

## Being like Gaia: Biomimicry and Ecological Ethics

Henry Dicks  
Faculty of Philosophy  
University Jean Moulin Lyon 3  
15 Quai Claude Bernard  
69007 Lyon, France

<http://orcid.org/0000-0002-9534-0299>

[henryjdicks@gmail.com](mailto:henryjdicks@gmail.com)

### Abstract

This article analyses the philosophical status and ground of biomimicry's most distinctive principle: nature as measure. Starting with the argument that this principle is ethically normative, I go on to compare the ecological ethic it embodies with Aldo Leopold's land ethic. In so doing, I argue that the ultimate measure against which the ethical rightness of our actions should be judged is the way of being of Gaia: letting be her present inhabitants. I then explore the idea that taking as measure Gaia's way of being provides powerful responses to a number of longstanding problems in environmental ethics, including the question of its 'centre', duties to preserve and restore nature, and duties to present and future beings.

**Key words:** philosophy of biomimicry; land ethic; earth ethic; geocentrism; future generations

### Introduction

The philosophical significance of biomimicry manifests itself primarily at the level of the three basic principles set out by biomimicry's foremost theorist and practitioner, Janine Benyus (1997): nature as model; nature as measure; and nature as mentor. Of these principles, the most distinctive is nature as measure, for it is here that biomimicry's well-known ties to ecology, environmental values, and sustainability are most clearly visible: '*Nature as measure*. Biomimicry uses an ecological standard to judge the "rightness" of our innovation. After 3.8

billion years of evolution, nature has learned: What works. What is appropriate. What lasts' (Benyus, 1997: epigraph). So, whereas the closely related field of biomimetics often takes nature as model and mentor (Ball, 2001; Bhushan, 2009), albeit not necessarily in the guise of explicit statements and explications of first principles, it does not invoke the idea of nature as providing a 'standard', and more precisely an 'ecological standard', against which innovations or designs should be judged.

If the principle of nature as measure is what is most distinctive about biomimicry, the philosophical status and ground of this principle is not immediately apparent. Blok and Gremmen (2016) claim that it introduces an *ethical* dimension to biomimicry, for it explicitly tells us about the 'rightness' of our innovation. But while references to 'rightness' and 'standards' clearly indicate that this principle is normative, it is not immediately obvious why one would suppose it to be *ethically* normative. After all, if what this principle allows us to evaluate is the rightness of our *innovation*, its normativity could be purely technical or technological nature, such that it provides a standard for evaluating the performance of our innovations, but without the performance criteria being ethically grounded.

With a view to understanding the philosophical status and ground of this principle, I begin by arguing that taking nature as measure goes beyond the purely *technological* norm of effectiveness, for it also integrates what I suggest are the *ethical* norms of appropriateness and sustainability (Part 1). I then compare and contrast the ecological ethics embedded in this principle with Aldo Leopold's land ethic. In so doing, I argue that the principle of nature as measure can be integrated within an earth ethic of 'being like Gaia' capable of resolving the two principal problems with Leopold's land ethic: first, its restricted focus on preservation; and second, the problematic ontological status of the biotic communities it seeks to preserve (Part 2). I then set out to explore this earth ethic, focussing on its relation to various widely discussed issues in environmental ethics, including the questions of its 'centre', duties to preserve and restore nature, and duties to present and future beings (Part 3).

## 1. The Normative Status of ‘Nature as Measure’

Benyus’s explication of the principle of nature as measure comprises two parts. The first part is simply affirmative: ‘Biomimicry uses an ecological standard to judge the “rightness” of our innovation.’ The second part then provides a justification of this affirmation: ‘After 3.8 billion years of evolution, nature has learned: What works. What is appropriate. What lasts’ (1997: epigraph).

This justification may in turn be divided in two. First, it tells us that nature has acquired knowledge of three things that, so it would seem, are self-evidently valuable: 1. what works; 2. what is appropriate; 3. what lasts. The first of these, ‘what works’, may be identified with effectiveness or perhaps efficiency; what works is what is effective (or efficient). The second, ‘what is appropriate’, may be identified with fittingness; what is appropriate is what is fitting. The key feature of fittingness is that it is contextual; what is appropriate or fitting in one context may not be so in another. The third, ‘what lasts’, may be identified with sustainability. What lasts is what may be sustained over long periods of time, perhaps indefinitely. So, whereas fittingness introduces a spatial dimension to the knowledge embedded in nature, such that it is always adapted to a context, sustainability introduces a temporal dimension, specifically the capacity to endure. The self-evident character of these three forms of knowledge becomes manifest when one considers that their opposites – the ineffective, the inappropriate, the unsustainable – should in every case be avoided. Evaluation against nature’s ‘ecological standard’ would thus appear to be justified on the grounds that it

involves judging our innovation against three self-evidently valuable forms of knowledge present in nature: knowledge of the effective, the fitting, and the sustainable.<sup>1</sup>

Benyus's justification also informs us of the reason that nature has been able to acquire these self-evidently valuable forms of knowledge: it has had ample time to do so, approximately 3.8 billion years. This is not, however, intended simply as an argument from venerability. The argument is not that the knowledge acquired by nature may function as a measure because nature – manifestly identified here with life on earth – is very old. The argument is rather that the process by which nature acquires knowledge – evolution – tends over long periods of time to select the effective over the ineffective, the appropriate over the inappropriate, and the sustainable over the unsustainable. As a result of its well-known 'blindness', evolution may be slow in comparison with the cultural learning characteristic of humans, but over very long periods of time it will nevertheless tend to accumulate these three self-evidently valuable forms of knowledge. So, while we humans may have learnt a great deal, particularly over the last decades and centuries of rapid technological and cultural development, including many things unknown to nature, the proposal to take 'nature as measure' implies that, as a general rule, we currently differ from nature in that the knowledge we currently possess is not simultaneously effective, appropriate, and sustainable. Contemporary human knowledge may often be highly effective, at least as measured by narrow standards of performance (speed, durability, accuracy...), but not only will it in some cases be less effective than nature, but, more importantly, it will typically be much less

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<sup>1</sup> By saying that nature contains knowledge, I am not affirming that this knowledge is consciously understood. An in-depth epistemological analysis of the claim that nature is capable of accumulating knowledge would, however, lie beyond the scope of this article.

appropriate and sustainable – a state of affairs that explains the growing contemporary calls for ‘appropriate’ and ‘sustainable’ technologies.<sup>2</sup>

In light of the above analysis of the structure, content, and rationale behind the principle of nature as measure, let us now consider its philosophical status, and more specifically the question of whether the norm it upholds is technological or ethical. To resolve this question, it shall prove instructive to take a brief look at the philosophy of technology.

Influenced initially by German idealism, especially Kant and Hegel, the first thinkers to propose explicit ‘philosophies of technology’ advocated an understanding of technology that espoused two key ideas of direct relevance to the present discussion of biomimicry. First, they advocated a decisive break with the longstanding view, traceable back to the ancient Greeks, of technology as imitation of nature. Thus it was that reflecting on the work of such major early philosophers of technology as Ernst Kapp, Max Eyth, Friedrich Dessauer, and Franz Reuleaux, Ernst Cassirer argued that, far from being an exemplar to be followed, natural models had been reduced to the status of the primitive; the fully developed pure creations of the human mind were deemed vastly superior: ‘[w]hat separates the instruments of fully developed technology from primitive tools is that they have, so to speak, detached and dissociated themselves from the model that nature is able immediately to offer them’ (Cassirer, 2014: 302). Second, as pure inventions or discoveries of the human mind, technological innovations were radically cut off from their earthly context. Max Eyth, for example, promulgated the thesis of the ‘spiritual autonomy’ of technology. Far from arising from proximity to and observation of nature, technology arises out of the ‘pure life of the spirit’ (Eyth 1924), mixing only with nature to the extent that the technological forms or ideas devised by the human mind require raw materials and energy obtained from nature in order to achieve physical realization (Blumenberg 2010: 88).

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<sup>2</sup> On the subject of appropriate technologies, see, for example, the work of the National Centre for Appropriate Technology, <https://www.ncat.org/> (accessed 06 September 2018).

These two traits – radical difference from the workings of nature and separateness from earthly context – are particularly manifest in the work of Dessauer (1927; 1983). The starting point of Dessauer’s philosophy of technology is the idea that, to Kant’s three Critiques, there must be added a fourth Critique, a Critique of Technology. This fourth Critique, Dessauer thought, would be concerned with how, in the process of technological invention, the human mind accesses a quasi-Platonic realm of ‘pre-established ideal solution[s]’ (1983: 334) to technical problems. And these ‘ideal solutions’, he thought, were not only radically ‘alien to nature’ (1983: 320), but also, by virtue of their eternal presence in an abstract realm of pure spirit, fundamentally independent of all earthly context.

In view of the above, it is not hard to see that philosophy of technology, at least as it first emerged in nineteenth-century Germany, was almost totally antithetical to the principle of ‘nature as measure’ later advanced by biomimicry. Human solutions to technical problems were considered radically different from natural solutions, the imitation of which was deemed primitive in comparison. Similarly, while effectiveness may have been the basic norm for these human solutions, the standard of effectiveness was not provided by nature. Further, since these human solutions were believed to belong in one way or another to a transcendent spiritual realm, fittingness and sustainability had no normative bearing. Dessauer’s ‘pre-established ideal solutions’, for example, were not only theorized as pure ‘things in themselves’ (Mitcham 1994: 31) devoid of all earthly context, and thus indifferent to the norm of appropriateness, but also as existing eternally in an entirely separate realm of pure spirit, in which case there could have been no question of their sustainability, their capacity to endure.

Despite having jettisoned the sweeping post-Kantian and post-Hegelian idealist frameworks characteristic of the early German philosophers of technology, more recent philosophy of technology remains strongly attached to the idea of effectiveness or efficiency as the sole grounding norm for technology. Indeed, particularly when philosophy of technology concentrates on the analytic issue of precisely defining and delimiting technology,

effectiveness and efficiency have typically taken centre stage, the result being that theoretical differences between philosophers of technology come to depend primarily on subtle variations on the theme of effectiveness or efficiency. James Feibleman, for example, contends that ‘the ideal of technology is efficiency’ (1983: 37), adding that the longstanding quest for efficiency has been greatly advanced through technology having been ‘brought under applied science’ (36). For Ian Jarvie, technology is seen primarily as a form of knowledge, but it differs from scientific knowledge in that it is of ‘what is effective’ (1983: 55). For Mario Bunge, technology is also knowledge of what is effective, but he thinks that it differs from traditional crafts in that it draws on scientific laws and is thus able to account for *why* it is effective. And for Skolimowski, technology is also knowledge of ‘effectiveness’ (1983: 45), though he goes on to develop the idea that the broad category of effectiveness may be sub-divided into various other sub-categories, including speed, durability, accuracy, and so on.

But if the norm or ideal of technology is effectiveness, ‘what works’, then how does it relate to the norms of fittingness, ‘what is appropriate’, and sustainability, ‘what lasts’? Skolimowski’s more complex understanding of effectiveness suggests the possibility that fittingness and sustainability could potentially be integrated within mainstream philosophy of technology as additional sub-categories of effectiveness. The problem with this approach, however, is that, unlike such sub-categories as speed, durability, or accuracy, which are only normative in certain cases, fittingness and sustainability are normative in *all* cases. So, whereas speed may be normative for planes but not for chairs, durability for bridges but not for biodegradable packaging, and accuracy for thermometers but not for wheels, the self-evident value of appropriateness and sustainability means that their normativity, like that of effectiveness, assumes a fundamental and general character. Just as *all* technologies should be effective, so *all* technologies should be appropriate and sustainable. Fittingness and sustainability thus differ from such properties as speed, durability, and accuracy in that they cannot be reduced to sub-categories of the effective, but must instead, as is the case in

Benyus's explication of the principle of nature as measure, sit alongside effectiveness as self-evidently normative criteria for judging the 'rightness' of our innovation.

If, as philosophy of technology has traditionally maintained, the sole grounding norm for technology is effectiveness (or efficiency), and if appropriateness and sustainability cannot be reduced to sub-categories of the effective, then the possibility presents itself that the norms of appropriateness and sustainability are not technological at all, but derive instead from another realm. And this other realm, I shall now suggest, is the ethical.

A hypothetical example may provide some preliminary support for this suggestion. Imagine that a company, working in a developed country, is seeking to build a large airport on a disused site previously occupied by light industry. Imagine also that the airport's hard surfaces – buildings, runways, roads, car parks, and so on – would radically alter the hydrological regime of the area in such a way that significant flooding would almost inevitably occur downstream. Now, there can be little doubt that this project is inappropriate, that is to say, ill-adapted to the site in question. Further, given the knowledge we have of the impacts of mass aviation on climate change, and the responsibility of developed countries to reduce their emissions to sustainable levels, the project is also clearly unsustainable.

It would, however, also be possible to take nature as a standard against which an appropriate and sustainable development project on the same site could be undertaken. Imagine, for example, that the local community were in need of a new hospital complex. Imagine also that the site had formerly been occupied by a forest. Were the developers to take nature as measure, such that the design of the hospital complex took the forest's ecological standards of water management, energy generation, carbon sequestration, and so on, as measure, then the project would clearly be both appropriate and sustainable.

Now, the claim I am making is that the difference between these two projects is not one of technological performance, of effectiveness and efficiency. Both the airport and the hospital complex may attain high performance standards with respect to their ability to

achieve their intrinsic functions effectively and efficiently: flying passengers around the world and treating the ill. The difference lies rather in the fact that only in the case of the hospital complex have the designers sought to integrate what I suggest are the *ethical* norms of appropriateness and sustainability. There is, in other words, an ecological ethic underlying the work of the hospital designers that is absent from the work of the airport designers. Of course, a mere example which appeals only to our intuition leaves open the question of the *philosophical* justification for seeing natural standards of appropriateness and sustainability as ethically normative, but for the time being my claim is simply that it is quite plausible to see these norms as ethical. Explicit justification for this claim will emerge in the following sections.

## **2. Nature as Measure and Ecological Ethics: From Preserving the Land to Being like Gaia**

If, as I have suggested, the principle of nature as measure provides humans with what might be called an ‘ecological ethic’ of appropriate and sustainable design, then how does this ethic compare and relate to mainstream environmental ethics, and in particular that ethic most often associated with ecology, Aldo Leopold’s land ethic? And could bringing the principle of nature as measure into dialogue with mainstream environmental ethics provide its norms of appropriateness and sustainability with a philosophically justifiable ethical ground?

Leopold famously summarized his land ethic in the following maxim: ‘A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise’ (Leopold, 1949: 225). In what follows, I argue that there are two major problems with this ethic. In the course of addressing these problems, I also argue that a strong ethical ground may be provided for the principle of nature as measure, and more specifically for the idea of taking the way of being of the earth system, Gaia, as a measure against which we evaluate the rightness of our innovation and design.

The first problem – or perhaps rather limitation – with Leopold’s land ethic is its focus on preservation. Up until now, perhaps the most sustained criticism of the preservationist focus of traditional environmentalism has come from restoration ecologists (Baldwin et al., 1994). The most obvious problem restoration ecologists identify with preservation is simply that, as a result of past human interference, the biotic community that previously inhabited a site will often have been entirely or almost entirely destroyed, in which case our duty is to restore nature, not to preserve it. Further, given the vast extent of the anthropic degradation of nature, many restoration ecologists think that the values and attitudes associated with restoration are now more important than those associated with preservation (Baldwin et al. 1994; Turner, 2003). There is, however, also a radical limit to restoration ecology: it is usually applicable only when the land in question is not in use. Land previously used for, say, agriculture or industry, but which now lies vacant, could of course be restored, such that it would come to be inhabited by something like its former biotic community. Similarly, land adversely affected by human use, but not in itself used directly, could also be restored. But the vast swathes of land that are in use, in particular for the purposes of agriculture, industry, or human settlement, could not be restored, or at least not fully, without forfeiting their human use. It is very hard to see, for example, how one could even begin to restore the biotic community that existed previously on the site of Paris or Manhattan without first demolishing the city that has since replaced it. There would thus appear to be a glaring hole in preservationist and restorationist ethics as regards those parts of the earth where the former biotic community has been wiped out and replaced by alternative, artificial systems.

These latter cases are of course where the ecological ethic embedded in the principle of nature as measure comes into play, for it calls on us to take nature as measure for the effectiveness, appropriateness, and sustainability of our artificial products and systems. The first person to propose an explicit formulation and discussion of the principle of nature as measure, Wes Jackson (2011), applied it to farming. On Jackson’s own farm in Kansas, for

example, it is the native prairie that provides the ‘measure’ of the farm’s effectiveness, appropriateness, and sustainability. Similarly, Maibritt Pedersen Zari (2015) has argued that we should take the native ecosystem as setting the ‘standard’ against which urban design projects should be evaluated. In her case study of the city of Wellington, for example, this standard is set by the native broadleaf podocarp forest. And as for industry, the principle of nature as measure can be applied not just to the manufacture of individual biomimetic products, as Benyus clearly intended, but also for industrial systems conceived as wholes, as is arguably already the case in industrial ecology. So, whether the native ecosystem is replaced by farms, industry, or cities, it is in every case possible to take it as measure for whatever artificial system may replace it. An ecological ethic, consisting of taking nature as measure for design and innovation, would thus appear to complement but not replace more traditional ecological ethics, which focus rather on preservation and restoration.

There is, however, a second, more fundamental problem with Leopold’s land ethic. This problem, which has recently been discussed at length by Leopold’s most famous and perceptive commentator, J. Baird Callicott (2013), concerns the ontological status of the ecological entities or units that Leopold takes as the object of his preservationist ethic. At the time Leopold was writing, the idea that there existed basic ecological entities or units was not really in doubt. There may have been doubts as to whether they were best described as organisms, communities, ecosystems, or something else again, but their basic existence remained largely unquestioned. Frederic Clements (1916), for example, had proposed a widely accepted theory of these ecological units as functionally integrated ‘species associations’ analogous to living organisms. Likewise, the rise of cybernetic ecology, and in particular the work of E.P. Odum (1953), also supposed that the ecological units – referred to as ‘ecosystems’ in the wake of Arthur Tansley (1935) – were ontologically unproblematic entities. From the 1950s onwards (Barbour, 1995), however, these assumptions were increasingly challenged by the rise of the ‘individualistic concept’ of ecology put forward

several decades earlier by Henry Gleason (1926), but initially overlooked. According to Gleason, what Clements saw as functionally integrated plant associations were but ‘coincidental assemblages’ of individuals adapted to similar gradients of temperature, water, soil nutrients, and so on.

Callicott (2013) also notes that more recent developments in ecological science and ontology, and hierarchy theory (O’Neill et al., 1986) in particular, suggest that whether or not one observes coincidental assemblages or functionally integrated units depends on the type and scale of the measurements made. This has in turn led some hierarchy theorists (Ahl and Allen, 1996) to espouse an anti-realist ontology, such that whether or not one observes an integrated unit or a coincidental assemblage depends not on an ontological reality independent of human observers, but rather on the nature of the research project, in which case, as Callicott (2013: 93) puts it, ‘[e]cosystem ontology is driven by ecological epistemology’, and not the reverse.

But if putative ecological units are either just coincidental assemblages or theoretical constructions, in both cases the ontological ground would appear to have been removed from under Leopold’s land ethic. If the land qua biotic community is not ‘real’, then it would seem that we cannot have any duties towards it. We may still have ethical duties towards biological individuals, as is the case in the sort of biocentric ethics proposed by Paul Taylor (1986), but a holistic, ecocentric ethics based on the concept of duties towards ecosystems or biotic communities, conceived as ontologically separate wholes, would not be tenable. Callicott (1996) himself shied away from this radical conclusion, arguing only that what is undermined by ‘deconstructive ecology’, Gleasonian individualism and hierarchy theory included, is not the existence of the biotic community, but only its integrity and stability, such that of the three traits of the biotic community Leopold deemed worthy of preservation, only beauty remains (Callicott, 2013: 97, 210). But, apart from the obvious problem that the beauty of biotic communities is hardly immune to deconstructive critique, it is hard to see how something that

lacks integrity could be said to exist at all. When a thing loses its integrity, when it disintegrates, it no longer exists. And, by parity of reasoning, a putative ‘thing’ that did not possess any integrity in the first place, or whose integrity was but the result of a theoretical construction, would not be a true ‘thing’ at all.

To reject the idea that there exist multiple, ontologically separate ecological units is not, however, necessarily to reject the idea that ecological science is concerned only with coincidental assemblages or theoretical constructions. Indeed, as Callicott has noted, while the idea ‘that ecosystems exist as independent biophysical objects is dubious’ (2013: 3), this is not to say that the macro-system of which they are but artificially delimited parts, the earth system as a whole, suffers from the same problem: ‘[r]egarded as a huge ecosystem, the living planet Earth, Gaia, is *more robust ontologically* than its *constitutive ecosystems*’ (Callicott 2013, 209, his italics). It is, however, somewhat unclear on the basis of what ontology or criteria of ontological robustness Callicott is making his claim that the earth is ‘ontologically robust’. With this in mind, I will in what follows present an ontology that clearly explains why the earth, conceived as a vast global ecosystem, is indeed ‘real’.

According to T.H. Allen, probably the leading hierarchy theorist in the field of ecology, the anti-realist or constructionist argument outlined above with respect to ecosystems can be generalized to the rest of reality (Ahl and Allen, 1996). From this perspective, underlying reality is but a Heraclitean flux, such that the appearance of any stable and enduring ‘thing’ is but the consequence of the way the human mind artificially divides up and parcels out this underlying flux. It follows that every time that a human sees a thing – or rather think they see a thing – they are not identifying a real, naturally existing entity, but are instead separating out a portion of the underlying flux and calling that a ‘thing’.

The principal problem with this argument may become apparent through consideration of the distinction made by the ancient Greeks, and Aristotle (2000) in particular, between *physis* and *technē*. According to this distinction, whereas beings that arise through *technē* are

produced by *other beings*, namely humans, beings that arise through *physis* produce *themselves* (see also Heidegger, 1998). This ancient notion of self-production has, in recent times, re-emerged in the context of a critical reception of cybernetics and systems theory, in particular the work of Humberto Maturana and Francisco Varela (1980) on ‘autopoiesis’ (self-production) in biology and of Edgar Morin (1977) on self-production in physics. The ontological importance of the notion of autopoiesis or self-production is the following: something that produces itself is by definition not produced by humans; it is not an artificial construction, whether of the human hand or mind. Further, the way that self-production has been theorized, especially in the field of biology (Maturana and Varela 1980; Kauffman 1995), clearly shows the limitations of Allen’s unswervingly Heraclitean ontology. A being may be said to produce itself when two conditions are fulfilled: first, the primordial flux *loops back on itself*, such that the various different parts or moments of the loop may be said to produce each other; second, this loop also produces, as an integral part of itself, some sort of boundary or limit which delimits it from what thereby becomes its environment, two obvious biological examples of which are cell membranes and skin. From this perspective, things do not arise only when human observers or makers *artificially* delimit them from the primordial flux; they also arise when that flux loops back on itself in such a way that beings *naturally* delimit themselves from the rest of that flux.

The importance of self-production for ecological ethics lies primarily in the fact that, while there is little evidence that ecosystems delimit themselves by producing boundaries or limits that set them apart from other ecosystems (Callicott 2013: 209), the concept does appear to be applicable to the earth as a whole (Margulis and Sagan, 1995: 20-23; Capra, 1997: 208-211). Indeed, not only do the various different parts of the earth system, Gaia, produce each other in a circular manner, most obviously in the form of nutrient cycles, but a strong case can be made for saying that in the course of Gaian self-production a boundary or limit is also produced which functions in a comparable way to the boundaries or limits of

living beings. The workings of this boundary or limit are most readily apparent in the earth's atmosphere: the ozone layer filters out harmful UV light, while also letting in wavelengths necessary for photosynthesis; low levels of atmospheric carbon dioxide let heat from the sun penetrate to the earth's surface while also retaining sufficient heat to stop it completely freezing over; and the atmosphere as a whole also provides protection from meteorites.

If it is true that the earth system, Gaia, is not a product of the human hand or mind, but on the contrary produces itself, then it could theoretically take on the ethical role Leopold attributed to the land. According to Callicott, however, there is a problem with the idea that we have an ethical duty to preserve the earth: the earth simply does not need us. Gaia, on Lovelock's account, has been around for almost as long as life on earth and will no doubt continue to exist even if we humans were to disappear. The idea that we have a duty to preserve or promote the well-being of Gaia is thus, for Callicott, '[t]he ultimate expression of human arrogance and self-importance', for '[t]he planet takes care of us, not we of it' (Callicott, 2013: 237). He concludes that whereas Leopold's original land ethic was ecocentric, for it takes easily destroyed biotic communities as intrinsically valuable objects in need of preservation, the earth ethic is anthropocentric: when taking the earth as a whole into our ethical considerations our duty is not to protect Gaia, for Gaia has no need of our protection, but only to protect ourselves (Callicott 2013: 237).

There is, however, an alternative way of thinking about our ethical relationship to Gaia, one that is congruent with the principle of nature as measure. The key to this alternative way of thinking lies in reflecting on Gaia's specific *way of being*. Lovelock's characterization of Gaia is "ecological". Gaia is characterized as a home (*oikos*) or habitat for living beings. This is not, however, to say that we must follow Lovelock (2009) in understanding Gaia teleologically, as if she had the unconscious 'purpose' of providing a home for living beings. The only argument that need be upheld here is the much weaker one that Gaia *does in fact* provide a home for living beings, that is to say, that at any given moment there exists within

Gaia various different entities, states, or processes – including, at present, the ozone layer, low levels of atmospheric carbon dioxide, nutrient cycling, solar energy capture via photosynthesis... – that in myriad different ways provide a home for living beings. But providing a home for living beings is not Gaia’s purpose; it is simply how she is; it is her way of being.

A further important point to note about Gaia, albeit one not underlined explicitly by Lovelock, is that it is her *present* inhabitants for which she provides a home. At any given point in her history Gaia is a home to the living beings that inhabit her *at that point*. At different points in her history, during what Lovelock calls the different “Ages of Gaia”, Gaia has been a home to quite different collections of living beings. For example, prior to the so-called “Great Oxygenation Event” around 2.4 billion years ago, when significant quantities of oxygen were released into the atmosphere by cyanobacteria, it was impossible for aerobic organisms such as dinosaurs or mammals to inhabit Gaia, and she was instead dominated by anaerobic bacteria. After the Great Oxygenation Event, by contrast, the situation was reversed. Gaia, it follows, is not a home for past or future inhabitants, but only for her present inhabitants. She may be “indifferent” – to use Lovelock’s anthropomorphic characterization – to *who or what* these present inhabitants are, but she is not indifferent to the fact *that they are*, for it is in her very being or nature to provide a home for them, regardless of who or what they are. Gaia’s way of being may thus be more precisely characterized as follows: *Gaia is in such a way that she provides a home for her present inhabitants.*

The relevance of this characterization of Gaia for ecological ethics lies in the following claim: what is good about Gaia is precisely her way of being, namely, providing a home for, and thus letting be, her present inhabitants.<sup>3</sup> What is good about Gaia, in other

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<sup>3</sup> The relation between providing a home for, and letting be, may be explained as follows. A home does not guarantee the existence of an entity, preserving it from every possible accident

words, is not her bare existence, regardless of how exactly she is characterized, but rather her way of being: letting be her present inhabitants. And, since this way of being is good, it may be taken as a measure against which we evaluate our own way of being. One thus arrives at an ecological ethics rooted in the one and only genuine ecological entity, Gaia. What we are to take as measure for our own way of being is the way of being of Gaia: letting be the earth's present inhabitants. This, then, is the essence of the earth ethic I am proposing: taking Gaia's way of being, letting be the earth's present inhabitants, as a standard against which we judge our own way of being.

In what follows, I will explore some of the key philosophical features of this earth ethic, starting with its relation to the three main 'centrisms' of classical environmental ethics.

### **3. Exploring the Earth Ethic**

#### **3.1 Outline of a 'Geocentric' Ethics**

The obvious descriptor for the ethics presented above is 'geocentric', earth-centred. But to attribute a descriptor is obviously not to offer anything like a full characterization. With this in mind, I will in what follows argue firstly, that the way the earth ethic is characterized means that it steers an intuitively appealing path between biocentrism and ecocentrism, and secondly, that this geocentric ethic must be supplemented by a human ethic whose ground is ontologically distinct.<sup>4</sup>

According to the earth ethic I am proposing, we have an ethical duty to be like Gaia, to let her present inhabitants be. This ethic thus resembles biocentrism in that it sees intrinsic

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or eventuality, but it does let the entity be in the sense of providing a space where its existence may unfold.

<sup>4</sup> I will not address here the issue of animal ethics, though there is no reason why the same principle of separate ontological grounding could not also be applied to animal ethics.

value in extant living beings. And yet, unlike classical biocentric ethics, notably that of Taylor (1986), this ethic is not *individualist*; it does not maintain that we have duties towards biological *individuals*. The basic theoretical reason for this is easy to understand: the ethic involves being like Gaia, who, while providing a home for her present inhabitants, does not protect each and every one of them. Further, there are many well-known practical reasons why an individualist biocentric ethic is unworkable: biological individuals are often too small and too numerous to be a meaningful object of individual ethical care and attention; in order for humans to exist at all, they must kill many biological individuals for food and other needs (timber, clothing, etc.); and biological individuals will often pose a direct threat either to us (e.g., infectious bacteria) or to significant numbers of other living beings (e.g., invasive species). The earth ethic can thus maintain the intuitively appealing position that to preside over the wide-scale destruction of living beings is wrong, independently of the instrumental value of these beings to us, while also maintaining that we do not have duties towards these beings *as individuals*.

The fact that the earth ethic does not uphold duties to biological individuals does not, however, imply that it is classically eco-centric either, for its goal is not to preserve Gaia, at least if Gaia is conceived as a multi-billion year-old global ecosystem, but rather to be in the same way as Gaia, which is to let be her present inhabitants. The primary value of the ecological whole, on this view, lies not in itself, conceived simply as an enduring thing, but rather in the way that it lets be and provides a home for its present inhabitants. So, whereas classical biocentrism and ecocentrism exaggerate the opposition between biological individuals and ecological wholes by seeing them each as intrinsically valuable entities whose interests or well-being may come into conflict, the earth ethics I am proposing overcomes this stark opposition by arguing that our ethical duty is not to the ecological whole or to the biological individuals that inhabit it, but rather to being in the same way as the one genuine,

ecological whole, Gaia, the specificity of which is that it lets be, or provides a home for, its present inhabitants, but without protecting each and every one of them as individuals.

If our ethical duty is to follow Gaia in letting be her present inhabitants, it might be thought that this problematically erodes or ignores the distinction between humans and non-humans. The fact that we have an ethical duty to be like Gaia does not mean, however, that that is our *sole* ethical duty. Indeed, it would suffice to present a viable ontological distinction between humans and non-humans, such that human beings make specific ethical claims on us, for this objection to be overcome. Further, while it would be beyond the scope of the present contribution to dwell on the ontological specificity of humans, there is, I believe, a requirement of any such conception of human ontological specificity that is necessary to overcome the worry that the earth ethic will reduce us to mere inhabitants of Gaia, no different in that respect from tics, bacteria, or nematode worms. This requirement is that any characterization of the ontological specificity of humans must ground duties towards human *individuals*, but not to biological *individuals*.

To appreciate the importance of this distinction, consider the case of an inappropriate and unsustainable agricultural system. Now, since the earth ethic does not defend duties to biological individuals, but only to Gaia's present inhabitants *in general*, it follows that we have no direct duties towards the individual plants that compose that system. If replacing that system with completely different plants would make it appropriate and sustainable, thus contributing to the over-riding ethical objective of letting Gaia's present inhabitants be, then we would have a duty to do so, even if *some* of Gaia's current inhabitants will be wiped out in the process. Acting in ways that let be Gaia's present inhabitants may thus involve the legitimate destruction or replacement of some of those non-human inhabitants. By contrast, if we have ethical duties towards human *individuals*, then, unlike in the case of inappropriately and unsustainably cultivated plants, these human individuals cannot be sacrificed on the grounds that doing so would tend to let be Gaia's present inhabitants.

### 3.2 The Spatiality of the Earth Ethic

Another objection that could be made to this earth ethic is that it focusses on the whole, on Gaia, and, as such, overlooks or is ill-adapted to local spatial scales. Living beings may be included in the earth ethic, but they are defined in relation to Gaia, rather than in relation to local ecosystems or biotic communities. To be in the same way as Gaia does not, however, mean considering only the global aspects or implications of one's actions. Indeed, Gaia would not be what she is without all the various sub-Gaian phenomena that take place within her, both biological and ecological. As regards locally focused actions, then, the best way to let be Gaia's present inhabitants will typically be to look to the living beings that inhabit or are native to the locality in question, including their relations to each other, and then to take these beings and relations as the 'measure' against which our own local products and systems are judged.

With this claim in mind, consider again my earlier example, in which an inappropriate and unsustainable project for a large airport was contrasted with an appropriate and sustainable one for a hospital complex. In avoiding aviation emissions and instead taking the native forest's solar energy generation and carbon sequestration as measure, the latter project would clearly participate in the objective of mitigating climate change and thus also letting be Gaia's present inhabitants. But this is not to say that nature's ecological standard relates only to such global objectives as climate change mitigation. For example, in avoiding the hard surfaces that would have been introduced by the airport, it is the local biology and ecology – the interactions between the living beings, rainwater, and soils – that provide the measure of appropriate water management. Further, we are also in a better position now to see why the appropriateness of this course of action gives it an ethical dimension: significant downstream flooding would likely jeopardize the lives of the present inhabitants of the affected downstream area, whether human or non-human, and would, as such, fall foul of the ethical

principle of letting be Gaia's present inhabitants. So, while the ultimate ground of the ecological ethic I am proposing derives from the way of being Gaia, such that the global impacts and implications of any project must be considered, it is also true that to be like Gaia we must also seek to be like the local inhabitants and components of Gaia, thereby adapting our artificial products and systems to their local context.

But if this earth ethic grounds the transformation of our artificial products and systems according to the principle of nature as measure, what does it have to say about preservation and restoration? Given that Leopold's land ethic has been abandoned on the grounds that biotic communities are not ontologically real, it may perhaps be thought that the principle of nature as measure will lead us to embrace an anti-preservationist ethic, according to which humans may replace wild nature with artificial systems whenever they wish to do so, provided only that these artificial systems are evaluated according to ecological standards. If, however, the ultimate duty of ecological ethics is to take the way of being of Gaia – letting be her present inhabitants – as a measure for our actions, this objection is easily answered. The first reason for this is that a policy of destroying wild nature for the purpose of development would not tend towards letting be Gaia's present inhabitants, for the inhabitants of that particular part of Gaia would be more or less wiped out in the process. The second is that a policy of replacing wild nature with artificial systems, even ones that take nature as measure, would involve the further generalization of 'sub-standard' systems, which, as such, diminish the capacity of Gaia to let be her present inhabitants (Dicks 2017: 298). Given that artificial systems cannot be more ecological than nature, even artificial systems built according to the principle of nature as measure will never be as ecological, that is to say, as appropriate and sustainable, as the natural ones they replace.

Regarding restoration, the earth ethic is more ambivalent. When there is a strong need for renewed human use of presently disused land, as in the above example of the hospital complex, development that respected the principle of nature as measure would be an ethically

viable option. But, since natural ecosystems set the ultimate ecological standard, it is also true that restoration will almost certainly contribute more to the over-riding ethical objective of letting be the earth's present inhabitants. It follows that, in the absence of a strong human need, land no longer in use should be restored to its natural state, for it is this policy that will contribute most to letting Gaia's present inhabitants be.

### **3.3 The Temporality of the Earth Ethic**

The earth ethic I am proposing does not only see living beings as *inhabitants* of Gaia, and thus as spatially situated; it also sees them as *present* inhabitants of Gaia, and thus as temporally situated. The earth ethic is thus, in an important sense, an ethics of the present. This may at first seem surprising, for much important thinking about environmental values and ethics has advocated an orientation to the future. The concept of sustainable development, for example, famously assumes that focussing on the present will lead us to sacrifice the needs of future generations and thus proposes that we integrate their needs into our development objectives (World Commission on Environment and Development, 1987). Similarly, Hans Jonas (1985) has argued that traditional ethics, especially Kantian deontology, has considered only the present, thus overlooking duties to future generations.

If, however, the expression 'future generations' refers to beings that do not even exist yet, then a future-oriented ethic is highly problematic. The first reason for this is theoretical and derives from the fact that one cannot have duties towards beings that do not exist, a state of affairs that clearly applies to future beings, which only exist in the speculative constructions or imaginings of demographers, population biologists, or would-be parents. The second reason is practical and concerns the problematic consequences of positing ethical duties to future beings. Consider the fact that the human population is likely to rise from its current level of 7.6 billion, perhaps reaching

as many as 14 billion by the end of the century.<sup>5</sup> Imagine also a scenario in which a forward-looking global agricultural policy is adopted that seeks to provide enough food in 2100 for only 7.6 billion. In such circumstances, it could plausibly be argued that this policy is unethical, for if we aim to provide enough food for 7.6 billion, but there end up being 14 billion, then over 6 billion will starve or suffer from hunger and malnutrition. Further, given that we don't know how many people will exist in 2100, precaution dictates that it would be wise to assume that the number will be at the top end of current estimates, for otherwise we may fail in our duty to meet their eventual needs. The obvious problem with this position, however, is that if we set out now to meet the needs of what we assume will be a significantly expanded human population, then this may well end up becoming a self-fulfilling prophecy, for the agricultural expansion it would entail would likely drive further population growth. By contrast, if our focus is on letting be Gaia's current inhabitants, both its 7.6 billion or so humans and its countless other living beings, then attention will turn away from meeting the needs of an expanded population of future humans and towards: i) preserving and restoring wild nature; and ii) transforming our artificial products and systems, especially our agriculture, industry, and cities, such that they come to approximate to nature's ecological standards. These twin foci would in turn remove the drivers for population growth that would very likely arise from a policy of expanding the production of agricultural goods to meet the hypothesized needs of inexistent future beings. Of course, if the human population did end up increasing, then we would still have an ethical obligation to let those humans be; but this is very different from saying we should adopt an expansionist policy in the present on the assumption that these extra beings might exist in the future.

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<sup>5</sup> UN world population estimates,

<https://esa.un.org/unpd/wpp/Graphs/Probabilistic/POP/TOT/> (accessed 06 September 2018)

Another important feature of this ethics of the present concerns what exactly is meant by ‘presence’. ‘Presence’ must be understood here neither in terms of *eternal presence*, as if we could potentially allow every single present inhabitant of Gaia to exist forever in the manner of immortal souls, Platonic ideas, of Dessauer’s pre-established solutions to technical problems, nor in terms of what one might call *infinitesimal presence*, as if our duties to these beings were only to their immediate needs at the present instant in time. In contrast to these two extremes, ‘presence’ must be understood rather in terms of *enduring presence*, such that our duty is towards letting present beings endure for something like their ‘allotted time’, or, more prosaically, their normal or expected lifespan. To let be today’s new-born babies, for example, does not mean simply ensuring their well-being in the present, but rather ensuring their well-being for something like their normal lifespan, which, assuming we do not fail in this duty, will in many cases continue to at least 2100, a date beyond which even those concerned with the future rarely take the trouble to make plans or predictions. Further, since the present is *dynamic*, such that which beings exist at any given moment in time is gradually changing, as some pass away and others are born, there is also no worry that, since we are not presently focussing on inexistent future beings, there will be a sort of ethical vacuum when these future beings come into being; as the future arrives, it becomes present and is at that point covered by the ethic of allowing Gaia’s present inhabitants to be. Lastly, it is also important to realize that this ethical focus on letting be only Gaia’s present inhabitants also overcomes the problem of how far into the future a future-oriented ethics must apply: there is no question here of arbitrarily fixing a cut-off date in the future beyond which future beings no longer have moral standing, for the only beings to possess moral standing are those that presently exist.

## Conclusion

I have made two major claims. First, I claimed that the principle of ‘nature as measure’, advanced by Benyus as one of three fundamental principles of biomimicry, is *ethically* normative, for it does not uphold only the technological norm of effectiveness, but also the ethical norms of appropriateness and sustainability. Second, I claimed that the ultimate ethical justification for taking nature as measure lies in an ‘earth ethic’, the basic principle of which is not to *preserve* the earth system, Gaia, at least where Gaia is conceived as a multi-billion year-old global ecosystem, but rather to *be in the same way* as Gaia, that is, to let be Gaia’s present inhabitants.

This earth ethic, I further argued, makes it possible to resolve a number of longstanding problems in environmental ethics. First, it treads an intuitively and practically appealing middle ground between biocentrism and ecocentrism, according to which our duty is neither to ecological wholes nor to biological individuals, but rather to being in the same way as the one genuine ecological whole, Gaia, which is to let be the living beings that presently inhabit her. Second, it provides an ethical justification not just for the transformation of our artificial products and systems, such that they henceforth become both appropriate and sustainable, but also for the preservation and restoration of wild nature, and in a way that avoids succumbing to the ontological problems that beset Leopold’s land ethic. Third, it integrates an ethical concern for the future, not by positing problematic duties to inexistent future beings, but rather by focussing on the long-term future of beings that presently exist, including both the myriad living beings under threat from inappropriate and unsustainable human activity, but also today’s babies and young children, who will, one hopes, in many cases still be alive at the beginning of the 22<sup>nd</sup> century.

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