant magnet and from the day you are born until the day you physically die you are constantly under the influence of the Earth's magnetic forces. While the magnetic fields that surround the Earth protect you from many harmful radiations from the sun and other harmful emissions from outer space, they also affect your mental functions and your health and welfare each and every day of your life. Plants and lower animals are also affected by this invisible energy that passes through all material and immaterial matter. The science of how magnetism affects biological systems is called biomagnetism or biomagnetics.* We can harness nature's greatest energy and use it for the benefit of all mankind. In fact, many nations of the world are racing to determine to what extent man can utilize the new and important discoveries of biomagnetism. The scope of biomagnetism is unlimited. *Birds and fish use magnetic field to reach their migratory destinations. Experts know birds and fish posses an internal compass. Scientists believe that tiny magnets in the beak or mouth, wired to the nervous system detect lines of magnetic force.* There is strong evidence that upper beak magneto-sensors were used by pigeons. Scientists have also located candidate magnetite-based magneto-receptor cells in the nose of fish and traced the magnetically responsive nerve to the area the candidate receptor cells are found. The positions where fin whales are sighted during the migration seasons are statistically associated with geomagnetic field intensity patterns. Responses to magnetic intensity theoretically permit animals to navigate effectively over long distances. Another assumption is that magnetic fields are "seen" via the eyes using a complex light-sensitive mechanism. Other types of magnetic sensor may also exist in birds and fish. Magnetic Field is indeed, one of the heroes of Biosphere.

**Biomagnetism is science that can help the body heal itself of even chronic and long-term diseases. Magnetic therapy is used worldwide to treat broken bones, relieve pain, heal arthritis, and increase vitality. Biomagnetism closely related with the measurement and the analysis of the magnetic field. This magnetic field phenomenon which is produced from human body can change and raise the electrical currents and charges, thereby increasing the efficiency of the body's metabolism.*

Ten Commandments of Biosphere

1. Thou shall not put pressure on Biosphere with over-population: remember you have only one Biosphere. Limit your families.
2. Thou shall not exploit Biosphere for its natural resources: limit your desires by living sustainably.
3. Thou shall not waste paper on Biosphere, use only as much as you require: use only recycled paper and do not use paper towels, human or animal diapers.
4. Thou shall keep Biosphere holy and friendly: respect all life, love all life, and protect all life: remember you are the steward.
5. Thou shall honor Biosphere by honoring Earth Systems such as, Lithosphere, Hydrosphere and Atmosphere.
6. Thou shall not kill any animal life in Biosphere: refrain from eating meat and fish, eat lots of vegetables.
7. Thou shall not commit abuse in Biosphere, mistreating animals and pets: leave oceans unpolluted, leave forests pristine and atmosphere unaltered.
8. Thou shall not steal any trees and minerals from Biosphere: remember they are not yours: keep in your mind the generations yet to come.
9. Thou shall not harm your neighbors in the Biosphere by your wastes such as, plastic bags, sewage, auto exhaust and chemical hazardous wastes.
10. Though shall not covet: Biosphere has enough for all your need, but not for all your greed.

Finally ...

Man is the latest arrival in Biosphere. I think man can destroy, but at the same time he can create. I believe with help from faith, that man is more of a Creator. It is an appeal I want to make to humanity. It is an appeal to protect Biosphere and its Biodiversity. I have seen that appeal for help in the eyes of so many suffering creatures. An orphan chimp tied up for sale in an African market; an adult male looking out from his five-by-five-foot sterile cell in a medical research laboratory in Germany; a dog emaciated and starving, abandoned by her owner on the beach in Australia; an elephant chained to a cement floor in India, by one front and one hind foot. I've seen

it in the eyes of street children, and those who have seen their families killed in the racial war in Sri Lanka. All around us with a plea in their eyes, asking us for help. *And if we dare to look into those eyes, then we shall feel their suffering in our hearts. More and more people have seen that appeal and felt it in their hearts. All around the world there is an awakening of understanding and compassion, an understanding that reaches out to help the suffering animals in their vanishing Biosphere*. That embraces hungry, sick, and desperate human beings, people who are starving and dying while the fortunate among us, anyone who can afford to buy this book, have so much more than we need. And if, one by one, we help them, the hurting animals, the desperate humans, then together we shall alleviate so much of the hunger, fear, and pain in the Biosphere and in the world. Together we can bring change in Biosphere and to the world, gradually replacing fear and hatred with compassion and love. Love for all living beings. With lots of love, life will find a way.

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