Banished behind the curtain of nothingness: the ecological problem of species extinction

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One of the main facets of the contemporary ecological crisis – increasingly recognized as probably the greatest challenge facing humanity today - is the phenomenon of species extinction. There is almost unanimous consensus in the scientific community today that the Earth is on the verge of a sixth mass extinction of species and consequent loss of biodiversity.[1] However, the problem of species extinction often comes to be under-rated, as it gets overshadowed by the mounting concern and growing outcry over the phenomenon of global warming. The exclusive attention on climate change could lead to the obfuscation of the multidimensional environmental crisis, of which global warming is part but not all of the problem.[2] While most environmental problems are linked to global warming and the resultant climate change, it would be a gross error, however, to identify or reduce ecological crisis to global warming alone, as it often happens in media and public discussion. The problem of species extinction, I shall argue, is so huge and its consequences so far-reaching, that it deserves much more attention than what is presently accorded to it.

In this paper, I will, first of all, discuss the problem of species extinction. While placing the current mass extinction against the background of five previous ones in the long geological history of the Earth, it will be pointed out how the present one is unique, as it is caused by one dominant species alone, namely the *homo sapiens*. Secondly, the anthropogenic character of the large scale of loss of biodiversity will be highlighted through an analysis of the factors – all of which have to do with human activities – triggering the present mass extinction. Thirdly, the implications of the loss of biodiversity will be examined, moving from immediate consequences for human physical and economic well-being to aesthetic, spiritual and ethical considerations. I will then proceed to sketch out the strictly philosophical contribution to the discussion on species extinction. Here I will try to propose some "meta-physical" considerations on the phenomenon of the current mass extinction of species. Most important of these is the realization that extinction is annihilation of life itself for the particular species driven out of existence, with dire implications for the entire web of life when it comes to mass extinctions like the one currently in course. The recognition that the contemporary mass extinction is caused by the human beings raises some serious interrogatives in turn about the right of one species to so radically alter the future course of evolution on the Earth, threatening in the process the sustainability of the entire biosphere itself for the survival of future biotic generations, including the humans. It will also be important here to address the question about the 'intrinsic' value of non-human species and of ecosystems, an issue that has been largely circumspect to the debate in environmental ethics so far. By way of overcoming the dilemma, I shall argue

[1] See footnotes 9-11.

[2] Michael J. Novacek, "Engaging the public in biodiversity issues" in *Proceedings of the National Academy of Sciences* 105 (2008), 11571, 11577; T. E. Lovejoy – L. Hannah (eds.), *Climate Change and Biodiversity* (New Haven, CT: Yale University Press, 2005), 387-395.

that it is necessary, among other measures, to move out of a strictly anthropocentric metaphysics and mechanistic worldview to a more relational ontology and an 'ecological' worldview respectively.

1. **At the verge of a sixth mass extinction of species**

Life, as we know today, exists only on the Earth. Life has been in continuous evolution ever since it sparked off on this planet, in the oceans as it is commonly believed, nearly four billion years ago, before reaching the magnificent variety and forms with which it now presents itself. Scientists use the term biodiversity to refer to life on Earth in all aspects of its diversity and interactions among living organisms. The term biodiversity was used first by the Harvard based scientist Edward O. Wilson[3] - the doyen of living biologists - in the 1988 proceedings from a conference held in 1986 organized by W. J. Rosen, who originally coined the term.[4] The *Millennium Ecosystem Assessment* (2005) defines biodiversity as "the variability among living organisms from all sources, including terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part."[5] As the *Global Environment Outlook* (GEO4) of 2007 succinctly states, "biodiversity is the variety of life on Earth."[6] It needs to be borne in mind that even after decades of painstaking work, only a fraction of the total species on Earth have been formally identified: namely 1.7-2 million species. Estimates of the total number of species on Earth range from 5 million to 30 million (and conceivably even 100 million).[7]

In the long geological history of the Earth, the evolution of life has suffered innumerable setbacks in terms of mass extinctions of species and consequent loss of biodiversity. Among these five are canonically referred to as the great mass extinctions on account of the wholesale severe biotic change incurred during each of these spasms of decimation. Below is a list of them in chronological order:

i) the mass extinction at the end of the Ordovician era (nearly 439 Mys) during which approximately 25% of the families and nearly 60% of the genera of marine organism were lost;
ii) the late Devonian extinction (nearly 364 Mys), when 22% of marine families and 57% of marine genera disappeared;
iii) the Permian-Triassic extinction (nearly 251 Mys), the worst of the five mass extinctions, during which 95% of all species (marine as well as terrestrial) were lost;

[3] Edward O. Wilson (ed.), *Biodiversity* (Washington, DC: National Academy Press, 1988).

[4] See Novacek, "Engaging the public in biodiversity issues," 11571.

[5] Millennium Ecosystem Assessment, *Ecosystems and Human Well-being: Biodiversity Synthesis* (Washington: World Resources Institute, 2005), 1.

[6] United Nations Environment Programme (UNEP), *Global Environment Outlook GEO4: Environment for Development* (Nairobi: UNEP, 2007), 160.

[7] Millennium Ecosystem Assessment, *Biodiversity Synthesis*, 19; Paul R. Ehrlich – Edward O. Wilson, "Biodiversity Studies: Science and Policy" in *Science* 16 (1991), 758-762; Robert M. May, "How many species are there on Earth?" in *Science* 241 (1988), 1441-1449.

iv) the End Triassic extinction (nearly 199-214 Mys) during which marine organisms were most strongly affected (22% of marine families and 53% of marine genera were lost);

v) and the most recent mass extinction at the Cretaceous-Tertiary boundary (nearly 65 Mys) during which went extinct, among other species, the nonavian dinosaurs.[8]

Scientists now believe that a sixth mass extinction spasm is upon the Earth,[9] and predict that coming decades will see the loss of large numbers of species.[10] There exists substantial evidence in this regard from both land and the oceans. According to the World Conservation Union (IUCN) Red List, between 12% and 52% of species within well-studied higher taxa are threatened with extinction.[11] As far as the amphibians are concerned of the nearly 6,300 extant species of frogs, salamanders, and caecilians, at least one-third are currently threatened with extinction, and many more are likely to become so in the near future.

The oceans too that cover three-quarters of the Earth's surface manifest direct evidence of biodiversity loss as marine ecosystems have come under duress from human impacts. Jeremy Jackson describes the situation as foreboding the risk of a mass extinction of species in the oceans.

> Today, the synergistic effects of human impacts are laying the groundwork for a comparably great Anthropocene mass extinction in the oceans with unknown ecological and evolutionary consequences. Synergistic effects of habitat destruction, overfishing, introduced species, warming, acidification, toxins, and massive runoff of nutrients are transforming once complex ecosystems like coral reefs and kelp forests into monotonous level bottoms, transforming clear and productive coastal seas into anoxic dead zones, and transforming complex food webs topped by big animals into simplified, microbially dominated ecosystems with boom and bust cycles of toxic dinoflagellate blooms, jellyfish, and disease.[12]

Particularly alarming in this regard is the state of biodiverse coral reefs which are among the most threatened ecological systems on Earth. It is estimated that approximately 70% of coral reefs globally have been either degraded beyond

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[8] For a detailed account of the five mass extinctions see D. Jablonski, "Extinctions in the fossil record" in J.H. Lawton – R.M. May (eds.), *Extinction Rates* (Oxford: Oxford University Press, 1995), 25-44. For a synthetic summary of them see David B. Wake – Vance T. Vredenburg, "Are we in the midst of the sixth mass extinction? A view from the world of amphibians" in *Proceedings of the National Academy of Sciences* 105 (2008), 11466. See also D.H. Erwin, "Lessons from the past: Biotic recoveries from mass extinctions" in *Proceedings of the National Academy of Sciences* 98 (2001), 1399-1403.

[9] Chris D. Thomas et al., "Extinction risk from climate change" in *Nature* 427 (2004), 145-148; John C. Avise – Stephen P. Hubbell – Francisco J. Ayala, "In the light of evolution II: Biodiversity and extinction" in *Proceedings of the National Academy of Sciences* 105 (2008), 11453; Wake –Vredenburg, "Are we in the midst of the sixth mass extinction?," 11466-7; United Nations Environment Programme, *Global Environment Outlook GEO4* (2007), 162.

[10] See Norman Myers – Andrew H. Knoll, "The biotic crisis and the future of evolution" in *Proceedings of the National Academy of Sciences* 98 (2001), 5389. See also the list of eminent biologists that the authors cite in this regard. Notes 1-5 in *Ibid*., 5391.

[11] Millennium Ecosystem Assessment, *Biodiversity Synthesis*, 44. It may be recalled here that less than 10% of named species have been assessed in terms of their conservation status.

[12] Jeremy B.C. Jackson, "Ecological extinction and evolution in the brave new ocean" in *Proceedings of the National Academy of Sciences* 105 (2008), 11458.

recognition, are in imminent danger of collapse, or are under longer-term threat of demise.[13]

What strikes about the current spasm of extinction is that it is much above the natural rates. As Michael J. Novacek notes there is a persistent widespread misperception from the part of a vast segment of the general public that what we are witnessing is merely the current wave of extinctions that are part of the normal turnover in the history of life. The underlying argument here is that life on Earth has experienced myriad extinction events over billions of years, and it will continue to thrive, irrespective of the current extinction spasms, offering new opportunities for new better-adapted species.[14] However, the naked truth is that the current rates of species extinction exceed those of the historical past by several orders of magnitude and is bound to accelerate. It is estimated that the normal background rates of extinction is roughly 0.1-1.0 extinctions per million species per year.[15] But, as per the *Millennium Ecosystem Assessment* "over the past few hundred years, humans have increased species extinction rates by as much as 1,000 times background rates that were typical over Earth's history."[16] According to the same report the current extinction rate is up to one thousand times higher than the fossil record when it comes to birds, mammals and amphibians.[17] In fact, scientists fear that extinction rates will increase to the order of 1,000 to 10,000 times background rates over the coming decades.[18]

According to the *Fourth Assessment Report* of the Intergovernmental Panel on Climate Change of 2007, up to 30 per cent of plant and animal species so far assessed are likely to be at increased risk of extinction, if increases in global average temperatures exceed 1.5-2.5°C.[19] The planet Earth is indeed poised precariously on the verge of a sixth mass extinction of species.

2. **The anthropogenic character of the current mass extinction of species**

The unique feature about the sixth mass extinction of species is that it is anthropogenic in origin. While all the previous five mass extinctions were caused by physical or natural causes, the present one is caused by one species alone – the human kind. As the *Millennium Ecosystem Assessment* points out although biodiversity and ecosystem

[13] See Wilkinson C. (ed.), *Status of Coral Reefs of the World* (Townsville: Australian Institute of Marine Science, 2004).

[14] Novacek, "Engaging the public in biodiversity issues," 11752. Novacek refers to a survey conducted a few years ago by the American Museum of Natural History. See American Museum of Natural History, *Biodiversity and the Next Millennium: A Nationwide Survey* (Nichols Hills, OK: Harris, 1998).

[15] Millennium Ecosystem Assessment, *Biodiversity Synthesis*, 21.

[16] Millennium Ecosystem Assessment, *Biodiversity Synthesis*, 3.

[17] Millennium Ecosystem Assessment, *Biodiversity Synthesis*, 4.

[18] Millennium Ecosystem Assessment, *Biodiversity Synthesis*, 43.

[19] See *Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability. Summary for Policymakers. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [approved at the IPCC Session in Brussels, 6 April 2007] (Geneva: IPCC Secretariat, 2007), 8.

services experience change due to natural causes, current change is dominated by anthropogenic drivers.[20]

Scientists speak of three phases in the biotic holocaust associated with the current mass extinction of species. The first phase of the current extinction episode is associated with the dispersal around the planet of the modern humans nearly 50,000–100,000 years ago. The second phase is associated with the invention of agriculture nearly 10,000 years ago along with further population increases and land-use changes. The third and most acute phase of biodiversity loss was ushered in by the industrial revolution.[21] While the decimation of species in the first two phases were minimal compared to the background rates, it is the third phase beginning with the industrial revolution that set the ratio soaring to the present one of 1,000 times background rates and destined to increase to the order of 10,000 times background rates in the future. The anthropogenic fingerprints are clearly evident here as the analysis of its underlying cause below will reveal.

The anthropogenic character of the current mass extinction of species becomes evident when one examines the principal causes that are directly or indirectly triggering it.

Negative human pressures on biodiversity leading to partial or total extinction of species occur due to a number of factors. According to the *Millennium Ecosystem Assessment* the most important direct drivers of biodiversity loss are habitat conversion (such as land use changes, physical modifications of rivers or water withdrawal from rivers, loss of coral reefs, and damage to sea floors due to trawling), climate change, overexploitation of natural resources, pollution of land, air and water, and introduction of alien species and exotic organisms into naïve ecosystems.[22]

Habitat conversion occurs particularly from conversion of land for agriculture. Cultivated systems now cover one quarter of Earth's terrestrial surface, a ratio which is only bound to shoot up with the burgeoning human population which is predicted to reach 8 billion by 2025 and 9.3 billion by 2050. It is known according to a recent study that humanity already appropriates nearly a quarter of global terrestrial net primary productivity, and up to 80% in large regional swaths.[23] "Global market demand for high value commodities such as soybeans, coffee, cotton, oil palm, horticultural crops and biofuels, has resulted in substantial habitat conversion and ecosystem degradation."[24] It is known from global mapping studies that nearly 50% of all temperate grasslands, tropical dry forests, and temperate broadleaf forests have been converted to human-dominated uses worldwide.[25] I quote Michael S. Northcott in this regard.

[20] Millennium Ecosystem Assessment, *Biodiversity Synthesis*, 8.

[21] Avise – Hubbell – Ayala, "In the light of evolution II: Biodiversity and extinction," 11453.

[22] Millennium Ecosystem Assessment, *Biodiversity Synthesis*, vi, 8. For a synthetic presentation of these five principal causes for the loss of biodiversity see United Nations Environment Programme, *Global Environment Outlook GEO4* (2007), 169.

[23] See H. Haberl et al. "Quantifying and mapping the human appropriation of net primary production in earth's terrestrial ecosystems" in *Proceedings of the National Academy of Sciences* 104 (2007), 12942-12945.

[24] United Nations Environment Programme, *Global Environment Outlook GEO4* (2007), 167.

[25] J.M. Hoesktra – T.M. Boucher – T.H. Ricketts – C. Roberts, "Confronting a biome crisis: Global disparities of habitat loss and protection" in *Ecology Letters* 8 (2005), 23-29.

> The biggest single cause of species extinction is the destruction of the rainforests of Amazonia, Central Africa and South East Asia. These areas are the richest in species diversity on the planet, and the ecosystem of the forest is fragile. Three or four hectares of rainforest in South East Asia or Central America contain more tree species than the whole of Europe or North America. These trees are in turn home to thousands of species of insects, birds, epiphytic plants and reptiles. Tropical rainforests cover only 6 per cent of the earth's surface and yet contain around 90 per cent of its species.[26]

It is said that the island of Madagascar alone contained around 12,000 plant species and possibly 190,000 animal species, 60 per cent of which were unique to the island. With 93 per cent of the original forest gone, scientists estimate that more half of the original species have disappeared.[27] Human activities have greatly reduced the amount of land area available to wild species. Habitat loss also occurs in coastal and marine ecosystems, though these are less well documented.

Climate change, on account of global warming in this century, may be the largest anthropogenic disturbance ever placed on natural systems.[28] Warmer regional temperatures are already having significant impacts on biodiversity and ecosystems.

> Many coral reefs have undergone major, although often partially reversible, bleaching episodes when local sea surface temperatures have increased during one month by 0.5–1˚ Celsius above the average of the hottest months. By the end of the twenty-first century, climate change and its impacts may be the dominant direct driver of biodiversity loss and changes in ecosystem services globally.[29]

It may be recalled that the Intergovernmental Panel on Climate Change (IPCC) projects an increase in global mean surface temperature of 2.0-6.4° Celsius above preindustrial levels by 2100. As scientists warn there will be a significant net harmful impact on ecosystems and individual species if global mean surface temperature increases more than 2° Celsius. The resulting climate change from temperature rise is projected to exacerbate the loss of biodiversity and increase the risk of extinction of many species. "Species most likely to be affected include those that already are threatened, migratory species, polar species, genetically impoverished species, peripheral population and specialized species, including those restricted to alpine areas and islands."[30] A recent global study has estimated that 15-37 per cent of regional endemic species could be committed to extinction as early as 2050.[31]

The *overexploitation of natural resources* is another factor that leads to species extinction and loss of biodiversity and can take a variety of forms. One example is over-fishing which has resulted in increased risk of major, long-lasting collapses of regional

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[26] Michael S. Northcott, *The Environment and Christian Ethics* (Cambridge: Cambridge University Press, 1996) 21. See also World Commission on Environment and Development, *Our Common Future* (Oxford: Oxford University Press, 1987) 150; Norman Myers, *The Primary Source: Tropical Forests and Our Future* (New York: W.W. Norton, 1984), 106.

[27] World Commission on Environment and Development, *Our Common Future*, 149.

[28] See O.E. Sala et al. "Biodiversity: Global biodiversity scenarios for the year 2100" in *Science* 287 (2000), 1770-1774.

[29] Millennium Ecosystem Assessment, *Biodiversity Synthesis*, 10. See also *Ibid*., 56-57.

[30] United Nations Environment Programme, *Global Environment Outlook GEO4* (2007), 176.

[31] C.D. Thomas et al., "Extinction Risk from Climate Change" in *Nature* 427 (2004), 145-148.

marine fisheries. The world marine fish catch appears to have been declining for more than a decade[32] and about three quarters of the world's commercial marine fisheries are either fully exploited (50%) or overexploited (25%).[33] Top piscivores suffer disproportionately in oceans as fleets fish down the food web.[34] The various sources of energy for human activities – for which demand is projected to grow at least 53 per cent by 2030 - contribute directly or indirectly to biodiversity stress or loss.[35] In this process human kind has also appropriated for itself a disproportionate proportion of Earth's resources, depriving the rest of the biotic community. Anthony Barnosky observes, based on the historical chronologies of biomass transitions in various parts of the world, how at the moment much of the planet's total supply of energy becomes concentrated in one species (*Homo sapiens*) and its domesticates. "Today, we stand at a […] crossroads, because growth of human biomass in the past few decades has moved us to the point where we are beginning to coopt resources from, further displace, and cause extinctions of species with whom we have been coexisting for 10,000 years."[36] According to Paul Ehrlich, "human beings now use or co-opt some 40 percent of the food available to all land animals and about 45 percent of the available freshwater flows."[37]

As for *pollution*, since 1950, nutrient loading – anthropogenic increases in nitrogen, phosphorus, sulphur, and other nutrient-associated-pollutants – has emerged as one of the principal drivers of ecosystem change in terrestrial, freshwater, and coastal ecosystems, a driver which is projected to increase substantially in the future.[38] According to Paul Ehrlich and Robert M. Pringle, a major byproduct of human consumption is the toxification of Earth's ecosystems. "Human agriculture and fossil-fuel combustion have multiplied the emission and deposition of nitrogen in recent decades, with negative consequences for biodiversity in grasslands and aquatic ecosystem."[39]

> Indeed, most people still don't realize that humanity has become a truly global force, interfering in a very real and direct way in many of the planet's natural cycles. For example, human activity puts ten times as much oil into the oceans as comes from natural seeps, has multiplied the natural flow of cadmium into the atmosphere eightfold, has doubled the rate of nitrogen fixation, and is responsible for about half the concentration of methane (a potent greenhouse gas) and nearly a third of the carbon dioxide (also a greenhouse gas) in the atmosphere today – all added since the industrial revolution, most notably in the past half-century.[40]

[32] B. Groombridge – M.D. Jenkins (eds.), *World Atlas of Biodiversity: Earth's Living Resources in the 21st Century* (California: University of California Press, 2002), 147.

[33] Millennium Ecosystem Assessment, *Biodiversity Synthesis*, 8.

[34] D. Pauly et al., "Fishing down marine food webs" in *Science* 279 (1998), 860-863.

[35] For the impacts of various energy sources on biodiversity see United Nations Environment Programme, *Global Environment Outlook GEO4* (2007), 176, 179.

[36] Anthony Barnosky, "Megafauna biomass tradeoff as a driver of Quaternary and future extinctions" in *Proceedings of the National Academy of Sciences* 105 (2008), 11546.

[37] Paul R. Ehrlich –Anne H. Ehrlich, *Betrayal of Science and Reason: How Anti-Environmental Rhetoric Threatens Our Future* (Washington, D.C.: Island Press, 1998), 14. See also Edward O. Wilson, *The Creation: An Appeal to Save Life on Earth* (New York – London: W.W. Norton, 2006), 29.

[38] Millennium Ecosystem Assessment, *Biodiversity Synthesis*, 8, 53-54.

[39] Paul Ehrlich – Robert M. Pringle, "Where does biodiversity go from here? A grim business-as-usual forecast and a hopeful portfolio of partial solutions" in *Proceedings of the National Academy of Sciences* 105 (2008), 11580.

[40] Paul Ehrlich – Anne Ehrlich, *Betrayal of Science and Reason*, 14.

The introduction of *alien species* and exotic organisms into naïve ecosystems have also wrought havoc on local biodiversity. The arrival of nonnative species result in competition with and predation on native species, changes in ecosystem functions and genetic contamination, extinctions of some native species, and homogenization of the species with significant reduction of biodiversity.[41]

As it is evident from the above analysis, virtually all the factors leading to the accelerating loss of biodiversity have to do with human activities. Human activities are indeed altering the geographic distributions of many taxa around the world and are associated directly or indirectly with nearly every aspect of the current extinction spasm.[42] As the *Millennium Ecosystem Assessment* indicates effectively all of Earth's ecosystems have now been dramatically transformed through human actions, which are fundamentally, and to a significant extent irreversibly, changing the diversity of life on Earth.[43] It can then rightly be concluded that "there is no doubt that humans are the root cause of most ecosystem stresses and biotic extinctions in the modern world."[44] The anthopogenic footprints of the current mass extinction of species are conspicuously evident.

3. **Implications of the loss of biodiversity**

What are the implications of the loss of biodiversity on account of the current sixth mass extinction of species, of which the roots are evidently anthropogenic? This is the question that needs to be addressed now. It is heartening to note that there is increasing discussion on the repercussions of the loss of biodiversity for human well-being in both scientific and non-scientific literature. Here I shall attempt to sum up this debate moving from immediate consequences for human physical and economic well-being to ethical aesthetic, and spiritual considerations. It will be followed by an exploration of the philosophical implications of the loss of biodiversity in the fourth and last section of the paper.

A preliminary consideration is in order before going to spell out the implications of the loss of biodiversity for human well-being. It needs to be borne in mind that the path of calculating the economic cost of environmental services in order to asses the implications of species extinction – a trend that appears to be becoming increasingly popular today – is fraught with drawbacks. Of course, the economic costs of the environmental services provided by the rich diversity of species on Earth are impressive and mind-boggling in terms of sheer statistics. Such costs are huge and often incommensurable as the following passage indicates.

> On a larger scale, consider the cost of Biosphere 2, being the man-made technosphere in the Arizona desert that (marginally) regulated life-support systems for eight Biospherians

[41] United Nations Environment Programme, *Global Environment Outlook GEO4* (2007), 169.

[42] Wake – Vredenburg, "Are we in the midst of the sixth mass extinction?," 11472; D. Jablonski, "Extinction and the spatial dynamics of biodiversity" in *Proceedings of the National Academy of Sciences* 105 (2008), 11528-11535.

[43] Millennium Ecosystem Assessment, *Biodiversity Synthesis*, 2.

[44] Avise – Hubbell – Ayala, "In the light of evolution II: Biodiversity and extinction," 11453.

> over 2 years: about $150 million, or $9 million per person per year. These same services are provided to the rest of us by natural processes, at no cost. But if we were charged at the rate levied by Biosphere 2, the total bill for all Earthospherians would come to $3 quintillion for the current generation alone.[45]

However, the attempt to offer an economic view of environmental services proves to be insufficient in real terms. This is so because the importance of biodiversity and natural processes in producing ecosystem services that people depend on is not captured in financial markets. As pointed out by the *Millennium Ecosystem Assessment*, "a country could cut its forests and deplete its fisheries which would show only as a positive gain to GDP, under the economic scenario, despite the loss of the capital asset of biodiversity"[46] Unlike goods bought and sold in markets, many ecosystem services do not have markets or readily observable prices.[47] In fact, biodiversity loss continues because the values of biodiversity are insufficiently recognized by political and market systems.[48] Besides, at will be made evident further ahead, the loss of biodiversity has enormous implications when it comes to cultural, aesthetic, ethical and spiritual considerations, spheres which defy economic costs and calculations.

With the loss of biodiversity what is at stake is nothing less than the survival of human life and human physical well being, as men and women depend on the intricate network of other species and biomass for their physical existence, survival and well being. Human beings rely on biodiversity in their daily lives, often without realizing it. In this regard, to be able to figure out the consequences of the current mass extinction of species it is important to take stock of the vital services provided by biodiversity. These can be grouped into two categories: environmental or ecosystem services and material goods.

On the one hand, biodiversity provides huge ecosystem services beginning with the oxygen humans breathe and the almost infinite variety of genetic resources. Biodiversity provides the biospheric medium for energy and material flows, which in turn provide ecosystems with their functional properties.[49] Biodiversity ensures the regulation of climate, biogeochemical cycles and hydrological functions,[50] the pollination of crops and flowers by insects - a process so fundamental to agriculture - soil protection, coral reefs and mangroves that protect coastlines, ecosystems that

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[45] Norman Myers, "Environmental services of biodiversity" in *Proceedings of the National Academy of Sciences* 93 (1996), 2768. See also Avise J.C., "The real message from Biosphere" in *Conservation Biology* 8 (1994), 327-329.

[46] Millennium Ecosystem Assessment, *Biodiversity Synthesis*, 6.

[47] Millennium Ecosystem Assessment, *Biodiversity Synthesis*, 38. The consideration of the economic costs alone is an exercise that also proves to be futile for the conservation of species. As the most recent *Global Environmental Outlook* states, "although more complete economic valuation is necessary to help create important incentives and opportunities for conservation, it will be insufficient to fully conserve biodiversity for future generations." United Nations Environment Programme, *Global Environment Outlook GEO4* (2007), 185.

[48] United Nations Environment Programme, *Global Environment Outlook GEO4* (2007), 185.

[49] Myers, "Environmental services of biodiversity," 2765.

[50] A leading example is provided by Amazonia. "At least half of Amazonia's moisture is retained within the forest ecosystem, being constantly transpired by plants before being precipitated back onto the forest, with a mean recycling time of 5.5 days." Myers, "Environmental services of biodiversity," 2765. It is said that a ingle rainforest tree can, during a lifetime of 100 years, return at least 10 million litres of water to the atmosphere. Myers, "Environmental services of biodiversity," 2767.

function as buffers against extreme climate events, as carbon sinks, and as filters for water-borne and airborne pollutants, and a number of miscellaneous services.[51] In short, together, biodiversity and the ecosystem services it provides sustain the environmental functions on which all forms of life, especially the human beings, depend. It is only against the background of the varied and innumerable services provided by the environment that the implications of the current mass extinction of species can really be measured.

On the other hand, the rich diversity of species on the Earth provide material goods, in terms of foods, medicine and drugs, raw materials for industry, and sources of bio-energy.[52] The individuals and communities need these goods to secure sustainable livelihoods. A significant contribution of biodiversity is towards human diet. It is estimated that about one-third of the human diet depends on insect-pollinated vegetables, legumes, and fruits.[53] According to the *Millennium Ecosystem Assessment* "about 7,000 species of plants and several hundred species of animals have been used for human food consumption at one time or another. Some indigenous and traditional communities currently consume 200 or more species. Wild sources of food remain particularly important for the poor and landless to provide a somewhat balanced diet."[54] The current mass extinction of species will have dire implications on food security for masses. According to the *World Atlas of Biodiversity* 80% of the maize varieties used in Mexico in 1930 have already been lost.[55]

Human health too depends largely on biodiversity and ecosystem services. As for medicines, it is roughly estimated that 80 per cent of people in developing countries rely on medicines based largely on plants and animals. At current extinction rates of plants and animals, Earth is said to be losing one major drug every two years. It is estimated that less than one per cent of the world's 250,000 tropical plants has been screened for potential pharmaceutical applications. The loss of genetic diversity, overcrowding and habitat fragmentation all contribute to increase susceptibility to disease outbreaks.[56] It also needs to be noted that the widespread anthropogenic changes to the environment have altered patterns of human disease, and increased pressures on human well-being. Some ecosystem changes create new habitat niches for disease vectors, for example, increasing the risk of malaria in Africa and the Amazon Basin.[57] According to the *Global Environmental Outlook*:

> Emerging diseases resulting from the destruction and fragmentation of tropical forests and other ecosystems, wildlife-human disease linkages (for example, Lyme disease, West Nile

[51] United Nations Environment Programme, *Global Environment Outlook GEO4* (2007), 158; Myers, "Environmental services of biodiversity," 2764-2769.

[52] Myers, "Environmental services of biodiversity," 2764.

[53] Myers, "Environmental services of biodiversity," 2766.

[54] Millennium Ecosystem Assessment, *Biodiversity Synthesis*, 31.

[55] Groombridge – Jenkins (eds.), *World Atlas of Biodiversity*, p. 40 (Tab 4.1).

[56] See K. D. Lafferty – L. Gerber, "Good medicine for conservation biology: The intersection of epidemiology and conservation theory" in *Conservation Biology* 16 (2002), 593-604.

[57] United Nations Environment Programme, *Global Environment Outlook GEO4* (2007), 167. See in this regard A.Y. Vittor - R.H. Gilman – J. Tielsch – G.E. Glass – T.M. Shields – W. Sanchez-Lozano – V.V. Pinedo – J.A. Patz, "The effects of deforestation on the human-biting rate of Anopheles darlingi, the primary vector of falciparum malaria in the Peruvian Amazon" in *American Journal of Tropical Medicine and Hygiene* 74 (2006), 3-11.

> virus and avian influenza), the many known and as yet undiscovered pharmaceutical products found in nature, the contribution of ecosystem services to human health and the increasing recognition of the impacts of endocrine disrupters on both animal and human health, all underline the links between biodiversity and human health.[58]

It is important to note that the effects of species extinction and resultant biodiversity loss will be felt mostly by specially vulnerable groups, as it strikes the poor most. Today, about 1 billion people live a subsistence lifestyle, and loss of ecosystem productivity (through loss of soil fertility, drought or overfishing, etc.) can lead to malnutrition, stunted childhood growth and development, and increased susceptibility to other diseases.[59] The costs and risks associated with biodiversity loss are expected to increase, and to fall disproportionately on the poor.

> Many aspects of biodiversity decline have a disproportionate impact on poor people. The decline in fish population, for example, has major implications for artisanal fishers and the communities that depend on fish as an important source of protein. As dryland resources are degraded, it is the poor and vulnerable who suffer the most.[60]

The loss of biodiversity or changes in biodiversity patterns on account of the mass extinction of species, will affect the rural poor most threatening their livelihood, as rural men and women – among the world's most poor and vulnerable groups - are often entirely dependent on their surrounding environment for daily living and food security. It is so because the rural poor are most directly dependent on ecosystem services at the local scale and are unable to pay for alternatives.

The truth that the loss of biodiversity on account of the mass extinction of species affects the poor most and in a hugely disproportionate way raises some serious moral interrogatives about the ethical implications of the human activities – as it was demonstrated in the previous section – that lead to the loss or change of biodiversity patterns in the first place.

The loss of biodiversity has also cultural, aesthetic and spiritual implications, as people from all walks of life value biodiversity for spiritual, aesthetic, recreational, and other cultural reasons.[61] As the *Global Environmental Outlook* recognizes, "human societies everywhere have depended on biodiversity for cultural identity, spirituality, inspiration, aesthetic enjoyment and recreation."[62] In fact, the importance of species in providing these services is inestimable. At the aesthetic level, it is important to recognize how the wonder, beauty and tranquillity of nature provide human beings with solace and inspiration. Today, for example, biodiversity plays a vital part in the sector of eco-tourism (nature-based tourism) – one of the fastest growing segments of tourism worldwide. At the social level, many cultures attach spiritual and religious values to ecosystems or their components such as a tree, hill, river, or grove. "Damage to ecosystems, highly valued for their aesthetic, recreational, or spiritual values can damage social relations, both by reducing the bonding value of shared experience as well as by

[58] United Nations Environment Programme, *Global Environment Outlook GEO4* (2007), 180.
[59] United Nations Environment Programme, *Global Environment Outlook GEO4* (2007), 180.
[60] Millennium Ecosystem Assessment, *Biodiversity Synthesis*, 6.
[61] Millennium Ecosystem Assessment, *Biodiversity Synthesis*, 6.
[62] United Nations Environment Programme, *Global Environment Outlook GEO4* (2007), 159.

causing resentment toward groups that profit from their damage."[63] As Michael J. Novacek points out, "the degradation of habitats and biodiversity has huge implications for human health, economics, political instability, and even conflict."[64] At the spiritual level, it is disheartening to realize that there has been a decline in the numbers of sacred groves and religious other such protected areas. "The loss of particular ecosystem values attributes (sacred species or sacred forests), combined with social and economic changes, can sometimes weaken the spiritual benefits people obtain from ecosystems."[65] As ecosystems serve for many cultural groups, especially for the indigenous and tribal peoples, a source of their cultural and spiritual identity, the loss of biodiversity on account of species extinction have implications that go beyond the immediate considerations about human physical or economic well-being. Along with the disappearance of species and the resultant collapse of entire ecosystems, cultural traditions, identities and memories of local communities become extinct once and for all.

The implications of the loss of biodiversity are thus far-reaching, moving from immediate consequences for human physical well-being to ethical, aesthetic, social and spiritual repercussions, as it has been evidenced above. There is, however, one area that has largely been uncharted when dealing with the implications of the loss of biodiversity caused by the current mass extinction of species. It is the arena of philosophical or metaphysical considerations about the extinction of life that takes place with the current spasm of decimation of species. I go to reflect over this crucial point in the final section of the present paper.

4. **'Meta-physical' considerations about the current mass extinction of species**

So far in this paper, an abundance of 'physical' knowledge has been provided on the phenomenon of the sixth mass extinction of species currently in act and destined to accelerate, about its causes which are conspicuously anthropogenic in origin, and about its immediate and far-reaching consequences. I shall now conclude the present study on the contemporary spasm of species extermination with a few 'meta-physical' considerations, seeking to understand philosophically what is really at stake. Here I follow a crypt remark from the Oxford scholar Norman Myers on the question of biodiversity loss: "the critical track ahead lies not so much with knowledge as with understanding."[66] Such an exercise, besides facilitating a strictly philosophical contribution to the discussion on biodiversity loss, will also hopefully help to let emerge the "bigger picture" about the problem of the current mass extinction of species.

A primary metaphysical reflection that springs up on the face of the current mass extinction of species is that the realization that extinction is annihilation of life itself for the particular species driven out of existence, with dire implications for the entire web

[63] Millennium Ecosystem Assessment, *Biodiversity Synthesis*, 31.

[64] Novacek, "Engaging the public in biodiversity issues," 11573.

[65] Millennium Ecosystem Assessment, *Biodiversity Synthesis*, 36.

[66] Myers, "Environmental services of biodiversity," 2768. As the *Millennium Ecosystem Assessment* acknowledges "science can help ensure that decisions are made with the best available information, but ultimately the future of biodiversity will be determined by society." Millennium Ecosystem Assessment, *Biodiversity Synthesis*, vi.

of life. To cause the extinction of a species is tantamount to banishing it for ever behind the veil of nothingness. The extinction of a species is, in philosophical terms, a passage from *ens* to non-*ens*, from being to non-being, from existence to non-existence. The mass extinction of species is not just death for the individual species concerned, but death of birth itself, as the extant species are consigned for ever in the cauldron of nothingness with no hope of re-birth.

Here one might object that extinction is in nature's natural rhythm, that it has always been part of life on Earth and is the ultimate fate awaiting all species. This objection has been responded to earlier in this paper. The key element to remember here is the vast difference between the current mass extinction of species and the natural background extinction rates. While the normal background rates of extinction was roughly 0.1-1.0 extinctions per million species per year, the current rates of extinction of species is in the order of 10,000 times than the background rates and is bound to accelerate.[67]

What takes place with the extinction of species is the loss of evolutionary history along with its biological legacy. Extinction is indeed the loss of evolutionary history itself,[68] as no living traces of the extant species remain, with its evolutionary course brought to a sudden and abrupt standstill, being flung across the abyss of nothingness. It is a colossal loss for humanity too. "As biodiversity recedes, we also lose the stories that go with it and many ways of relating to the world in which we evolved."[69]

The mass extinction of species is also tantamount to shutting the doors, at least partially, to the future course of the evolution of life on the Earth. In fact, the effects of mass extinctions extend beyond the losses observed during the event itself.[70] The loss of species threatens to impoverish future diversity.[71] The present mass extinction of species will alter not only biological diversity but also the evolutionary processes by which diversity is generated. In short, the current mass extinction of species will slice into both the legacy and future of evolution.

The public awareness about the spectre of the sixth mass extinction of species is on the increase. However, "not so well known but probably more significant in the long term is that the crisis will surely disrupt and deplete certain basic processes of evolution, with consequences likely to persist for millions of years."[72] Recovery proceeds slowly in the wake of grand scale biotic disruption. From the geological records of past mass extinctions, it can be calculated that the time span required rediversification and ecological reorganization is around five million years - a broadly representative recovery time.[73] The sober conclusion that one arrives on the face of such a realization

[67] See Millennium Ecosystem Assessment, *Biodiversity Synthesis*, 21, 43.

[68] See in this regard Douglas H. Erwin, "Extinction as the loss of evolutionary history" in *Proceedings of the National Academy of Sciences* 105 (2008), 11520-11527.

[69] Ehrlich – Pringle, "Where does biodiversity go from here?," 11580.

[70] David Jablonski, "Survival without recovery after mass extinctions" in *Proceedings of the National Academy of Sciences* 99 (2002), 8139.

[71] See in this regard Michael L. Rosenzweig, "Loss of speciation rate will impoverish future diversity" in *Proceedings of the National Academy of Sciences* 98 (2001), 5404-5410.

[72] Myers – Knoll, "The biotic crisis and the future of evolution," 5389.

[73] Myers – Andrew H. Knoll, "The biotic crisis and the future of evolution," 5389.

is that the environmental disruption of the current mass extinction of species is going to be permanent as far the human chronological time scale is concerned.

> In some major extinctions, for example the Cretaceous-Tertiary boundary event, environmental perturbation was swift and sure, but also short-lived. Recovery began soon after disruption. In the present biotic crisis, it is hard to envision a scenario under which the factors that are driving the biosphere toward grand scale biodiversity loss will be mitigated in the wake of such loss. … Thus, on the time scale of the human species, environmental disruption (or at least aspects of it) is permanent."[74]

The above metaphysical reflection about the annihilation of life – or forms of life – as it takes place in the current mass extinction of species raises several questions in turn. One of them is about the responsibility of current generations, who are causing the extinction ripple in the first place, towards future generations who will be deprived of vast portions of the current biodiversity available on the planet. It may be recalled here that according to the *Fourth Assessment Report* up to 30 % of plant and animal are likely to become extinct by the end of the present century, if increases in global average temperatures exceed 1.5-2.5°C, which is widely accepted as a real possibility.[75]

A second metaphysical reflection arises from the recognition that the contemporary mass extinction is caused by the human beings, namely one dominant species – the *homo sapiens*. This raises serious interrogatives about the right of one species to so radically alter the future course of evolution on the Earth, threatening in the process the sustainability of the entire biosphere itself for the survival of future biotic generations, including the humans. As it was argued previously the mass decimation of species is annihilation of life itself in some way. The question that arises naturally here is whether the human being is allowed the play the role of terminator of life for fellow species.

The deeper question here is whether the anthropogenic character of the current mass extinction of species can be justified falling back to an anthropocentric worldview. Some environmental philosophers, in fact, have sought to present anthropocentrism – the ideology according to which everything revolves around the humans who consider themselves as the absolute centre of all norms and values – as one of the root causes of the contemporary ecological crisis.[76] Anthropocentrism is ubiquitous in contemporary life and thinking.

> The imperial and anti-ecological anthropology at work in the contemporary dreams, projects, ideals, institutions, and values can be summed up in one word: *anthropocentrism*. The term means that everything throughout the fifteen-billion-year story exists solely for the human being, man and woman. Hence, everything culminates in the human being. Nothing has intrinsic value, nothing has otherness and meaning

[74] Myers – Knoll, "The biotic crisis and the future of evolution," 5390.

[75] See *Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability. Summary for Policymakers. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, 8.

[76] See Arne Naess, "The Shallow and the Deep, Long-Range Ecology Movement: A Summary," *Inquiry* 16 (1973), 95-100. See also John Seed, "Beyond Anthropocentrism" in *Thinking Like a Mountain: Towards a Council of All Beings*, eds. John Seed *et al.* (Philadelphia: New Society Publishers, 1988), 35-40; George Sessions, "Anthropocentrism and the Environmental Crisis," *Humboldt Journal of Social Relations* 2 (Fall/Winter 1974), 71-81.

> apart from the human being. All beings are at the disposal of human beings, to serve as their property and under their control, so that humans may attain their desires and projects. Human beings feel that they are *above* things rather than *alongside* and *with* things. They imagine themselves as an isolated single point, outside nature and above it.[77]

Anthropocentrism, in fact, does lead to a despotic attitude towards nature. As all subjectivity and value is concentrated on the human self alone, the rest of the physical world - both animate and inanimate - is seen to be at the disposal of humans and incapable of posing any limit whatsoever to the human quest for conquest and mastery. The present state of the planet is a clear indication that humanity appears to have usurped for itself a disproportionate centrality imperilling its own and the survival of other forms of life on it.

Anthropocentrism places humans in the centre as everything else, including non-human nature, is supposed to revolve around them. Here nature is pushed to the periphery whereas humans occupy the coveted central spot. However, when it comes to the geological time scale the anthropocentric outlook becomes indeed difficult to sustain. This is so because the human species itself is only a recent arrival on the scene, and is entirely dependent – as it will be discussed later – on the surrounding physical environment. It is enough to recall here the geological history of the Earth, which places humans within nature rather than above or apart from it. The human domination and exploitation of the Earth appears all the more repulsive when the human being is situated against the background of geological history. If the age of the Earth (4,600 million years) is compressed into 46 years of human life-span, the modern human being appeared barely 4 hours ago, agriculture one hour ago, industrial revolution one minute ago. It is during this tiny fraction of geological *chronos* that the human being has sought to exploit the planet's resources to the extent of threatening the future evolution of life and endangering other forms of life, apart from its own.[78] It is obvious that humanity has obviously usurped for itself the place of centrality within the cosmos in an exclusive and arrogant manner.

As the geological history of the planet reveals, life existed on the Earth much before the humans appeared on the scene, and will carry on existing without them, subject to mutation of course, which however has been the hallmark of evolution right through. It is more correct to say that humans belong to the Earth rather than claim that the Earth belongs to humans as modern anthropocentrism would have it. Humans depend on the biospheric processes and not vice-versa! Nature can continue to exist without humans but not human life and human civilization without nature!

A third metaphysical reflection is about the 'intrinsic' value of non-human species and of ecosystems, an issue that has been largely circumspect to the debate in environmental ethics so far. The underlying debate here is centred on whether the

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[77] Leonardo Boff, *Cry of the Earth, Cry of the Poor* (Maryknoll, N.Y.: Orbis Books, 1997), 70. Italics as in the original.

[78] It is in this context that one needs to understand Thomas Berry's remark which otherwise could sound highly misanthropic. Berry writes: "If there were a parliament of creatures, its first decision might well be to vote the humans out of the community, too deadly a presence to tolerate any further." Thomas Berry, *The Dream of the Earth* (San Fransisco: Sierra Club Books, 1988), 209.

physical world is purely mechanistic – inert, deteleogized heap of matter, a storehouse of resources for human consumption – or whether nature is organismic – dynamic and with inherent goals that need to be respected by the humans. This debate is crucial as the intrinsic value of species and ecosystems can be defended only within a non-mechanistic metaphysical framework.

Within a mechanistic ontology of nature, the physical world is seen as non non-agentic, passive, non-creative and inert, with action being imposed from without by an external force. Nature is thus mere stuff, mere matter, with no internal principle of agency or movement.[79] Within a mechanistic metaphysics no final causes (*telos*) is admitted in nature. All physical entities – both animate and inanimate – are perceived here only in terms of efficient causes alone, namely, in terms of its functionality. Since no agency or ends or goals need to be recognized in nature, it is assumed that one treat nature at will! Such a mechanistic conception of the physical world leads to view nature in terms of instrumentality alone, wherein all non-human entities come to be seen as mere resources or utilities, without possessing any inherent worth or intrinsic value. This leads to an exploitative attitude of domination towards animals and the rest of the biotic community. As Carolyn Merchant notes, "because nature was now viewed as a system of dead forces, the mechanical framework itself could legitimate the manipulation of nature."[80] The current mass extinction of species at the hands of humanity, the dominant species, can be understood only within such a mechanistic ontological framework.

In contrast to the mechanistic conception of the physical world as inert and in terms of efficient causes alone, an organismic conception of the physical world proposes a dynamic view of nature with its own inherent goals and ends. It needs to be remembered here that a certain dynamism is immanent to nature, as the very etymological meaning of the term refers. Nature is etymologically derived from *natus*, which refers to the process of birth. For Aristotle the natural world was essentially a living world. In his *Metaphysics* he declared the meaning of nature (*phusis*) to be the essence of things which have a source of movement in themselves.[81] The science of ecology has shed much light on the dynamic aspect of nature. Some clear indications in this regard have come from the study of food chains and energy circuits that exist within the biosphere. Within environmental sciences, nature does not come to be looked upon any more as a machine, but rather as a living organism. Herein, the Earth is itself perceived as a unitary living organism, and as a self regulating system.[82]

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[79] Cf. Val Plumwood, *Feminism and the Mastery of Nature* (London – New York: Routledge, 1993), 105.

[80] Carolyn Merchant, *The Death of Nature: Women, Ecology, and the Scientific Revolution* (New York: HarperCollins, 1980), 193. Merchant notes: "In 1500 the parts of the cosmos were bound together as a living organism; by 1700 the dominant metaphor had become the machine." *Ibid*., 288.

[81] See Aristotle, *Metaphysics*, Bk 5, ch. 3, 1014b,16-17. See also R. G. Collingwood, *The Idea of Nature* (Oxford – New York: Oxford University Press, 1960), 82; Juergen Mittelstrass, "Historical and Epistemological Aspects of the Concept of Nature" in *Changing Concepts of Nature at the Turn of the Millennium. Proceedings of the Plenary Session of the Pontifical Academy of Sciences. 26-29 October 1998* (Vatican City: Pontificia Academia Scientiarum, 2000), 3.

[82] See in this regard James E. Lovelock, *Gaia: A New Look at Life on Earth* (Oxford – New York: Oxford University Press, 1979). It needs to be pointed out that the original intuition regarding the Earth as an animate organism dates back to ancient times. One may recall here the concept of world soul (*anima mundi*) in Plato. See *Timaeus,* 49e-50a, 52a.

Within an organismic metaphysics of nature, it is also possible to reinstate teleology back into nature. A teleological vision of nature has characterised human perception of, and relationship with, nature right from the dawn of humanity, and within the Western tradition itself one can trace its roots back to the Greek thought. Aristotle, for example, noticed that natural processes are inherently directed towards goals, and need to be explained also by taking into account their final causes.[83] Accordingly the ontological nature (*phusis*) of an entity may be said to be constituted also by its potentiality, as within the Aristotelian scheme the final causes are essential to the definition and description of natural entities. The concept of *telos* is one of the foundations for a truly organismic metaphysics that is currently emerging within environmental thought. While, within a mechanistic framework, there is no room for inner projectiveness or inherent goals, within an organismic outlook, instead, it is recognised that organisms contain a sort of immanent finality. The environmental thinkers insist that not only the inherent finality of individual organisms, but also of ecosystems and the biosphere as a whole, revealed in their interrelated existence, be taken into account. In concrete terms, this means that "in addition to the values of biodiversity for the supply of particular ecosystem services, biodiversity also has intrinsic value, independent from its functions and other benefits to people."[84]

In fourth place, by way of overcoming the dilemma, I shall argue that it is necessary - along with other measures at various levels[85] - to move out of the mechanistic and dualistic worldview to a more relational ontology and an 'ecological' worldview.

A root cause of the current ecological crisis is the ontological dualism between human beings and the physical world that arose in the wake of Modernity. As O.R.W. Pergams and PA Zaradic have pointed out, humans are becoming seriously disconnected from nature.[86] Such a radical bifurcation that also accounts, to a great extent, for the alienation of the human being from nature and the spoliation of the latter by humans. Wim Zweers writes:

> In this view, humans stand outside of, opposite to nature, they are essentially different from it and do not, in essence, belong to it. That is the core of mainstream Western philosophy since Descartes, who also gave exemplary expression to this in his distinction between 'thinking being' and 'extended matter'. This opposition of humans and nature … provides on the one hand the foundation for the aforesaid view of nature and self view of humans, and on the other the justification for humans to treat nature exclusively according to their own wishes.[87]

Instead, the science of ecology reveals the natural world to be a biotic community which is itself held together by a host of relationships. As Fritjof Capra

[83] Cf. John Habgood, *The Concept of Nature* (London: Darton, Longman and Todd Ltd., 2002), 8.

[84] United Nations Environment Programme, *Global Environment Outlook GEO4* (2007), 160.

[85] Concrete proposals are not lacking in this regard. For a comprehensive list see in this regard, Ehrlich – Pringle, "Where does biodiversity go from here?," 11579-11586.

[86] O.R.W. Pergams - PA Zaradic, "Evidence of a fundamental and pervasive shift away from nature-based recreation" in *Proceedings of the National Academy of Sciences* 105 (2008), 2295-2300.

[87] Wim Zweers, *Participating with Nature: Outline for an Ecologization of Our World View* (Utrecht: International Books, 2000), 60-61.

writes: "No individual organism can exist in isolation. Animals depend on the photosynthesis of plants for their energy needs; plants depend on the carbon dioxide produced by animals, as well as on the nitrogen fixed by the bacteria at their roots; and together plants, animals and micro-organisms regulate the entire biosphere and maintain the conditions conducive to life."[88] Ecology is, by definition, the study of the relationships between organisms and environment, relationships which guarantee the equilibrium of nature and all living beings, including the humans, collocated in nature.[89] The first law of ecology, according to Barry Commoner, is that every thing is connected to every other thing.[90]

In the physical world, the species are not only interrelated but are also interdependent. The biological interdependence of organisms is explicit in the case of food chain composed of photosynthesizing plants, herbivores, carnivores and decomposers (microbes and fungi). A species or biota cannot be seen in isolation from its support system. "A mammal species, a butterfly community, a wetland food web, or a forest ecosystem cannot exist except within the myriad ecological relationships and ecosystem processes (moisture supply, nutrient cycling, energy flow, and the like) of its environs.[91] The species are in themselves the fabric of ecosystems, which in turn provide essential services. For example, animal pollination of plants is not only central to the function of terrestrial ecosystems, but it is also essential to the survival, sustainability, and economics of human populations.[92] "In other words, the world that is so familiar to us is strongly shaped by an extraordinary collaboration between flowering plants and pollinating insects (as well as some mammals and birds)."[93]

A lack of understanding of this underlying metaphysical truth and appreciation for the richness and interconnectedness of diverse species, from elephants to soil bacteria, yields a distorted picture of what is really at risk.[94] What is needed is "an increasing recognition that people are part of, not separate from, the ecosystems in which they live, and are affected by changes in ecosystems, populations of species and genetic changes."[95]

The spectre of the current mass extinction of species threatens the complex interdependencies of the biotic community on which human life depends. Paul Ehrlich uses the striking metaphor to refer to species as rivets which hold together the 'aeroplane' in which we circuit the sun. What is implied in this analogy is that the loss

[88] Fritjof Capra, *The Hidden Connections: A Science for Sustainable Living* (London: Flamingo, 2003), 5.

[89] Ernst Haeckel who is credited with the coining of the neologism 'ecology' defined it as "the totality of the sciences of relationships of the organism with the ambient." Ernst Haeckel, *Generelle Morphologie der Organismen* (Berlin: 1866), vol. II, 286. On an interpretation of Haeckel's work as a response to the dualism of classical science see Anna Bramwell, *Ecology in Twentieth Century: A History* (London: Yale University Press, 1989), 43 ff.

[90] Cf. Barry Commoner, *The Closing Circle: Confronting the Environmental Crisis* (London: Jonathan Cape, 1971), 33-39.

[91] Myers, "Environmental services of biodiversity," 2765.

[92] See in this regard S.E. McGregor, *Insect Pollination of Cultivated Crop Plants* (Washington, DC: US Department of Agriculture, Agricultural Research Service, 1976).

[93] Novacek, "Engaging the public in biodiversity issues," 11574.

[94] Novacek, "Engaging the public in biodiversity issues," 11572.

[95] United Nations Environment Programme, *Global Environment Outlook GEO4* (2007), 160.

of species may threaten the continued existence of the biotic community: at some point so many rivets may be removed from the plane that it is bound to crash.[96]

A serious implication of the current mass extinction of species is that humans cannot survive unless they align themselves to the rhythm of the biospheric processes, and be willing to acknowledge their dependency on them.[97]

5. **Conclusion**

It is evident that the fate of biological diversity for the next 10 million years will almost certainly be determined during the next 50-100 years by the activities of a single species – the *Homo sapiens* which has unwittingly achieved the ability to directly affect its own fate and that of most of the other species on this planet.[98] The future of evolution and the destiny of the web of life on the planet Earth at this historical juncture depend on one species, namely, mankind. To this species falls the enormous and historical responsibility to steward global biodiversity through the crucial 21st century.

The gravity of the situation of the current mass extinction of species – on which I have reflected at length in this article – transforms it into a unique challenge and a unique opportunity. The warning from the scientific community is loud and clear.

> The current extinction crisis is of human making, and any favourable resolution of that biodiversity crisis – among the most dire in the 4-billion-year history of the Earth – will have to be initiated by mankind. Preserving biodiversity is undeniably in humanity's enlightened self-interest, but the tragic irony is that a majority of humanity is not yet enlightened to this fact. Little time remains for the public, corporations, and governments to awaken to the magnitude of what is at stake.[99]

The clarion call to humanity, in the wake of the current mass extinction of species, is to re-discover its vocation to be stewards and shepherds of the rest of creation, rather than script the obituary of extant species. It is a choice that could determine the survival of humanity itself on the planet Earth.

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[96] Paul R. Ehrlich, *Extinction: The Implications of the Loss of Our Biological Heritage* (Murdoch, WA: Murdoch University Press, 1985). Cited in Michael S. Northcott, *The Environment and Christian Ethics* (Cambridge: Cambridge University Press, 1996), 22.

[97] See in this regard Val Plumwood, *Environmental Culture: The Ecological Crisis of Reason* (London – New York: Routledge, 2002), 3.

[98] See Ehrlich – Pringle, "Where does biodiversity go from here?," 11579; Wake –Vredenburg, "Are we in the midst of the sixth mass extinction?," 11472.

[99] Avise – Hubbell – Ayala, "In the light of evolution II: Biodiversity and extinction," 11456.