

ECOLOGY OF THE CANTICLE OF CREATION



Saint Francis and the life sciences agree—Earth’s creatures live in dynamic relationship with each other. The *Canticle of the Creatures* sings of creation as a familial, interdependent system. All elements have a particular role, all are related, all play a part. Biology and ecology confirm this through scientific means. For most of the twentieth century, biologists described nature as “red in tooth and claw,” as shaped primarily by relationships of competition and predation: It was eat lunch or be lunch. Recent scientific discoveries have highlighted the relationships of mutual interdependence, even cooperation among different species. Ecology makes this clear: Life is diverse, interdependent and vulnerable.¹ Saint Francis celebrated these spiritual insights centuries before biology or ecology were developed. He recognized creation as good, lived out conscious relationships with elements and creatures and expressed compassion toward them. His example inspires us to care for creation today. This chapter describes the diversity of life, also known as biodiversity, and how we humans are woven into life’s fabric. It then offers a portrait of the *biodiversity crisis*, a new term to describe the full scale of species extinction. It concludes by proposing a Franciscan response to the biodiversity crisis based on a vision of humans as brothers and sisters to all creation.

OF RABBITS, WORMS AND CRICKETS

Biodiversity should have a special importance in Franciscan spirituality because of the importance of diverse creatures in the life of Francis. The early stories of his life relate more than a dozen encounters with rabbits, worms, lambs, fish and crickets. Birds appear most frequently in these stories, and Francis referred to them as noble creatures. Unfortunately, popular stories of Francis' relationship with animals have been "domesticated" and rendered quaint. The common image of Francis and the birdbath is a case in point.² A close analysis of these stories, however, indicates that unlike other medieval saints, Francis was profoundly affected by his encounters with creatures.³ The story of Francis preaching to the birds illustrates this point well. Most modern people are tickled to discover a saint that preached to creatures, but the most important lesson from this encounter is related after he preached to the birds and they flew away. Thomas of Celano wrote, "After the birds had listened so reverently to the Word of God, he began to accuse himself of negligence because he had not preached to them before. From that day on, he carefully exhorted all birds, all animals, all reptiles, and also insensible creatures, to love the Creator, because daily, *invoking the name* of the Savior, he observed their obedience in his own experience."⁴ Roger Sorrell argues that this experience served to integrate Francis' care for creatures with his understanding of himself as preacher, and that it resulted in a "new outlook" on creation.⁵ The most important part of this story is not that he preached to birds but the impact that preaching to birds had *on him*. After his encounter with the birds, he "woke up" and recognized that they were his brothers and sisters as well. In the same way we may ask, how do we relate to this richly diverse Earth as brothers and sisters?

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DYNAMIC ECOSYSTEMS

The *oikos*, God's house, brims over with a rich diversity of life. All creatures need food, a home and a family. Ours is not a homogenous, monotonous home planet, no, for it offers an abundance of food sources,

diverse habitats and vibrant ecosystems. The diversity of environmental conditions offers a multiplicity of diverse strategies for organisms to make a living; thus, the diversity of life. But ecosystems are so dynamic that each creature can reshape them and allow other creatures to make their living, and further diversify life in that ecosystem. For example, after a wet winter, a pond or small wetland develops. Migratory birds carry in seeds for specialized, water-loving plants from their droppings. Some insects are attracted to the wetland for food or shelter, which in turn attract insect-eating birds, who may find the right conditions for nesting. As this shows, soil and water alone do not define ecological niches. Life depends upon many factors.

Several examples illustrate how humans benefit from life's diversity. The lowly earthworm, picked up from the road by Saint Francis, helps humans by tilling the soil.⁶ Their tunneling opens up air passages, helps the soil hold the right balance of water and allows microscopic creatures to convert rock and organic matter into fertile soil. Earthworm castings provide terrific natural fertilizer, which provides nutrients and energy for other decomposers. Worms are among the largest of soil creatures, and they help make the right conditions for the formation of topsoil. Organic farmers evaluate soil health by the number of earthworms they find in it. Food for humans depends on healthy soil, so we benefit from the work of earthworms. Our lives depend upon life's diversity.

Agriculture would collapse without the pollination work of bees, whom Francis praised for their hard work.⁷ Many plants depend upon insects to fertilize their flowers. These plants have evolved the ability to produce proteins in their pollen, attracting bees. As they move from flower to flower, bees (and some other insects) transfer a portion of the pollen to other flowers, fertilizing them. Some plants and pollinators have evolved quite closely. For example, several species of desert cactus are utterly dependent upon one species of bat to pollinate its flowers—only at night! And one species of bee has evolved so that its specific vibration stimulates the tomato flower to release its pollen. Relationships like these are said to be tightly coupled, or *coevolved*.

As winter gives way to spring, a thousand-mile-wide green wave rolls across the deciduous forests of eastern North America. With the right temperature conditions, forest trees break bud and sprout leaves. Because these new leaves are at their most tender stage, insects emerging from hibernation flock to eat them. Many species of small birds follow this wave, living off the abundance of insects attracted to the green wave. The birds are in no way conscious of the service they provide the trees, but that does not stop the trees from benefiting from them. These are examples of *mutualism*, or a mutually beneficial relationship.⁸

God must delight in diversity, for creation certainly abounds with it. Taxonomy is the science of classifying organisms, and a *taxon* is a particular category of organisms sharing a common ancestry. A *species* is the fundamental taxon, for only members of that group are capable of viably reproducing with each other in nature. Evolutionary biologists trace the evolution of life from monera (such as bacteria) through protista (such as algae) to the higher kingdoms of plants, animals and fungi. In the seventeenth century a scientist estimated the number of species to be twenty thousand. This number proved to be far too small, yet even with all our scientific technologies today, we still have only identified a fraction of the diversity of life.

In fact, taxonomists are unsure even about the number of species we have actually identified, because they cannot agree on the numbers of species in some families of lesser-known creatures. For example, estimates of the numbers of mollusks range from 45,000 to 150,000. The best guess for the number of currently named and identified species on Earth is 1.9 million, give or take 100,000! Although one entomologist proposed the number of Earth's species to be as high as 30 million, scientific consensus has converged around an estimate of 12.5 million total species. Thus far, humans have been able to name less than one-sixth of life's diversity! More than 85 percent is yet to be identified, even with all our scientific knowledge. The most common plants and animals have been identified, and most of the yet-to-be described creatures are members of the monera, protista and fungi kingdoms.⁹

The diversity of life is greater than human understanding. When most people think of biodiversity, they tend to think of beautiful, large animals, trees or fish. In reality, insects are the most abundant taxon. They constitute about 56 percent of named species, followed by fungi at 8 percent. Biologist E.O. Wilson refers to insects as “the little things that run the world,” because they play an essential role in shaping the organization and function of ecosystems, even though they are often invisible to the untrained eye. Vertebrate animals, those with a backbone, constitute less than 0.4 percent of named species, but of course, panda bears, whales, bald eagles and the like capture the popular imagination. Ecologists refer to colorful, attractive animals as “charismatic megafauna.” On one hand, popular interest in these is good because this can stimulate biodiversity conservation initiatives. For example, concern over the possible extinction of the bald eagle, the United States national bird, led to passage of the United States Endangered Species Act. On the other hand, large and beautiful vertebrates can divert our gaze from the overall importance of the integrity of creation. The problem with charismatic megafauna is that public attention and funds follow them, but not the less visible, attractive or inspiring creatures, nor the unglamorous but critical work of protecting their habitat. Efforts to save charismatic megafauna are good, but will not succeed without a broader understanding of the Earth’s biodiversity and the actions necessary to preserve the integrity of ecosystems upon which they depend.¹⁰

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HABITAT CONSERVATION IS VITAL

Human society also depends upon the health of ecosystems and biodiversity. “Ecosystem services” are the benefits to human society from the environment. Clean water, fertile soil and pollination of native and agricultural plants result from the service of creatures in their ecological niches. Wetlands and forests depend upon clean water. Wood and paper depend upon forest health. Marine fisheries depend upon clean coasts and oceans. These are goods that most humans take for granted.¹¹ The

richness or number of species is the most visible—but not the only—dimension of biodiversity. This term also encompasses the diversity of microscopic genes and far-reaching ecosystems necessary to support the diversity of species. Preserving the diversity of life requires habitat conservation. If a species loses its habitat, or even if its ecological niche changes in subtle but biologically important ways, it may not survive. Many migratory songbirds are threatened by loss of habitat due to forest fragmentation in the United States and Central America. Even if 90 percent of a songbird's habitat along their migration route is intact, the 10 percent that has been lost may serve as the “weakest link,” and threaten the viability of that species. If a population of species falls below a certain threshold, it does not have sufficient genetic variability to cope with environmental change. For example, some species of whales have been hunted virtually to extinction, but because of conservation initiatives, their populations have recovered somewhat. Will these species have sufficient genetic diversity to be able to respond to global climate change and its effect upon the oceans?

Recently, ecologists have begun describing the “biodiversity crisis,” or the massive wave of species extinction now occurring. Ecosystems around the world are suffering from degradation due to human activities, and this is pushing many species to the brink of extinction. The International Union for the Conservation of Nature organizes global information about the biodiversity crisis, and its 2006 report documents the accelerating rate of extinction. Of the 40,000 species assessed, over 16,000 are at imminent risk of extinction, and that number is rising rapidly.¹² Birds and amphibians are among the taxa most at risk.

Habitat loss is the primary cause of species' extinction. Much habitat has been plowed, paved, clear-cut, dammed or drained. Some habitat is degraded by air or water pollution. For example, frogs and other amphibians across the world are declining, and many are approaching extinction. Although the scientific explanation for this is not entirely clear, it appears that industrial and agricultural chemicals are able to

harm them—through their permeable skin—far more than other species. Some forms of pollution are invisible. Slight changes in the chemistry or even temperature of lakes and streams can push amphibians to extinction. If pollution is out of sight, it may be out of human minds, but it can continue to harm our bodies and other creatures.

Global climate change now looms as perhaps the greatest threat to the diversity of life, upsetting even the most remote habitat: Polar bears are poised to become one of the most visible casualties of melting ice caps. Climate change can serve to “evict” a species from its ecological niche by altering temperature and precipitation, making it inhospitable for species that had traditionally occupied that niche. Through global commerce or simple carelessness, human beings have moved many species to new habitats and, in some cases, new, more aggressive species have pushed threatened species to extinction.¹³

Direct taking of species—harvesting or hunting—is the most visible form of biodiversity loss and the most significant factor driving a few species to the brink of extinction. For most of human history, the oceans were thought to be limitless, and we fished as though they had an unlimited supply. Industrial fishing technologies are now so powerful that they strip everything out of the sea. In very poor countries, some fishermen are so desperate for any kind of fish that they use dynamite and cyanide to stun their prey. These crude technologies poison other creatures and destroy coral reefs, which are essential for the reproduction of future fish. This kind of myopic, unsustainable behavior is clearly foolish, yet the economic opportunities for impoverished people are so bleak that they have few other options. A very similar set of issues affects tropical forests: They were once thought to be limitless resources for timber, but are now groaning under human industrial exploitation, and very poor people in developing countries also exploit forests in a short-sighted way because they have so few economic options.

TWO CONVENTIONAL ETHICAL APPROACHES

Over the past few decades, many religious people have begun to recognize the ethical dimension of environmental issues, and many religious leaders and organizations are speaking out on behalf of the integrity of creation. This new effort, known as the “greening of religion,” marks a new stage in the dialogue between science and religion. Rather than quarrel over the exact process by which the world was created, religious and scientific leaders are tackling the moral problem of the human destruction of creation. As partners they are challenging the contemporary view that the Earth exists only to serve human needs, and they are using ethics language to do this. The greening of religion is taking place in virtually every religious tradition across the globe, and addressing the biodiversity crisis has received a great deal of attention.¹⁴

Faith communities bring a most important resource to environmental concerns: the practice of communal ethical reflection. This is a most important contribution, for until recently, environmental concerns have been defined as scientific (by scientists) or as government policy problems (by activists). The environment has generally not been framed as having moral significance, although this is beginning to change. Among faith communities, the simple shift in language from “environment” to “creation” indicates that the Earth is not passive or morally neutral, but rather sacred and signals that it belongs to God. Let us examine three simple ways of organizing ethical thought about the integrity of creation.¹⁵

The first ethical approach can be summarized as an adaptation of the Golden Rule: Do unto the earth as you would want done unto you. Do not pollute drinking water, because someone will have to drink it. Do not pollute the air, because someone will have to breathe it. Do not fish out all the species in the ocean, because future generations will need them to feed themselves. In this context, the diversity of life is only valued for its benefits to us: It feeds us, provides us fiber or pleases us with its beauty. Although the adoption of this rule would mark progress in