Protection of the Environment, the Biosphere and Biodiversity

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Introduction

For decades, scientists, educators, philosophers, ethicists, and concerned citizens have articulated strong warnings from different vantage points with a steadily growing measure of intensity that humankind is being confronted with a multilayered crisis entailing environmental degradation, biodiversity loss, climate change, and the detrimental effects this have on poor communities who depend directly on the environment and biodiversity for their livelihoods. All of these crises combine and reinforce one another through intricate internal feedback loops to form what Edgar Morin (1999) has called a polycrisis that not only places the quality of human life under threat but the very survival of life on earth.

In 1962, Rachel Carson published a book entitled *Silent Spring* (see Carson, 2002) to warn against the overuse of pesticides in agriculture, conjuring up the apocalyptic image of a world waking up one spring morning without the sounds of any bird singing. In 1968, biologist Garrett Hardin published an article on “The tragedy of the commons” pointing out that freedom in the commons, that is, open-access resources with no regulation on their use, leads to ruin for all (Hardin, 1968), while in 1972 the Club of Rome published the Meadows Report (Meadows, Meadows, Randers, & Behrens, 1972) with the self-explanatory title of *Limits to growth*. Focusing on accelerating industrialization, rapid population growth, widespread malnutrition, depletion of nonrenewable resources, and a deteriorating environment, this report warned that if present growth trends in the world continued unchanged, the world would reach physical limits to growth within 100 years. However, it also pointed out that these growth trends can be changed to establish a world that is ecologically and economically stable so that it is sustainable into the future. Similarly, *The Ecologist* also published in 1972 *A blueprint for survival* outlining “the overwhelming necessity for change towards a stable and sustainable society” (The Ecologist, 1972).

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Around the same time, environmental ethics emerged as a separate academic discipline with the publication of two seminal articles. In Australia, Richard Routley (later Sylvan) (1973) published a paper with the telling title: “Is there a need for a new, an environmental ethic?” in which he called for a new, non-anthropocentric ethics based on the idea of the intrinsic value of the environment, while Arne Naess, a Norwegian philosopher, published an article in 1973 with the title “The shallow and long range, deep-ecological movement.” In this article, Naess challenged the self-interested concerns of business and the middle class about pollution that may threaten a consumerist lifestyle, arguing that the solution to environmental problems should be sought on a much deeper level, that of radically questioning the identities assumed by consumers, driven as they are by a narrow egotistical and materialist notion of self. Instead, he argues for the realization of an expanded, mature self through identifying with the plight and interests of wider circles of being, based on the premise that every self is constituted by the wider circles of being in which its existence is embedded (Næss, 1973).

In parallel with this growing sense of crisis and of radical questioning, science, business, and international politics have responded with various initiatives that have recorded different measures of success over the years. The United Nations Conference on the Environment and Development (http://www.un.org/geninfo/bp/enviro.html) that was held in 1992 in Rio de Janeiro brought many of these initiatives together in a number of documents and conventions that were adopted. Among them were *Agenda 21* (http://www.un.org/esa/dsd/agenda21/) that is a comprehensive plan of action for sustainable development in the twenty-first century, the United Nations Framework Convention on Climate Change (UNFCCC) (http://unfccc.int/2860.php), and the United Nations Convention on Biological Diversity (http://www.cbd.int/). Today, however, 20 years later, serious questions are being asked about the efficacy of these initiatives in preventing or minimizing the combined crisis of unsustainable development, environmental destruction, biodiversity loss, climate change, and its disruptive impact on marginalized communities.

The urgency of responding to these crises and their primary drivers, however, has not disappeared. While population growth has become a politically loaded topic to address, and the same applies to the problem of overconsumption of about one billion of the affluent part of the world’s population (Swilling & Annecke, 2012), population growth is still regarded as one of the biggest drivers behind these crises (TEEB, 2010; The Royal Society, 2012). Others (Turner, 2008) argue that the world’s population still has not learned how to overcome unsustainable use of resources in industrial production and private consumption. From a biological point of view, E.O. Wilson (1992) has pointed out in 1992 already that the biodiversity crisis entails one of the biggest extinction periods that the history of life on earth has experienced in the last 65 million years, while Stephen Gardiner has argued recently (2011) that climate change confronts the world with a perfect moral storm that challenges the most basic assumptions underlying ethics and moral responsibility, paralyzing humankind into believing that nothing can or should be done about climate change.

In a strange turn of events, it seems as if these crises have been eclipsed to some extent by the financial crisis of 2008 and 2009 that has hit the world's economy and financial systems, and from which quite a number of national economies have not yet recovered from at the time of writing this chapter. Strict austerity measures, financial discipline, and smart investments will be required to overcome this financial crisis, but this has already raised the concern that little, if any, additional resources will be available to also address the challenges of environmental degradation, biodiversity loss, climate change, and the social disruption that they bring. In recent discussions of this polycrisis, it is recognized that measures to address the financial crisis will not be successful if environmental degradation, biodiversity loss, climate change, and their social impacts are not also addressed with the same measure of intensity (Stern, 2010).

With this as broader context, the focus in this chapter will fall on the challenge of protecting the environment, the biosphere, and biodiversity. In particular, an overview will be given of the conceptual, philosophical, and ethical challenges related to defining exactly what should be protected regarding the environment, the biosphere, and biodiversity and what the arguments are to justify why this should be done. The crux of this discussion will be devoted to different kinds of values that have been used to justify protection, as well as the different implications these values have for conservation management, not only in setting its goals but also in determining its tools and methods. Some of the discussion will also focus on the drivers behind biodiversity loss, destruction of the biosphere, and the environmental crisis and what if anything could be done about them. This chapter will begin with a discussion of definitions and conceptual issues and will conclude with an outlook on the future of the environment, the biosphere, and biodiversity.

Definitions

While there is substantive overlap in the meanings of *environment*, *biosphere*, and *biodiversity*, and while these concepts are sometimes used interchangeably, it is important to note that there are also subtle but important differences between them. As concepts, they do not fully coincide with one another. In its most widely accepted definition, biological diversity, or biodiversity in its abbreviated form, refers to "the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part: this include diversity within species, between species and of ecosystems" (Article 2 of the United Nations Convention on Biological Diversity, 1992).

In this definition, there is reference, albeit indirectly, to both the *elements* of biodiversity such as genes, species, and ecosystems, as well as the *processes* of which they form part. The latter is captured in this definition with the reference to "ecological complexes" which entail complex and dynamic processes of interaction between "elements" over time. As such, this definition represents a movement away from a "bits-and-pieces" or "itemizing" approach to the protection of biodiversity, to one where living and evolving wholes, and the processes making the existence of these wholes and their evolution possible are studied (O'Neill, Holland, & Light, 2008).

The biosphere is generally defined as "that part of the land, sea and atmosphere in which organisms are able to live. The biosphere is an irregularly shaped, relatively thin zone in which life is concentrated on or near the Earth's surface and throughout its waters" (*The American Heritage Science Dictionary*). According to a more general definition from the same source, the biosphere entails "all the Earth's ecosystems considered as a single self-sustaining unit." Here also the notion of life as an all-encompassing whole emerges but also the wider notion that this whole encapsulates all of the conditions that make life possible.

How incredibly fragile and also precious this biosphere is was first graphically illustrated with the photographs (http://www.nasa.gov/vision/earth/features/bm_gallery_4.html) that were taken from outer space by NASA astronauts aboard Apollo 8 on Christmas eve of 1968 of the earth rising over the moon. Statements by subsequent astronauts, for instance Loren W. Acton (http://www.solarviews.com/eng/earthsp.htm), as well as similar photographs (http://planetary.org/explore/space-topics/earth/pics-of-earth-by-planetary-spacecraft.html) from other space missions reinforced this image of the biosphere, an image of the whole earth that lies in the hands of humankind (http://farm3.staticflickr.com/2063/5769488751_83de7508b4_m.jpg) to be protected and cherished but at the same time is something that can be broken (http://www.freakingnews.com/pictures/63000/Cracked-Earth-Egg-63050.jpg) beyond repair, if not handled with care. Making the earth thus visible as a single, fragile whole inspired the notion of the biosphere as a living system *with limits* (Swilling & Annecke, 2012).

In the *Merriam-Webster Dictionary*, a distinction is made between a generalized meaning of *environment* and a more biological meaning. In a general sense, environment refers to the "circumstances, objects or conditions by which one is surrounded." In its biological sense, environment refers to "the complex of physical, chemical and biotic factors (as climate, soil and living things) that act upon an organism or an ecological community and ultimately determines its form and survival." In this comprehensive biological sense, the meaning of *environment* and *biosphere* virtually coincides, but there is also an overlap with *biodiversity*, in that the elements "making up" the environment, for example, individual living entities, species, communities of life, biomes, biological "hotspots," or ecosystems, can be emphasized, or the whole of the environment together with the natural processes of life unfolding in it. In a third meaning, environment refers in human terms to "the aggregate of social and cultural conditions that influence the life of an individual or community."

These definitions already illustrate the complex relationship between that which is taken as the environment, the biosphere, and biodiversity, and that they contain elements, entail processes, and display characteristics that are mutually dependent upon one another, and mutually influence one another in intricate feedback loops. It can thus be argued that these three terms refer to different aspects of the same unified system spanning the earth, namely, life in all of its different forms: *environment* serves as a framework concept, encapsulating the comprehensive preconditions of life in general (e.g., the water cycle, photosynthesis, and the absorption of heat); *biodiversity* is used to refer to the many differences in and between individual living organisms, species, and ecosystems, while *biosphere* is more of a geographical term that refers to the thin "layer" of life that spans more or less the surface of the earth.

Accordingly, it is not easy to distinguish between threats to biodiversity and the biosphere that are not at the same time threats to the environment as well, and vice versa. Similarly, it is not easy to think of environmental protection that is not at the same time protecting the biosphere or biodiversity. To illustrate the point, if the protection of biodiversity is set as a goal for conservation policies, such protection will at the same time entail protection of the environment and of the biosphere. To acknowledge the overlap between these three concepts but also to prevent confusion that may emerge from using these three terms interchangeably, the term "earth system" will be used in this chapter to refer to the environment, the biosphere, and biodiversity taken together as a whole, functioning as a complex living system with its own history and evolutionary path, possibilities, and boundaries. In the discussion below, however, references to the environment, the biosphere, and biodiversity in their own right will be made when required by the context.

Before proceeding to an overview of the arguments that are used to underline the importance of protecting the earth system, it is important to first consider a few conceptual issues, as well as the drivers leading to damage of the earth system. The discussion of conceptual issues will already illustrate some of the philosophical and ethical challenges involved in efforts to identify what exactly it is that should be protected and why it is important to do so. The discussion of the drivers will facilitate an understanding of the magnitude and extent of the problem facing humankind.

Conceptual Issues

In this section, an overview will be given of philosophical and ethical issues related firstly to the *vagueness* that is often encountered around the concepts of the environment, the biosphere, and biodiversity; secondly to the impossibility of giving *scientifically objective* definitions to these three concepts; and thirdly to approaching these three concepts from an *element* or a holistic, *processes* perspective.

The first conceptual issue emerges from the vast number of definitions that exist with regards to both *biodiversity* and *environment*. Gaston (1996) and Faith (2008, p. 1, 2) discuss the different variations that exist of *biodiversity* defined as "the variety of all forms of life, from genes to species, through to the broad scale of ecosystems," while Reaka-Kudla, Wilson and Wilson (1997) give an overview of the rapid rise of the term biodiversity, and trace aspects of the term back to the ancient Greek philosopher, Aristotle. Johnson et al. (1997) in turn focus on terms and expressions related to the environment and make a very valuable contribution toward standardizing the use of the ten most commonly used environmental terms.

O'Neill et al. (2008), however, point out that there is no such thing as *the* environment. If environment refers to the "surroundings *of* some person, being or community," there is always "a variety of places, processes and objects" that make up a vast variety of environments.

This highlights the problem that *biodiversity* and *environment* are concepts that can easily be taken to mean "everything" (Faith, 2008, p. 2) so that all concerns about the environment and biodiversity are lumped together in one big whole. *Biodiversity*, for instance, has sometimes been used to mean "life" or "wilderness" or "ecosystems" or "ecosystem processes" (Faith, p. 2), while the concept of the *natural environment* is commonly used to refer to "water," "oceans," "rivers," "lakes," "the atmosphere," "climate," "the weather," "life," "ecosystems," "biomes," "biogeochemical cycles," "wilderness," "vegetation," "soil," "rocks," and "natural phenomena" (see Wikipedia entry on *Natural environment* [http://en.wikipedia.org/wiki/Natural_environment]). This vagueness should be avoided and can be avoided by not only giving more precise conceptualizations of environment and biodiversity, respectively, but also defining much more precisely what exactly should be protected with regard to the environment, the biosphere, and biodiversity and why it should be done.

In the second place, it is important to note that many scholars, including prominent philosophers and conservation biologists, have pointed out that it is impossible to formulate a definition of biodiversity that is "scientifically objective." Instead, they accept that the kind and the level of biodiversity that is set as a target to protect, to maintain, or to restore is based on certain value assumptions that characterize the identity of a certain society, and that these values should be made explicit for critical scrutiny in ongoing societal debates. The same applies to the nature and extent of environmental protection that is accepted or set as a target by a certain society. As such, this constitutes what Faith (2008, p. 2) refers to as the problem of "biodiversity plurality": the existence of a wide spectrum of biodiversity targets or models that can be pursued, bringing about the question on what grounds a decision-maker should choose between them. Similarly, there exists the problem of "environmental plurality" and the concomitant challenge for someone like an environmental manager to find appropriate and sufficient grounds to choose between different targets or models of environmental protection (see Norton, 2003; O'Neill et al., 2008).

In the next section, the discussion will focus on the typical arguments that are used to justify choosing between different environmental/biodiversity targets for protection. At this point, it is important, though, to note that the problem of environmental/biodiversity plurality and responding to it by making explicit the values on the basis of which the choice between models/targets is made constitutes a "post-positivist" approach to conservation. As Faith (2008, p. 3) has pointed out: "there is no one, correct measure of biodiversity to be discovered but many, each having different values."

In this regard, the argument goes that all facts pertaining to conservation, whether they are related to the environment in general or to biodiversity more specifically, even if they are produced by scientific studies, are value-laden. This, however, does not make conservation or conservation science a totally arbitrary and fully subjective exercise (see Davis, 2009 for an insightful overview of this debate). On the contrary, this insight rather calls upon conservation scientists to make the values explicit that inform their work so that they can become part of the ongoing self-conscious and critical conversation taking place in societies about the sources of these values, as they are related to histories and social identities, that is, notions of who people are, how they wish to realize themselves in the present and in the future, and what role they deem conservation should play in all of this.

A third important conceptual issue to take into account is raised by biologists E.O. Wilson (1988) and David Ehrenfeld (1988). Summarized by Faith (2008, p. 3), Wilson sees the rise of the term *biodiversity* as a dramatic shift away from a “bits and pieces” to a much more holistic approach to biology. Where the protection of biodiversity was first aimed at endangered species, the emphasis shifted to the protection of ecosystems (Rolston, 2001). Wilson correctly identifies that the rapid emergence of the term *biodiversity* since the 1980s represents a growing concern about biological variety as a general phenomenon, that this variety is rapidly disappearing, and that “unlike other threatened things, is irreversible.” Ehrenfeld also elaborated on this idea of a “biodiversity crisis” by emphasizing the “idea of the value of diversity in the aggregate. He argues that diversity previously was never regarded in itself to be in danger, but that biodiversity now is recognized as endangered in its own right” (Faith, 2008, p. 3).

In a slightly different formulation, Norton (2003, p. 501) also draws attention to the biodiversity as a whole when he argues that biodiversity is not merely a resource among other resources, “but a generator – a source – of biological resources.” Norton argues that biodiversity is a necessary condition for the creation of biological resources. Such a holistic approach is also evident in literature about the environment and the biosphere, emphasizing that it is not only their compositional elements that are important but also the functional processes that constitute the environment and the biosphere as resilient, adaptive living wholes that should be considered as such in decision-making (Callicott, 1999).

The concepts of the environment, the biosphere, and biodiversity are brought closer to one another by placing the emphasis on the *earth system* as a functioning whole supporting all life on earth, as it was pointed out above. Accordingly, this conceptual shift from parts to the whole resonates with a significant expansion of conservation from a focus on the individual elements of the earth system, for example, species or specific species populations, even ecological “hotspots,” toward a focus more on ecosystem processes, and the manner in which, for example, a population unit of a species, characterized by a certain size and geographic distribution, in interaction with other population units of other species, together contribute to the functioning, resilience, and evolution of an ecosystem or ecosystems (Luck, Daily, & Ehrlich, 2003).

Such a systems approach thus introduces *ecological effectiveness* as the primary conservation goal, in which the protection of ecologically effective population sizes and critical ecological interactions rather than maintaining minimum viable populations stands central (Soulé, Estes, Berger, & Del Rio, 2003). This is at the same time a strong argument for *ecosystem recovery* as a conservation goal for damaged or degraded ecosystems, following explicitly formulated operational targets. The difficulty in pursuing these systemic goals, however, is uncertainty about future ecological dynamics, exacerbated by rapid environmental change: "... we cannot know exactly which interactions and which species will be most critical for the maintenance of biodiversity in the future" (Soulé et al., 2003).

In spite of such cognitive constraints, strong arguments can be formulated to explain why it is important to protect the earth system – based on the knowledge already available about its functioning and its value. Important background to these arguments is an understanding of the nature and extent of the damage that is currently done to the earth system and what the drivers behind this damage are.

Human Impact on the Earth System

According to paleontologist Niles Eldredge (http://www.actionbioscience.org/newfrontiers/eldredge2.html), Curator-in-Chief of the Hall of Biodiversity (http://www.amnh.org/exhibitions/permanent/biodiversity/) of the American Museum of Natural History in New York, human impact on the earth's ecosystems started about 100,000 years ago with the dispersion of humans around the earth and has been associated with the onset of the first phase of the Sixth Extinction period (http://extinct.petermaas.nl/). In this first phase, the biggest impact was on large game species like mammoths, mastodons, buffaloes, and big birds through overhunting. Phase 2 commenced with the onset of the Holocene epoch about 10,000 years ago when humans turned to agriculture, and the biggest impact of this phase occurred through the transformation of land to produce crops, changing on the one hand the habitats of natural species but on the other hand freeing humans from their dependence on natural ecosystems for survival, and through that, making it possible for humans to overpopulate.

Current concerns about the earth system stem from the impact of vast numbers of humans, empowered by mechanized tools, science, and technology that intensify and accelerate the impact. What makes the Sixth Extinction period different from the previous "Big Five" is that the sixth period is anthropogenic, that is, caused by humans, while all of the previous ones have been caused by natural events such as the eruption of volcanoes, the impact of a meteorite hitting the earth, or climate change. Formulated in broad terms, it is recognized that the drivers behind the current extinction period include population growth, the destruction or transformation of habitats (because of reasons that include the encroachment of agriculture), using biological resources faster than their natural rate of regeneration, clear-cutting of forests, water diversion, water extraction from rivers, pollution, alien invasive species, and climate change. The general consensus is also that these drivers are currently putting all of life on earth in the balance, unless the whole of humankind turn to and adopt a sustainable mode of living.

Factual data that are regularly updated about the current impact of human activities on the earth system, and that are based on literally thousands of scientific studies, can be found on various websites. The Convention on Biological Diversity (http://www.cbd.int/convention/) regularly publishes a *Global Biodiversity Outlook* (http://www.cbd.int/gbo/), of which the third edition (http://www.cbd.int/doc/publications/gbo/gbo3-final-en.pdf) appeared in 2010. Other United Nations agencies also provide regularly updated data and indicators, for instance, the United Nations Environmental Programme (UNEP [http://www.unep.org/]), the United Nations Development Programme (UNDP [http://www.undp.org/content/undp/en/home.html]), and the World Bank (http://www.worldbank.org/). Private sector initiatives and nongovernmental organizations also publish regular reports on the state of the environment and biodiversity, the most important of which are the World Resources Institute (http://www.wri.org/) that published the Millennium Ecosystem Assessment (http://www.maweb.org/en/index.aspx), The Club of Rome (http://www.clubofrome.org/), the Worldwide Fund for Nature (WWF [http://wwf.panda.org/]), the International Union for Conservation of Nature (IUCN [http://www.iucn.org/]), Greenpeace (http://www.greenpeace.org/international/en/), and the Heinrich Böll Foundation (http://www.boell.org/web/137.html).

The assessment reports of the Intergovernmental Panel on Climate Change (IPCC [http://www.ipcc.ch/]) also provides very valuable information about the extent of climate change in different parts of the world and what climate change could entail under different scenarios in the future. The extent of the impacts of climate change on sustainable development and biodiversity is also discussed in these reports, as well as measures that could be taken in the area of conservation, sustainable development, and caring for biodiversity to adapt to climate change. The *Fourth Assessment Report* (AR 4 [http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm]) of the IPCC appeared in 2007, and the four volumes of the *Fifth Assessment Report* are to be published during the course of 2013 and 2014.

In these reports, a bleak picture of life on earth under severe threat is sketched. In the 2010 *Global Biodiversity Outlook 3* (http://www.cbd.int/doc/publications/gbo/gbo3-final-en.pdf) of the United Nations Convention on Biological Diversity the following is stated: "The target agreed by the world's Governments in 2002, 'to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on Earth', has not been met. There are multiple indications of continuing decline in biodiversity in all three of its main components – genes, species and ecosystems . . ."

This is confirmed by the *Millennium Ecosystem Assessment* of 2005 in which it is stated that "Over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fiber, and fuel. This has resulted in a substantial and largely irreversible loss in the diversity of life on Earth" (General *Synthesis* of its report on *Ecosystems and Human Well-Being*, p. 1 [http://www.maweb.org/documents/document.356.aspx.pdf]). While it is difficult to put figures on biodiversity loss, biologist E.O. Wilson has calculated in 1992 that human-induced extinctions have reached crisis proportions in that between 20,000 and 30,000 species are lost annually from a total number of between 10 and 30 million extant species (Wilson, 1992). Using different assumptions, Pimm, Russell, Gittleman and Brooks (1995) calculated that about 140,000 species are lost per year – while the background rate of natural extinctions is calculated to be about 10 species per year (Raup, 1991). In addition, the WWF in its *Living Planet Report* of 2012 (http://wwf.panda.org/about_our_earth/all_publications/living_planet_report/) indicated a decline of almost 30 % in the Living Planet Index in the period from 1992 to 2008 (p. 18), while UNEP pointed out in 2011 (http://unep.org/geo/pdfs/Keeping_Track.pdf) that every year, 52 vertebrate species move one Red List (http://www.iucnredlist.org/) category closer to extinction.

Others have studied habitat loss and the destruction of ecosystems, and while it is equally difficult to quantify this, Primack (2006) mentions that, for instance, only 15 % of land in Europe remains unmodified by human activities, while only 9 million square kilometers of tropical rain forests remain today from an original 16 million square kilometers. Laurance (1999) estimates that the current rate of deforestation is 160,000 km^2 per year, while it is pointed out in the *Millennium Ecosystem Assessment* (2005) that 20 % of coral reefs have been destroyed and another 20 % have been severely damaged by overfishing, while 35 % of mangrove forest systems have been destroyed.

While it is important to note that this pressure on the earth system will increase in future as the demand for food rises with a growing world population, it is equally important to note the social and health impacts of environmental degradation. As it is pointed out in the *Millennium Ecosystem Assessment* (2005), habitat destruction not only impacts negatively on biodiversity but also on the livelihoods and health status of already marginalized people, that is, those most vulnerable to changes in the environment. Habitat destruction, for instance, impacts directly on water quality, and poor water quality can be a significant disease vector in poor communities.

From this, it follows that protection of the earth system is not only a "green" or conservation issue in the narrow sense of nature conservation. It also has to do with the protection of livelihoods, of human health, and the survival of people and that policies designed to address environmental degradation, threats to the biosphere, and loss of biodiversity unavoidably also have a people's agenda intertwined with them. To formulate it differently, conservation policies, measures to protect biodiversity, and strategies to safeguard the biosphere against threats such as pollution or climate change can play a significant role in the empowerment and development of marginalized communities and at the same time help to address the issue of world poverty.

Arguments for Protection of the Earth System

Why is it of the utmost importance to protect the environment, the biosphere, and biodiversity? Why are threats to the earth system such a big danger that they require urgent attention? There are typically two sets of reasons used to answer these questions: reasons based on *instrumental value* and reasons based on *intrinsic value* (Afeissa, 2009). In the first, most widely accepted set of reasons, the use value of the earth system in maintaining human well-being in the widest possible sense of the word, is emphasized – acknowledging that there is a wide spectrum of human interests that are or can be satisfied in many different ways by the earth system. The earth system, however, is more than just a resource for human use alone. The earth system taken as a whole, as well as its component parts, have value in and of themselves, it is often claimed, regardless of any use value that humans can derive from them. In this context, the flourishing, abundance, and diversity of life in general, as well as its component parts, are seen as having intrinsic value that need to be protected for nothing but their own sake.

While both types of value provide strong arguments to protect the earth system, the ethical basis of instrumental value is often questioned for its anthropocentrism: it argues that the earth system should be protected because it is in the interest of humans to do so. Duties to the earth system are then only indirect duties; ultimately the only concern is to satisfy human interests, and this more often than not leads to exploitation or even destruction of the earth system or parts of it, including the complex processes that sustain life and its ongoing evolution. On the other hand, intrinsic value emphasizes that humans have direct duties to the earth system as a whole, its parts, and its processes, and thus claim to offer deeper or stronger reasons for their protection (Rolston, 2001). In this latter context, the challenge is to determine these duties in such a manner that they do not lead to the trap of the opposite extreme of an absolute reverence for the earth system that makes human life on earth impossible in that the earth system cannot be used to satisfy any human interests. Furthermore, critics argue that intrinsic value cannot inspire and move people to protect the earth system if the notion of intrinsic value is not combined with values that humans can strongly identify with (O'Neill et al., 2008).

Below different kinds of instrumental value will be discussed, showing how *direct use value, indirect use value, amenity value*, *option value*, and *existence value* can all be used to provide strong reasons to protect the earth system. Some discussion will also be devoted to intrinsic value and how a certain interpretation of it can provide equally strong reasons to protect the earth system.

Direct and Indirect Use Value as Basis for Protection

Resource economists, consumers, and ethicists alike emphasize that the direct use value of natural phenomena derives from transforming them into something that is useful to humans. Accordingly, a patch of land has to be cleared and plowed and watered to plant crops on it that can be harvested for the market and sold for human consumption. A river has to be dammed in places to make use of its water for agriculture and industry. Trees in a forest have to be cut to provide timber for building and furniture or pulp for paper. Animals have to be slaughtered to feed people. This transformation or primary resource extraction forms the basis of a value chain that spreads throughout society and makes a variety of other human activities possible, besides primary consumption for the sake of subsistence and survival. As such, this transformation has an economic value, and as such, it forms the material basis of human well-being.

Under the assumption that the earth is an infinite repository of raw material and energy, the direct use value of the earth system has been horribly exploited to satisfy short-term human interests, creating the problems of environmental damage, biospheric deterioration, and biodiversity loss. However, many have come to realize on rational, utilitarian grounds that this unrestrained development and expansionism (see Fox, 1995) cannot be sustained. Under the conviction that the well-being of humankind should be ensured over the long run, it was realized that the goal for resource management should be shifted from maximum benefit to maximum *sustainable* benefit, that is, benefit that can be maintained over time. This new goal was first known as *wise use*, or *conservation* of resources, and later from the 1980s as *sustainability*. As Holland (2001, p. 390) states, sustainability entails at least the hope "that we might provide for human needs with decreasing impact on the natural environment, and even reverse some of the degradation that has already occurred." Of late, sustainability has also been interpreted to include equitable sharing of the benefits and burdens of resource use (Swilling & Annecke, 2012).

One of the strong arguments often used to justify protection of the earth system is thus maintaining its direct use value over time, since it forms the material basis of all economic activity, human well-being in the present, as well as the ability of future generations to meet their needs – as the well-known definition of sustainable development of the Brundtland Report suggests: "Sustainable development is development that meets the need of present generations, without compromising the ability of future generations to meet their needs" (WCED, 1987, p. 43). There are a number of problems with this argument, though, if it is articulated purely in economic language based on the narrow assumptions of neoclassic economic theory. Economic efficiency and optimality then becomes the dominant values, leading to a weak interpretation of sustainability that has no concept of limitations and thus cannot protect the earth system from unrestrained exploitation.

In the first place, if interpreted in narrow financial terms, the espoused management goal of sustainability will not lead to the protection of the earth system as a whole. It will rather lead to a protection of only those components of the earth system that has clear economic value – reinforcing a "bits-and-pieces" approach to protection of biodiversity and the environment. If a holistic approach is followed, though, the economic argument will similarly only be able to justify protection of those processes and systems that have economic value derived from direct use. Other components of natural phenomena, or natural processes and systems that have little or no obvious economic value, will thus be left to their own devices with not special protection for them available.

In addition, those components, processes, and systems of the earth system that indeed have economic value clearly will only be protected as long as they have economic value and only up to the point where it is economically viable to do so. Bluntly formulated, this will entail the principle: *If it pays, it stays*. However, this principle cannot guarantee protection in the long run. Instead, the principle of diminishing marginal utility applies, which states that humans will protect the earth system or its components only up to that point where they start to feel that they can spend their money better to satisfy other interests.

In the second place, a narrow financial approach to protection based on the values of efficiency and optimality entails a weak interpretation of sustainability. Formulated in economic terms, *weak sustainability* sets the management goal of maintaining the total value of capital over time (Solow, 1993). According to this view, there are different kinds of capital besides natural capital, for instance, human-made capital such as infrastructure (roads and buildings and power stations), human capital such as education, and financial capital such as funds available in a bank for utilization. Under the meaning of maintaining total capital over time, sustainability implies an infinite intersubstitutability of capital (Norton, 2003). As long as total capital is maintained, the argument goes, sustainability is achieved.

There is a problem with the notion of infinite intersubstitutability of forms of capital, however, since it implies that a natural resource, for instance a forest, can be totally "used up" over a short period of time, as long as its capital value has been transformed in other forms of capital – for instance, used for education or the building of roads, schools, and hospitals. The total and irreversible loss of a forest and all of the biodiversity and ecosystem functions it entailed, would therefore, under this interpretation of weak sustainability, still be acceptable as an instance of sustainability. Besides the problem of seeing the earth system and its functioning as merely another form of capital that can be "traded in" for another form of capital, it clearly also entertain no conception of systemic limits that should be taken into account when decisions about resource use and development paths are taken (Norton, 2003; Swilling & Annecke, 2012).

Some critics of weak sustainability therefore introduced a strong interpretation of sustainability as a corrective (Costanza, 1991). Formulated in economic terms, *strong sustainability* would entail maintaining *natural* capital over time. This introduces the notion of certain limits to the use of natural capital below which humans should not go. The notion of strong sustainability also acknowledges that "the environment provides humankind with 'benefits' which no human-made capital can replicate: both particular functions (such as climate regulation and genetic diversity) and non-eliminable inputs (such as raw materials, land, and waste assimilation capacities)" (Jacobs, 1995, p. 59).

From this point of view, there is not only recognition of the direct use value of the earth system and some of its components but also of a number of very real nondirect "services" that humans depend on for survival and well-being, for instance, the provisioning of a tolerable climate, the processing of waste, the provisioning of clean air and water, as well as the raw material required for subsistence, shelter, agriculture, etc. Strong sustainability as a management goal thus calls for much more than maintaining the commodity (direct use) value of the earth system and its components; it argues for the maintenance of the *functioning* of the earth system that provide those commodities in the first place, as well as a wide spectrum of other, indirect, and nonconsumptive use values on the basis of which protection of the earth system can also be based.

While much is already known about the functioning of the earth system, what keeps it together and going as it were, there are also many gaps in this knowledge on these topics. A certain species, for instance, or a certain process, can play a key role in the functioning of a particular ecosystem, and a fair amount of scientific or localized knowledge may be available about it, but there may be many other key components or processes of ecosystems that very little or nothing is known about. Formulated in terms of a metaphor, there may be a number of known "rivets" that keep the ecological support system intact, but there may be a number of other important "rivets" that are not known, that may be discarded or destroyed in ignorance at the peril of humankind (Rolston, 2001). Accordingly, it is often recommended that a cautious approach should be followed in human actions that may have an irreversible impact on the functioning of an ecosystem (Norton, 2003) – because humans may never know when they may destroy something that is crucial to the very functioning of the earth system they depend on for their existence and their well-being.

Amenity Value as Basis of Protection

Besides direct and indirect use value, some nonconsumptive values are also often used to justify protection of the earth system. *Amenity value*, one of these nonconsumptive values, is derived from the mere existence of natural phenomena. While the direct use value of natural phenomena is derived from transforming them, using them up as it were in consumption, amenity value is largely based on keeping the earth system relatively intact, allowing it and its components to be what they naturally are, or letting its processes and systems function and unfold as they naturally do, with the least possible human interference.

A wide range of amenity values can be distinguished that justify protection of the earth system, if not as a whole, then parts of it, in a condition as pristine, free, or wild as possible. In one of his earlier works, without actually using the term amenity value, Warwick Fox (1995) provides an insightful list of the amenity values of what he refers to as untouched nature:

- *Information value*. Scientific studies of untouched nature and the impact of human activities on it can serve as an early warning system that things are starting to go wrong with the health of ecosystems, making it possible to take early remedial measures to minimize the problem. Studying untouched nature can also yield a treasure house of information about the functioning of healthy ecosystems and what could be done to keep them functioning in a healthy state. It can also help to understand evolutionary processes and how humans are not only dependent on it, but also part of it – it helps to understand how humans have arrived at the evolutionary place they currently occupy, how the evolution of culture and nature are codependent upon one another, and how humans are currently influencing that evolutionary process. On the latter point Rolston (2001, p. 404) observes that destroying a species "is like tearing pages out of an unread book, written in a language humans hardly know how to read, about the place where we live." It denies insight into the history of evolution in which humans are embedded, precluding "insight into the full text of natural history."

- *Recreational value*. The mere existence of natural phenomena also provides a wide range of opportunities for humans to relax from their daily activities. These opportunities can range from taking a walk in a well-preserved forest or along a pristine beach, taking a swim in a clear lake, or testing one's agility and strength by scaling a high cliff in a mountain.
- *Aesthetic value*. Fox argues that nature can also function as an "art gallery" when its components, systems, or processes are contemplated and appreciated for their beauty.
- *Religious value*. Nature, as a whole, or some natural places can also function as sources of religious experience, generating respect for creative processes and creation that surpasses that of humans.
- *Symbolic instruction value*. Fox argues that untouched nature or untouched parts of it can also serve as "monuments," reminding humans of, for instance, symbiotic relationships in nature, or hierarchical relationships in nature, or efficiency in nature in that nothing in nature is wasted.
- *Refuge value*. This is closely related to recreational value, but Fox gives it a special mention to focus on the function that untouched nature can have in the psychological rejuvenation and development of humans. With its contrast to heavily managed places, untouched nature can serve as a necessary counterpoint, helping humans to achieve a psychological balance in their lives but also prompting them to acknowledge that everything on earth need not and cannot be fully managed and that some natural things and systems and processes can just be left alone to be what they are. (As such, this interpretation of amenity value comes very close to the notion of intrinsic value that will be discussed below, but there are some important differences in the arguments for protection of the earth system that are based on amenity values and intrinsic value.)

Taken together, and in interaction with one another, the nonconsumptive amenity values listed above play a large role in the formation of *human character and identity* – of individuals as well as communities. Wild nature, for instance, extremely cold temperatures in winter, or habitats populated by large alpha-predators, can be a survival challenge to humans, but by learning to overcome these challenges with certain behavioral patterns, the character and the identities of humans and communities are formed. These challenges and responding to them become part of the "lived stories they as humans are."

While others have drawn up similar lists, giving slightly different nuances to the notion of amenity value, all of these lists emphasize the value that humans can derive from a nonconsumptive interaction with the components, systems, and processes of the earth system, keeping them as untouched and pristine as possible. Wilderness preservation and wildlife sanctuaries are clear examples of management contexts where these nonconsumptive values are foregrounded. However, these amenity values can also be enjoyed where natural phenomena are kept intact, or restored in urban or industrial spaces to enhance, for example, their aesthetic appeal, or to break down "the hard edges" of life in manufactured environments. Parks in the centers of cities, or landscaped and beautified industrial areas, simulating natural landscapes are examples of this – serving as reminders that human well-being entails more than merely satisfying material needs.

Apart from the factual question whether the preservation of wilderness areas and wildlife sanctuaries or manufactured landscapes simulating nature are really adequate to stem the tide of biodiversity loss, habitat destruction, ecosystem damage, and destruction of the environment and the biosphere, the biggest conceptual and practical difficulty around amenity values occur when they are for all practical purposes separated from the consumptive, use value of the earth system. Such a separation occurred during the early years of industrialization in the Romantic movement, leading to an isolation of the spiritual and aesthetic dimension of human existence in the experience of nature, which represented the ideal of a rekindling of the human spirit, but also a flight to nature away from the industrialized world that is left to its own devices.

The trap of such a dichotomous world where the sphere of direct use value, dominated by efficiency and optimality, clashes with other dimensions of human existence that are equally essential for human well-being – recreation, aesthetic enjoyment, spirituality, and psychological rejuvenation – is still evident in the environmental debate today. The challenge, therefore, seems to be in finding a sufficient integration of direct use value and amenity value, and this could perhaps help to appreciate the manner in which humans are dependent for both survival and well-being on the existence of a well-functioning earth system. In the discussion below of *ecosystem services*, an effort is made visible to think direct use value and amenity value together right from the start.

Option Value as Basis of Protection

Protection of the earth system is also often justified on the basis of *option value*, an important nonconsumptive value that can be distinguished from amenity value. While direct and indirect use value as well as amenity value are derived from the known present value of components, systems, and processes of the earth system, option value is derived from the *unknown future value* that humans may derive from a well-functioning and healthy earth system. Option value entails the potential value that humans may derive from the components, systems, and processes of the earth system – whether it is direct use value or nonconsumptive amenity value. An as yet undiscovered species, for example, may in future yield the cure for AIDS; as an already discovered species that is currently regarded as of little medicinal value may prove to be highly valuable in the fight against a tropical disease that may develop in, say, 50 years' time from now. However, if these species are not in existence in the future, either to be discovered or to be used in a new application, humankind has lost its ability to exercise certain options.

But option value is not only dependent on the protection of the components of the earth system, for example, biodiversity on all of its levels (genetic, species, ecosystems). Option value is also and predominantly dependent on the systems and processes that generate, for example, ecosystems and biodiversity in the first place – and thus it is these processes that should be protected for the sake of future generations, the argument goes. In almost lyrical terms, Wilson (1988) points to *biodiversity* as a “frontier of the future” (see Faith, 2008, pp. 3–4). From an evolutionary point of view, Wilson (1988) argues that biodiversity presents “a dazzling prospect of largely unknown variety, with unanticipated uses” (Faith, p. 3). But even more importantly, from an evolutionary point of view, option value represents and recognizes the possibility of new forms of life and of forms of existence and interaction that are not existent yet but can emerge if the earth system is protected to function well and without irreversible damage.

Option value, however, is extremely difficult to translate into conservation policies and actions – mainly for two reasons. In the first place, humans are subject to cognitive constraints: they do not know exactly what the preferences of future generations will be and also do not have complete knowledge at present of all of the component parts and all of the systems and processes that maintain a healthy and robust earth system. Faith (2008, p. 3) refers to this as the problem of “unknown variety and unknown value.” In the second place, humans may not be able to save all of the components of the earth system and all of its evolutionary systems and processes that will ensure its maintenance and evolution. The costs involved to do so may be prohibitive.

Norton (2003) acknowledges this uncertainty about the exact preferences of future generations, but based on general human experience, he argues that those living now may be pretty sure that future generations may not want to inherit a world that is poorer in options than the one this generation has inherited from its ancestors. Those living now may also be sure that future generations will not want to inherit a world that is full of unpleasant surprises, such as toxic waste or ecological time bombs that were passed on to them. Accordingly, Norton argues (2003, p. 301) that those living now should do their utmost best to adopt policies that ensure the healthy functioning of the creative processes of nature that will maintain complexity, biodiversity, and evolution and at the same time make it possible to learn more about the components of life, the systems, and the evolutionary processes in which they are embedded.

When it comes to the question of how much should be invested in this, Norton (2003) is hesitant to argue for protection at all costs. However, from the point of view of his environmental pragmatism in which he opts for the coexistence of a plurality of values that should inform conservation efforts, he argues that conservative safe minimum standards should be set for activities whose effects are reversible at a reasonable cost in the short or medium term. He also argues that a precautionary approach should be followed (where costs are put in the background) when human action start to have irreversible effects – for instance, pushing a species toward the brink of extinction.

Existence Value

Existence value is usually reserved for elements of the earth system, such as dramatic landscapes or magnificent animals such as lions, wolves, ice bears, whales, dolphins, elephants, and rhinoceros, but it can also be extended to the earth system as a whole, either in its component parts such as biodiversity, biomes, and ecological "hotspots" where a number of biomes intersect to bring about an unusual concentration of diversity, ecosystems, or communities of life, or conceptualized in terms of the processes at work in these systems. This value represents *the satisfaction humans experience* from the knowledge of the mere existence of phenomena such as these, over and above any of the use values mentioned above. Encountering a pride of lions in a conservation area, for instance, may be the high point of a visit to Africa, while spotting an ice bear may have the same value for those on a visit to Siberia (see Rolston, 2001): the mere existence of these animals and the species they belong to are regarded as highly valuable, and therefore, the argument goes, these animals and their species should be protected. Existence value thus move very close to the argument that the earth system, its component parts, and its processes should be protected for their own sake (see O'Neill et al., 2008), but in so far as this argument is still based on instrumental value, albeit a subtle and nonconsumptive version of it, it cannot be equated to intrinsic value, as will be shown below (see Afeissa (2009) for an insightful discussion of the difference between instrumental and intrinsic value in environmental ethics).

Ecosystem Services as Basis for Protection

While a number of different kinds of use value can serve as basis to protect the earth system, it is clear from the discussion above that these kinds of values can be separated from one another and even played off against each other if they are not put into some kind of systematic relationship right from the outset. Direct use value, for instance, always seems to be the most obvious basis for protection, but this value, if not strongly qualified by indirect use values, amenity, option, and existence values, can serve as basis to justify the complete opposite of protection, namely, the overexploitation or even destruction of the earth system.

In response to this need, the notion of *ecosystem services* has emerged in an effort to conceptualize different kinds of use values in relationship with one another, mapping how they are mutually dependent upon one another, and how they all, in combination with one another, through direct, indirect, and nonconsumptive use value, contribute not only to the physical survival of human beings but also to their identity, general well-being, and quality of life. Usually, four main categories of ecosystem services are distinguished, three of which represent direct services (namely, provisioning, regulating, and cultural services), while the fourth represents a cluster of indirect services in the sense of supporting the other direct services (Millennium Ecosystem Assessment, 2005). As such, these categories of ecosystem services cut across the distinction of the direct and indirect use values, amenity, option, and existence values that can be derived from the earth system.

Provisioning ecosystem services include things such as food, fresh water, wood, fiber, and fuel that can be directly provided by natural entities, systems, and processes. But these basic goods can also be provided by way of artificial systems such as farms, water purification plants, plantations, and refineries. The point, however, is that all of these secondary provisioning services are dependent in some way or another on direct provisioning coming from natural entities, systems, and processes.

Regulating ecosystem services include climate regulation, flood regulation, disease regulation, and purification of water. Cultural ecosystem services, in turn, include the aesthetic or spiritual experience of natural entities, systems, and processes, or using them as a source of education or a space for recreation and rejuvenation. Supporting ecosystem services form the foundation of the other services that have already been mentioned and include nutrient cycling, soil formation, and primary production of which photosynthesis is an example.

While the components of human well-being and quality of life are fields of study for the different disciplines of the social and human sciences, there is agreement among most social scientists that security, access to the basic material for a good life, health, good social relations, and freedom of choice and action form the basic components of human well-being. Security includes personal safety, secure access to resources, and protection from disasters, while the material for a good life includes adequate livelihoods, sufficient nutritious food, shelter, and access to goods. Health, in turn, requires strength, feeling well, and access to clean air and water, while freedom of choice and action entail the opportunity to be able to achieve what an individual values doing and being (Millennium Ecosystem Assessment 2005, *Synthesis*, p. vi).

What must be emphasized as the core of this approach, but is often overlooked, is that the ecosystem services that support human well-being are all based on *biodiversity*, as it is understood in the *Millennium Ecosystem Assessment* as life on earth in general. In this meaning, "biodiversity" approximates the meaning of "earth system" as it has been used in this chapter. Something of this insight is captured in the United Nations Convention on Biological Diversity (1992) where it is stated that biodiversity should be protected because it provides the foundation of the "social, economic, scientific, educational, cultural, recreational and aesthetic values" that contribute to human well-being. However, as such, biodiversity, understood as life on earth, is not only a value among other values in a human calculus of what contributes or not to human well-being. Biodiversity rather forms the basis of such a value calculus. As Norton (2003, p. 501) has argued, "biodiversity . . . is not a resource among others, but a generator – a source – of biological resources." Thus, biodiversity, understood as life on earth in general (i.e., including the environment and biosphere), is a necessary condition of the use values that can be derived directly or indirectly, consumptively or nonconsumptively, from the earth system, while biodiversity as life on earth, as this necessary condition of resource values, is not a resource itself.

With this insight, a notion of value is revealed that actually falls outside the ambit of ecosystem services, or direct, indirect, and nonconsumptive use values that can be played off against one another in a calculus of what does and what does not promote human interests. It is the notion of value that makes the ecosystem services and use values of the environment, the biosphere, and biological resources possible – and as such, this value approximates the notion of the intrinsic value of the environment, the biosphere, and biodiversity, but is perhaps not exactly coinciding with it (see Afeissa, 2009), as will be shown in the next section.

Intrinsic Value

Intrinsic value features very prominently in arguments for protection of the earth system from an ethical point of view. Since the inception of environmental ethics in the middle 1970s, different aspects of the earth system have been singled out to have intrinsic value, ranging from certain individual animals (Tom Regan), any living entity (Paul Taylor), land (Aldo Leopold), species and ecosystems (Baird Callicott and Holmes Rolston), the community of life (Aldo Leopold), the evolutionary process (Rolston), the abundance and diversity of life and its flourishing (Arne Naess), and so the list can go on. The one element common to all of these arguments is the recognition that the whole of the earth system, or its component parts and constitutive processes, have value in and of themselves, regardless of any human use that can be derived from them. On the basis of intrinsic value, it is then further argued that these elements or the whole of the earth system should be morally considered or respected in their own right and not for their instrumental value for humans. Differently formulated, intrinsic value means that humans have direct moral duties to the earth system and its component parts and processes.

While there are debates between supporters of the intrinsic value approach, with some arguing for intrinsic value as objectively located within nature (Holmes Rolston) and others maintaining that intrinsic value is subjectively attributed by humans to nature (Baird Callicott), intrinsic value in this context, in whichever way it is deemed to be constituted, can be equated to a respectful reverence for all life in its variety and abundance, for individual entities as well as for the systems and processes making this variety and abundance possible. From this perspective, any loss of abundance and variety through, for instance, human-caused extinctions, represents a loss from the rich and complex tapestry that life itself is, consisting of a continuing process of complex interaction and biological creativity that unfolds through evolution.

In the words of Holmes Rolston (2001), the loss of a species is the loss of genetic possibilities – it is the death of a type and thus the loss of a form of life itself. In so far as a species represents an adaptive fit with a particular habitat that has evolved over millennia, a human-caused extinction represents a shutdown in a very long evolutionary story, and it leaves no further possibilities of regeneration, speciation, and the creation of further biological variety. Rolston argues that artificial extinctions in distinction from natural ones impoverish the earth system and close down the spontaneous evolution that otherwise would have taken place. For Rolston, the difference between a natural extinction and an artificial extinction can in moral terms be likened to the difference between death by natural causes and murder.

Accordingly, Rolston argues (2001) that humans have no direct moral duty to preserve species from natural extinction, although they do have a direct moral duty to avoid artificial extinctions. But Rolston goes even further by claiming humans also have direct moral duties to the habitats, biomes, and evolutionary processes that generate species in their abundance and variety in the first place. It is not only important that *species* are protected but that species are protected *within the system* that they survive and evolve. In this perspective, the appropriate level of moral concern is not the individual – either persons or sentient beings – as conventional Western ethics will maintain, but rather the appropriate survival unit that leads to the existence of individuals, like species, habitats, biomes, and evolutionary processes.

The central concern of Rolston's environmental ethics is thus not so much the loss of resources that humans may experience in the destruction of the environment, the biosphere, and biodiversity but rather the killing of and insensitivity to forms of life that stands within an evolutionary history. Accordingly, Rolston argues, the core of environmental ethics should be much more than prudence; it should entail a principled responsibility with the primary duty to consider every form of life as valuable in itself and to care for and about it – except for pest and disease species. With reference to the human species as a late arrival in evolutionary history, and the tendency of this species to act in mere self-interest, Rolston states (2001, p. 414): "On the naturalistic account, the host of species has a claim to care in its own right. There is something Newtonian, not yet Einsteinian, besides something morally naïve, about living in a reference frame where one species takes itself as absolute and values everything else relative to its utility."

Like option and existence value, the intrinsic value of the earth system is extremely difficult to translate into policy terms or into action – mainly because intrinsic value is so vastly different in nature from instrumental or use value. In fact, intrinsic value is mostly evoked in arguments to oppose the overemphasis of use value that often leads to an overexploitation of the earth system and sometimes even to its destruction (see O'Neill et al., 2008). The argument then usually goes that a natural resource cannot be treated in this manner because it has intrinsic value – it is alive – and forms a part of a rich web of life that has value independent from human use value and stands to be damaged or destroyed by human activity.

Under one extreme interpretation of this approach, the appeal to intrinsic value can be seen as an argument for the total protection of nature/the earth system (see Norton, 2003, p. 125), saving all of it at all costs. However, many will reject this as a legitimate management goal because, they would claim, it cannot be implemented without severe negative impacts on human well-being. A total "hands-off" approach to the earth system, they would argue, would bring agriculture, science, and medicine to a total halt, making it impossible for humankind to survive, let alone to thrive.

There is, however, a less extreme interpretation of intrinsic value possible that still opposes the reduction of nature and life to a commodity and rather sees the intrinsic value of the earth system and of life as point of departure for a caring and careful interaction with the earth system and the life it supports, in which its richness and diversity are embraced as valuable in itself – and is protected, cared for, nourished, and celebrated for nothing else than it being the wonder it is (Rolston, 2001). The general thrust of recognizing intrinsic value from this perspective is not in the first place to protect the earth system and life from harm but rather to enhance the earth system and the life it sustains so that it can flourish – for its own sake, in its own way (see Swilling & Annecke, 2012). The flourishing of life is thus the point of departure; it is not relegated to an afterthought after human use value has taken precedence.

From this point of view, intrinsic value does not entail a total abolishment of the human use of the earth system but rather opens up space for a modest use of it, inspired by the premise of the wonder of life as something extremely precious and fragile, something that requires respect and care – not only for the individual elements of life but also for life in general as a whole, together with all the conditions that make life possible in the first place. Under this interpretation, arguments for protecting the earth system based on the notion of intrinsic value do not stand far apart from arguments for protection based on option and existence values. The internal logic of intrinsic value, however, differs from the instrumental logic within which option and existence values are embedded. Intrinsic value arguments entail an approach of principled responsibility to be careful and take care of all life as valuable in itself, while instrumental value arguments entail a prudential approach to resource preservation in which human interests stand central.

Integrating the Value Arguments

From the discussion above, it can again be stated that protection of the earth system is more than just a green issue – in the narrow sense of focusing only on nature conservation. The different instrumental values derived from the earth system emphasize that its protection is ultimately done to ensure the well-being, and satisfy the interests of humans. In the words of Rolston (2001, p. 403), protection of the earth system justified from this perspective "is ultimately for the purpose of its enlightened exploitation." The emphasis on ecosystem services forming the foundation of the well-being of humans underscores this point. Instrumental value arguments for the protection of the earth system, however, presuppose a sort of separation between humankind on the one hand and the earth system on the other hand: The earth system is seen as something removed that stands at a distance from humans, and the mode of interaction with it is that of an object of management (often at arm's length) to make it and its component parts and processes available to "serve" humans in a variety of ways to satisfy their interests. In order for it to be available for human use, the earth system (comprising of the environment, the biosphere, and biodiversity) is simplified and reduced to become something less than what it fully is.

From an intrinsic value point of view, this separation and reductionism are challenged. Instead, the fundamental unity of humankind with the earth system is emphasized, arguing that human life, together with all other forms of life, emerged from a long history of evolution that has value in and of itself. From this perspective, protection of the earth system, that is, ensuring that the earth system is functioning well and continuing with its process of spontaneous evolution, is done for its own sake, regardless of any use value it may have for humans. Stated in positive terms, and under a modest interpretation of intrinsic value, the earth system is protected to enhance the richness, abundance, and flourishing of life – for the sake of life itself. In practical terms, this implies that humans, while dependent for their survival and well-being on well-functioning ecosystem services, should always see the earth system, in its component parts and processes, as well as the whole that it forms, as something much more than just a commodity or an amenity or an option that are or could be of use to humans. From an intrinsic value point of view, the earth system should rather be acknowledged as the very basis of the wonder of life itself, and therefore, it should be respected, treated, cared for, and celebrated as such.

From both angles then, strong arguments can be made for protecting the earth system. From a use value point of view, it is argued that the preconditions for human well-being can be lost if the ecosystem services provided by the environment, the biosphere, and biodiversity are not protected. From an intrinsic value point of view, it is argued that life itself will be diminished if the earth system is not protected and cared for. While the internal logic of instrumental and intrinsic value approaches differ vastly from one another, a survey of the environmental attitudes of the general public in the USA (Kempton, Boster, & Hartley, 1995) has found that the earth system/the environment is appreciated both instrumentally and intrinsically.

This is an important finding, although it calls for further studies in other countries. It means that there is a lot of common ground between the espoused attitudes of environmentalists and resource users, even if the challenge clearly lies in the translation of attitudes into action in a global transition from a development path based on overexploitation and even destruction in some cases of natural resources, to one that is based on justice and respect for all of life on earth.

In rising to this challenge, it is clear that humankind will have to figure out how to combine instrumental and intrinsic value with one another in an intelligent and productive manner in the very concrete management, and life choices that will have to be made in everyday contexts. Formulated in general terms, this will require that some limits are placed on consumptive use that leads to overexploitation, damage, and destruction of the earth system, but also that realism is brought to human action in response to the runaway idealism that sometimes characterizes ideas about the nonconsumptive value of the earth system, or its intrinsic value.

Conclusion: An Outlook for the Future of the Environment, the Biosphere, and Biodiversity

At the time of writing, 40 years after the Club of Rome has published its report on the limits to growth in 1972, the outlook for the future of the earth system looks bleak. In the second finding of the *Biodiversity Synthesis* of its report on *Ecosystems* *and Human Well-Being* (http://www.maweb.org/documents/document.354.aspx.pdf), the *Millennium Ecosystem Assessment* stated that "The drivers of loss of biodiversity and the drivers of changes in ecosystem services are either steady, show no evidence of declining over time, or are increasing in intensity" (p. 8). The same conclusion is reached in the *Global Biodiversity Outlook 3* that was published in 2010 by the United Nations Environmental Programme (UNEP), placing the loss of biodiversity and ecosystem services within the framework of a collective, global failure that will require extraordinary measures to turn around.

Having considered the state of biodiversity in 2010, the *Global Biodiversity Outlook 3* found that the "five principal pressures directly driving biodiversity loss (habitat change, overexploitation, pollution, invasive alien species and climate change) are either constant or increasing in intensity," and that the "ecological footprint of humanity exceeds the biological capacity of the Earth by a wider margin than at the time the 2010 target was agreed" (p. 9).

With this continuing and intensifying loss of biodiversity and ecosystem services due to human activities, the general consensus among scientists from a wide range of disciplines is that humankind is at risk to push the earth system beyond certain thresholds or tipping points "that could lead to large, rapid and potentially irreversible changes" (p. 71). As defined in the *Global Biodiversity Outlook 3*, a tipping point is a situation in which an ecosystem experiences an abrupt shift to a new state, "with significant changes to biodiversity and the services to people it underpins, at a regional or global scale," which will first and foremost affect the poor populations of the world since they are mostly directly dependent on the ecosystem services of the natural environment (p. 71, 72).

This outlook becomes bleaker if it is taken into account that the world population is expected to grow to nine billion in 2050, an increase of two billion people over the seven billion that the world population is in 2012. With higher demands placed on the agricultural sector to provide food for nine billion people, it can be expected that more and more pressure will be exerted on the earth system. At the same time, this will put more pressure on those societies that are already marginalized and are directly dependent on the maintenance of well-functioning ecosystems for their survival. For the future, this will require an intensification of an ethics of limits, justice, and sharing, in which efforts should be significantly increased to restore those ecosystems and ecosystem services that have already been damaged, to prevent further damage to those ecosystems and ecosystem services that are still intact, and to work toward a transition in which the conditions that sustain the flourishing of life on earth – all life on earth – are really cared for and enhanced.

In such an ethic of restoration, care, and transition, people and justice will have to play a central part, since life cannot be respected and celebrated without everyone enjoying their fair share of its richness and abundance (see Swilling & Annecke, 2012). While numerous examples exist of groups, organizations, and societies experimenting with the practical implementation of such an ethics in efforts to learn again how to live sustainably in a particular place, humankind is unfortunately a far way off from a position where mainstream decision-makers, governments, and business organizations make the transition to this ethic. It is possible, though, for individuals, consumers, landowners, NGOs, and any custodian of the smallest part of the earth system to influence these mainstream role-players and to start living this ethics of becoming sustainable in a place – even if this may entail overcoming prejudice and ideological resistance.

References

Afeissa, H. (2009). Intrinsic and instrumental value. In J. B. Callicott & R. Frodeman (Eds.), *Encyclopedia of environmental ethics and philosophy* (Gale, cengage learning, Vol. 1, pp. 529–531). Detroit: Macmillan Reference USA.

Callicott, J. B. (1999). *Beyond the land ethic: More essays in environmental philosophy*. Albany, NY: State University of New York Press.

Carson, R. (2002). *Silent spring*. New York: Mariner Books. (1st. Pub. Boston: Houghton Mifflin, 1962).

Costanza, R. (1991). *Ecological economics: The science and management of sustainability*. New York: Columbia University Press.

Davis, M. A. (2009). *Invasion biology*. Oxford: Oxford University Press.

Ehrenfeld, D. (1988). Why put a value on biodiversity? In E. O. Wilson (Ed.), *Biodiversity*. Washington, DC: National Academy Press.

Faith, D. P. (2008). Biodiversity. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy* (Fall 2008 Edition). URL: http://plato.stanford.edu/archives/fall2008/entries/biodiversity/

Fox, W. (1995). *Toward a transpersonal ecology: Developing new foundations for environmentalism*. Totnes, Devon: A Resurgence Book.

Gardiner, S. M. (2011). *A perfect moral storm. The ethical tragedy of climate change*. New York: Oxford University Press.

Gaston, K. J. (Ed.). (1996). *Biodiversity: A biology of numbers and difference*. Oxford: Blackwell.

Hardin, G. (1968). The tragedy of the commons. *Science*, New Series, 162 (3859), 1243–1248. Also available at: http://www.sciencemag.org/content/162/3859/1243.full

Holland, A. (2001). Sustainability. In D. Jamieson (Ed.), *A companion to environmental philosophy* (pp. 390–401). Malden, MA/Oxford, UK: Blackwell.

Jacobs, M. (1995). Sustainable development, capital substitution and economic humility: A response to Beckerman. *Environmental Values, 4*, 57–68.

Johnson, D. L., Ambrose, S. H., Bassett, T. J., Bowen, M. L., Crummey, D. E., Isaacson, J. S., Johnson, D. N., Lamb, P., Saul, M., & Winter-Nelson, A. E. (1997). Meanings of environmental terms. *Journal of Environmental Quality, 26*, 581–589.

Kempton, W. M., Boster, J. S., & Hartley, J. A. (1995). *Environmental values in American culture*. Cambridge, MA: MIT Press.

Laurance, W. F. (1999). Reflections on the tropical deforestation crisis. *Biological Conservation, 91*, 109–117.

Luck, G. W., Daily, G. C., & Ehrlich, P. R. (2003). Population diversity and ecosystem services. *Trends in ecology and evolution, 18*(7), 331–336.

Meadows, D. H., Meadows, D. l., Randers, J., & Behrens III, W. W. (1972). *The limits to growth. A report to the Club of Rome*. New York: Universe Books. Also available at: http://www.scribd.com/doc/2682517/Club-of-Rome-Report

Millennium Ecosystem Assessment. (2005). *Ecosystems and human well-being*: *Synthesis*, p. vi, available at: http://www.maweb.org/documents/document.356.aspx.pdf

Morin, E. (1999). *Homeland EARTH: A manifesto for the new millennium* (Advances in systems theory, complexity and the human sciences). London/England: Hampton Press.

Næss, A. (1973). The shallow and the deep, long-range ecology movement. *Inquiry, 16*(1), 95–100.

Norton, B. G. (2003). *Searching for sustainability. Interdisciplinary essays in the philosophy of conservation biology*. Cambridge: Cambridge University Press.

O'Neill, J., Holland, A., & Light, A. (2008). *Environmental values*. London/New York: Routledge.

Pimm, S. L., Russell, G. J., Gittleman, J. L., & Brooks, T. M. (1995). The future of biodiversity. *Science, 269*, 347–350.

Primack, R. B. (2006). *Essentials of conservation biology* (4th ed.). Sunderland, MA: Sinauer Associates.

Raup, D. M. (1991). *Extinction: Bad genes or bad luck?* New York: W.W. Norton.

Reaka-Kudla, M. L., Wilson, D. E., & Wilson, E. O. (Eds.). (1997). *Biodiversity II: Understanding and protecting our biological resources*. Washington, DC: Joseph Henry Press.

Rolston, H., III. (2001). Biodiversity. In D. Jamieson (Ed.), *A companion to environmental philosophy* (pp. 402–415). Malden, MA/Oxford, UK: Blackwell.

Routley, R. (1973). Is there a need for a new, an environmental ethic? In *Proceedings of the 15th World Congress of Philosophy* (Vol. 1, pp. 205–210). Sophia: Sophia Press.

Solow, R. M. (1993). Sustainability: An economist's perspective. In R. Dorfman & N. S. Dorfman (Eds.), *Economics of the environment: Selected readings* (3rd ed., pp. 178–187). New York: W. W. Norton.

Soulé, M. E., Estes, J. A., Berger, J., & Del Rio, C. M. (2003). Ecological effectiveness: Conservation goals for interactive species. *Conservation Biology, 17*(5), 1238–1250.

Stern, N. (2010). *A blueprint for a safer planet: How we can save the world and create prosperity*. London: Vintage Books.

Swilling, M., & Annecke, E. (2012). *Just transitions. Explorations of sustainability in an unfair world*. Claremont: UCT Press (in South Africa). Tokyo: United Nations University Press (in North America).

TEEB. (2010). *The economics of ecosystems and biodiversity: Mainstreaming the economics of nature: A synthesis of the approach, conclusions and recommendations of TEEB*. The Economics of Ecosystems and Biodiversity. Hosted by UNEP, this report is available at: http://www.teebweb.org/Portals/25/TEEB%20Synthesis/TEEB_SynthReport_09_2010_online.pdf

The Ecologist. (1972). A blueprint for survival. *The Ecologist*, 2 (1). Also available at: http://www.theecologist.info/key27.html

The Royal Society. (2012). *People and the planet*. The Royal Society Science Policy Centre report 01/12. Also available at: http://royalsociety.org/uploadedFiles/Royal_Society_Content/policy/projects/people-planet/2012-04-25-PeoplePlanet.pdf

Turner, G. (2008). *A comparison of 'The limits to growth' with thirty years of reality*. Canberra: Commonwealth Scientific and Industrial Research Organisation (CSIRO).

WCED. (1987). *Our common future*. Report of the World Commission on Environment and Development to the United Nations. Available at: http://www.un-documents.net/wced-ocf.htm Known as the Brundtland Report, also published in 1987 at Oxford: Oxford University Press.

Wilson, E. O. (Ed.). (1988). *Biodiversity*. Washington, DC: National Academy Press.

Wilson, E. O. (1992). *The diversity of life*. Cambridge, MA: Belknap Press of Harvard University Press.