



REVIEW ARTICLE

<https://doi.org/10.1057/s41599-020-0390-y>

OPEN

What does 'nature' mean?

Frédéric Ducarme^{1*} & Denis Couvet¹**ABSTRACT**

The idea of 'nature' is at the very core of science, considered as its flagship and deepest link with human societies. However, while nature preservation has become a major social concern, the idea of nature remains elusive. We examine here the origins, etymology, and historical semantics of this word and its different meanings in contemporary European languages. It appears that this word aggregated successively different and sometimes conflicting meanings throughout its history. One of the main present occidental meanings of "nature", designating what is opposed to humans, currently used in public policies, conservation science, or environmental ethics, hence appears rare and recent, and contradictory with most other visions of nature, including former European representations and contemporary foreign ones. Nature preservation ought to take into account this semantic diversity when proposing policies, integrating the relativity and potential inaccuracy of the currently dominating occidental definition.

Introduction

Since at least the 1970s, a wide scientific, political, and public consensus has emerged about the crucial necessity of "protecting nature" (Worster, 1994). Since early whistle-blowers such as John Muir or Rachel Carson to the theorization of a whole scientific discipline coined as "conservation biology" (Soulé, 1985), the conservation of nature has reached both wide popular concern and scientific maturity. Intense debates, significant thinkers and prominent scientific advances have made this field one of the most important socially in contemporary science, having a strong influence on national and international politics. However, the appealing concept of "nature" has never been really theorized during all this time, and has been used to name more and more diverse things, as well as their opposite, at the risk of becoming another meaningless *panchreston* (Simberloff, 2014). As scientific knowledge of nature is (and will always remain) incomplete, scientists have to rely on mental representations and theoretical concepts, but these must be identified as such, and clearly defined (Demeritt, 2002). Many close and successful new technical words have been born in the same lexical field, such as "ecosystem", "biodiversity", "biosphere", and even "Gaia", but none of them ever really supplanted "nature", even in scientific literature, and it is still the title of one of the most important scientific journals. However, "nature" is not such an easy word, and it actually fits the definition of an abstract *concept*, hence a mental construction rather than a concrete notion, which is situated both historically and geographically, and needs definition in context (Ellen, 1996), just like what has been done about "wilderness" (Rolston III, 1997, Callicott & Nelson, 1998, Callicott, 2008a) or more recently about the idea of a "balance [of nature]" (Simberloff, 2014).

¹ Centre d'Ecologie et des Sciences de la Conservation (CESCO lab, UMR 7204) at the Muséum National d'Histoire Naturelle (Paris), Paris, France.
*email: Frederic.Ducarme@gmail.com

Hence, studying the concept of “nature” itself and its relationship with practical objects and social projects is crucial for conservation sciences and derived policies: many linguists, philosophers, and historians have already shown that its meaning is far from being unified or self-evident (Larrère and Larrère, 2015), but such works have had little popularization in biological sciences so far. Nevertheless, these works have already stressed out that the word “nature” is very difficult to define, and has gone through many changes of meaning during its history (Lenoble, 1969). Moreover, some punctual studies showed that, as for “wilderness” (Callicott, 2000), the word “nature” does not always have a translation in other languages (Philippe Descola, 2005), or can embody different meanings within a language.

In this study, we analyze the origins and evolution of the word “nature” in European languages, from its ancient Greek equivalent to Latin and then to modern meanings, showing that this word, already deemed vague and ambiguous since its most ancient uses, overwhelmingly changed in meaning several times in its history, which is at the basis of its current vagueness and ambiguity. Such ambiguity may constitute the very source of many raging debates among ecologists, such as the “balance of nature” debate (Simberloff, 2014) and many others. As a conclusion, we compare the semantic clusters stemming from these analyses with the contemporary scientific vision of nature in conservation science, in order to see how this semantic diversity can be an obstacle or a chance for the global conservation of “nature”.

Origins and development of an abstract concept

Ancient Greece. The apparition of the word translating the idea of “nature” has been traced back by linguists in many languages: at least Latin (Pellicer, 1966; Rolston, 1997), ancient Greek (Benveniste, 1948) and Chinese (Zhang, 2011), but also some less widespread languages such as Finnish (Jämsä, 1999). Surprisingly enough, this word seems in every case to be quite “recent”, which means that its most ancient records for this meaning are present mostly in classical texts, but never in archaic ones. Both the Greek and Latin words all seem to have come into use when all these languages had already reached their linguistic and philosophical maturity (Berque, 2014).

In Greek, the word that later got translated into “nature” is *phusis* (φύσις), based on the verbal root for “growing, producing”, *phuein* (derived from the Indo-European root *bheu*, ancestor of the English verb “be”), with a suffix indicating the “objective realization of an abstract concept” (Benveniste, 1948). Its oldest known mention is in the *Odysseus*, but still with a primitive meaning (“appearance”); the classical meanings seemed to appear between Heraclitus (sixth century BC) and Aristotle (fourth century BC), already with an ambiguity between the process of growth and its result (Hadot, 2004). Pre-socratic uses such as Heraclitus’, known only from short fragments of text, and the actual meaning of *phusis* at that time are still unclear (from Heidegger, 1922 to Hadot, 2004) all the more so that it appears as a widely inclusive concept, difficult to render in any other language but referring to a general property of being (Heidegger, 1935), linked to religion and metaphysics in such a way that it could be compared to some modern usages of “Nature” with a capital N.

Aristotle (384–322 BC) is known as one of the world’s most influential thinkers, and the founder of most academic disciplines, including “natural sciences” such as biology (through his treatises on animals, plants, the human body...) as well as earth sciences, and coined, though unintentionally, physical sciences, in his major opus *Physics*, entitled long after his death on the basis of the same word *phusis*, which was probably the main source of

success for this word given the importance of this book in western philosophy and sciences. Surprisingly, Aristotle, who was not born Greek, obviously struggles with this word in his texts, especially in several extensive sections dedicated to the numerous, often contradictory and sometimes obscure meanings and uses of this word, for example the beginning of the second book of *Physics* (II, 1). In this book, he defines nature as the essence of things, what they are made of and entail their destiny: the nature of a bed or of a tree is wood (here this meaning is close to substance and entelechy). However, he concedes that this definition is only partial, and that the word is used in many very different meanings, often contradictory such as “the form and the matter”, or an abstract principle and its concrete realization. In his *Metaphysics* (Δ4, 1014b), he goes even further and proposes four different definitions: the generation of what grows (as a process), the primordial element from which things grow (as a principle), the principle of movement (a spontaneous cause), and the matter from which things are made (substance). Here, *phusis* already appears as a *panchreston*, “a term that means so many different things to different people that it is useless as a theoretical framework or explanatory device” (Simberloff, 2014): this text is hence the source of a long-lasting tradition of suspicion of philosophers towards this word. More importantly, Aristotle talks in these two books about theoretical physics and metaphysics, and these two books are not the most closely related to what we now call “nature”: on the contrary, we find only very few theoretical uses of this word in his numerous treatises on animals, plants and ecosystems. More generally, *phusis* is a philosophical and nearly technical word, mostly used by scholars in an urbanistic context, but does not appear to be widely used in other contexts, especially in the rural world or in nature-influenced poetry. To finish, it is noteworthy that most definitions of *phusis* do not exclude mankind. Only one—and the most famous—of Aristotle’s definitions opposes *phusis* to *technè* (technique, artifice), but mankind remains a part of nature, though able of making artifices. An opposed concept to nature would rather be chaos (as there is order in nature) : hence, civilized men are more “natural” in this point of view, as they live under laws, than “barbarian” peoples, submitted to disorder and then oblivious of their human nature (a man living like a beast is as unnatural as a beast living like a man) (Lenoble, 1969). This is why “nature” is not a synonym of wild, wildness or wilderness: it is initially not a state, but a spontaneous process. From this point of view, the epicurean and stoic traditions will add a moral vision of nature as a model to follow (Hadot, 2004), an idea still present nowadays through accusations of “un-natural” deeds (Dagognet, 1990).

Ancient Rome. The Latin word *natura* is quite recent in Roman history (Ernout and Meillet, 1994), and was still only seldom used at the time of Terence (second century BC), with a concrete, primitive meaning of “birth, initial character” (its etymological meaning, derived from the verb *nascor*, “to get born”), still far from modern uses (Gaffiot, 2000). It got its philosophical, Greek-influenced meaning at the classical period (first century BC) while used by Greece-inspired philosophers such as Cicero (first century BC), translating the Greek word (Pellicer, 1966). Hence, the idea stays quite the same between Greece and Rome, but the word changes—and will stay the same until today. The change of word allows new plays on words: especially, Cicero introduces a classical opposition between nature and culture, the first being an initial state devoid of human influence, and the second one corresponding to an appropriation by human societies. The Romans did not share the same vision of cities as the Greeks: cities (and especially Rome) were seen as places of filth and sin,

and the “good life” was in the countryside *villas* (an ideal of bucolics), in a manner surprisingly close to the modern American view of insane cities contrasting with safe residential suburbs. When the Christian view of the perverted Babylon, opposed to the enchanting wilderness as the place of encounter with God, spread in the Roman culture, this stark opposition between evil cities and holy nature got even more fortified. However, nature and culture were still seen as dynamic processes rather than fixed states: nature in a spatial view was still the place where nature as a process happened.

Semantic evolution in Christian societies. A completely new vision of nature appeared with the christianization of the Roman Empire, more linked to the Abrahamic idea of “creation” (White, 1966), supported by the etymological meaning of the Hebrew word for nature, תְּבִיאָה (*teva*: “the mark of an artist on its work”). At the end of the Middle Age, the meaning of “*natura*” as a creative process was no more an idea of changing process, but an attribute of God, as only creator of a static world (Simberloff, 2014). Whereas in the Greek and Roman view of the world, even the gods were part of nature, in a monotheist context God transcends nature, and so does the Man, as he is created at the image of God (Callicott and Ames, 1989). Then, from a cosmic principle, nature got downgraded to a simple (though magnificent) tool in the hands of God, and even the mere material result of his action (what used to be called *res naturae*, “things of nature” by the Romans). Influenced by Plato’s dualism placing spirit higher than matter, such religious conceptions lead to a certain scorn towards the material world (Callicott and Ames, 1989), as God was no more to be found in nature but beyond it. Nature was then no more viewed as sacred contrary to many polytheist religions and spiritualities, but rather as raw material given to men in order for them to “make the earth full and be masters of it; be rulers over [...] every living thing moving on the earth [...]: they will be for your food” (*Genesis*, 1, 28). This idea is supported by the thousands of agricultural metaphors throughout both parts of the Christian Bible, and the rarity of “wild” nature references, such as animal parables (which were much more abundant in polytheistic societies). The Christian Gospel added to this Judaic vision the idea that the “true life” of mankind does not lie in the material world but rather in the “Realm of God” (see for example Matthew 6, 19 or John 15, 19). The dualistic and mechanistic vision of nature, which characterized the classical era in Europe, through philosophers such as Bacon or Descartes, radicalized this trend (Merchant, 1980) along with neoplatonician influences (Simberloff, 2014), though discussed at the end of the eighteenth century (Hadot, 2004). Hence, the material world progressively lose its divine property and moral value in Europe and was entirely open for appropriation and exploitation as soon as the eighteenth century, with the apogee of protestant capitalism (Weber, 1905)—which was denounced as the main source of the ecological crisis by Lynn White (White, 1966). Last but not least, nature was no more seen as a process but as a mere initial state (entailing creationism), a decorum, the only force of change and history being Man, under the grace of God.

Of course, such a worldview was linked by critics (such as White, 1966) to behaviors that induced ecological disasters, such as species extinctions and extirpations, ecosystem malfunction, and eventually climate change and the global biodiversity crisis, all these being gathered in what is now called “Anthropocene” (Lewis and Maslin, 2015). Therefore it is not surprising if the countercurrent romantic vision of Nature was born in the most industrial cities of the 18th and 19th centuries (Worster, 1994), be it in England (Gilbert White) France (Rousseau), Germany

(Goethe, Schelling), and later America, first with arts (from W. Wordsworth to the Hudson River School) and then with philosophy, notably through the transcendentalist movement, as illustrated by Emerson and Thoreau, who influenced seminal conservationists like John Muir (Callicott, 1990). Interestingly enough, some kind of moral valuation of the “material” nature recently seemed to enter Catholicism, through the ecologically aware encyclical *Laudato si’* from Pope Francis (Francis, 2015), proving that conceptions are still evolving, even in religions.

The modern ages and the withdrawal of academics. In parallel with this linguistic evolution in popular language, scientists and philosophers often remained remarkably cautious with this word, and many of them repeated Aristotle’s suspicion. Hence, in *Three Essays on Religion*, John Stuart Mill laments “it is unfortunate that a set of terms, which play so great a part in moral and metaphysical speculation, should have acquired many meanings different from the primary one, yet sufficiently allied to it to admit of confusion [...] and which have made them one of the most copious sources of false taste, false philosophy, false morality and even bad law” (Mill, 1874). Similar warnings were given in the *Encyclopedia* (“this rather vague word, often used but hardly defined, that philosophers tend to use too much”, D’Alembert et al., 1765), by the famous French naturalist Buffon (Buffon, 1770) or by philosophers such as Maurice Merleau-Ponty (Merleau-Ponty, 1957). Some authors tried to establish unequivocal definitions of nature, such as René Descartes (“matter itself”, Descartes 1664) and Charles Darwin (“I mean by Nature only the aggregate action and product of many natural laws, and by laws the sequence of events as ascertained by us”, Darwin 1861), but even them did not manage to widespread their use of this word, which kept its fuzzy semantic cloud until today (Lenoble, 1969).

As a consequence, “nature”, which used to be the core concept of philosophy and science, is nowadays not considered as a philosophical concept or a scientific term any more. Strikingly, it is absent from most lists of philosophical concept in high school and academic programs and manuals (such as Zarader, 2015), maybe because it was neglected by Plato, and in the mere handful of manuals giving it a shy try, the authors seem as despaired by its absence of consensual definition as Aristotle seemed to be two millennia ago, and most of them recommend not using it in serious academic contexts (see for example Lalande, 2010). Furthermore and ironically enough, even specialized encyclopedic dictionaries of environmental sciences carefully avoid any entry to “nature” (even Callicott, 2008b) and once again the few environmental encyclopedias who dare confronting with nature shrug it off awkwardly and recommend using more “serious” terms (such as Ramade, 2002). In parallel, most famous milestone writings in scientific ecology during the twentieth century paid much attention to circumvent this cursed word (from Tansley, 1935 to Soulé, 1985).

This withdrawal can also be interpreted as a result of an academic compromise around a “great divide” (Charbonnier, 2015) stemming from the first definition of nature: sciences were divided between researchers focused exclusively on “nature” (“natural sciences”, also known as “hard sciences” or “sciences of matter”), and on the other hand researchers focused only on non-nature, i.e., metaphysics and social sciences (called “humanities”, “social sciences” or “cultural sciences”). Nature was then not a concern any more, as it was literally everything for some academics (hence massively converted to the second definition, see below), and nearly nothing of concern for the others.

However, this withdrawal of scholars did not entail the disappearance of the word from popular language, quite the contrary. It rather acted a kind of acknowledgement of failure. In

Table 1 List of main current definitions of “nature” in western dictionaries.

Definition	Opposed concept	Close philosophical tradition ^a
The whole of material reality, considered as independent of human activity and history	Culture, artifice, rational intention	Post-romantic philosophy (Rousseau, Romanticism, Marx, transcendentalism, Muir...), often attributed to Christian tradition, and formulated by Mill. This definition is at the root of the “great divide” in Western academics.
The whole universe, as it is the place, the source and the result of material phenomena (including man or at least man’s body)	Supernatural, unreal	Stoicism, Atomism, Epicurism, Taoism, Descartes, Bacon, Spinoza. Formulated by Aristotle and Mill.
The specific force at the core of life and change	Inertia, fixedness, entropy	Heraclitus, Hegel, Nietzsche, Darwin, vitalism.
The essence, inner quality and character, the whole of specific physical properties of an object, live or inert	Transmutation, denaturation	Alternate definition with distinct grammatical use (“nature of...”), too widespread to be assigned to specific traditions (see Aristotle and Mill)

^aRelated philosophical traditions are given as work examples, but their assignments are not definitive as most authors can be placed in several groups depending on the texts used as references (especially Aristotle or Hegel).

the same time, the bulk of scientists did not always prove as careful as the above-mentioned authors: “nature” still appears in 7291 scientific papers titles between 1990 and 2015 according to *Web of Science*. One can bet they do not all share the same definition of this concept, especially between different disciplines, but this hypothesis cannot be answered as none of these papers dare providing a definition of this word, or even a mere bibliographical reference giving a hint of their point of view on it. Hence, thousands of scientists still claim to work on “nature”, but none of them defines it. There is, once again, a lot to bet on the fact that divergences on their representation of nature feed many controversies in the field of nature conservation.

Contemporary definitions of nature

Nowadays, several conflicting meanings of the word “nature” are recorded together in European dictionaries, as a heritage of this history: they are synthetized in four great categories in Table 1.

These four definitions are exclusive of each other, according to many parameters. We identified in particular the inclusion of mankind or not (explicitly excluded from 1, included in all others), its dynamic or static quality (fundamentally dynamic in 3) and its inclusivity (including the whole of reality only in 2 and 3).

The idea of “protecting nature” seldom uses the second definition, as the universe itself is not under threat (and is beyond man’s protection), and physical properties of material things are not changing. This definition, already provided by Aristotle, is by far the most inclusive, and hence supposed to be the least political one, as we cannot act on it. However, this definition can be used in political controversies, be it by people saying that “saving nature” is beyond our reach, or by biotechnology advocates arguing that, in a Cartesian point of view, nothing is “against nature” and it is “natural” to manipulate life, according to its laws (such as synthetic genetics), as long as “everything which is artificial is natural” (Mill, 1874). Regarding this definition, both these claims are perfectly right (“arts is but the employment of the powers of nature for an end” (Mill, 1874)), even if, given so, this constitutes a non-information as nothing real at all can be against nature in this meaning, losing any moral validity of such claim.

The idea of “protecting nature” dwells on the 3 other meanings, but entails very different conceptions of this protection: in the first definition, nature is a series of material things devoid of human influence that can be conserved through preservation against such corruption. In the second one, nature is a process of change, which can be conserved by a proper understanding of its mechanisms, including eventually an active participation in its

dynamic. If a great divide was to be found in this definition, it would be less between mankind and nature than between life (including mankind) and the mineral world: the protection of deserts or high mountains in the name of “nature” appears pointless in this regard. The last one implies an idea of fundamental character, which is to protect against any denaturation or distortion. These definitions hence imply very different conservation policies, which can hardly be merged. For example, when the aim is conserving nature as a non-human natural heritage, there is need to limit as much as possible human intervention, such intervention being done mostly in order to remove previous human disturbance (restoration ecology). At the opposite, when the aim is conserving processes, human intervention can be needed for ensuring their good functioning (especially in a time of global change), including sometimes affirmative action such as species translocations, or ecosystem engineering : such ecosystem would be more “natural” in this meaning as it can shelter and produce more “nature”. Last but not least, if the aim is to conserve the fundamental character of a space, there is a theoretical idea of this place to showcase, in spite of its actual material reality.

One will recognize here echoes of the classical conservationist debate between preservationists and conservationists (Callicott and Nelson, 1998), or between conservation and restoration ecology (Wiens and Hobbs, 2015), which both may also be seen as incarnations of the more general scientific opposition between patterns and processes (Underwood et al., 2000) or between idealism and pragmatism. Each of these positions adopts a specific vision of nature (including the “great divide” between nature and culture, or not), and fights other groups with another vision. This has already been pointed out in related concerns such as the more classical “balance of nature” debate, which has been analyzed in terms of confrontation of different world views as well (Simberloff, 2014). The opposition between static and dynamic nature has been well-identified in philosophical tradition long before it was in biology, for example by Merleau-Ponty who commented around 1957 “The concept of nature does not evoke only the residue of what had not been constructed by me, but also a productivity, which is not ours, although we can use it—that is, an originary productivity that continues [to operate] beneath the artificial creations of man. It both partakes of the most ancient, and is something always new [...] Nature is not exhausted or used up by the very fact that endures” (cited by Rotundo, 2013). Furthermore, whether we include man as a part of nature—be them “traditional” populations or not—is also determinant in the way we fix conservation priorities (Wiens and Hobbs, 2015): this question is at the very core of the “land sparing vs land sharing”

debate (Kumaraswamy and Kunte, 2013), but also in the “new conservation” debate (Kareiva and Marvier, 2012; Doak et al., 2014). Last but not least, many debates about ecological restoration actually rely mostly on conflicting definitions of nature (obvious in works such as Katz, 1992), while this particular issue is rarely put in light. An extreme interpretation of ecological restoration is the American rewilding movement, in which some people advocate for the reintroduction of lions and elephants in northern America (or the resurrection of long-extinct species), in order to “restore” its ecosystems in its pre-human, Pleistocene state (Seddon et al., 2014): this idea clearly stems from the fourth definition, in which there is a state of ecosystem considered as the most legitimate and constituting the aim of environmental management. As these debates all participate in political decision about conservation, there is a capital need of a clear definition of the vision of nature at the basis of each speech.

Commenting on this issue, Larrère and Larrère (2015) use the example of the Christmas tree: “the plastic tree is more artificial than the spruce planted in order to get collected before Christmas, which in turn is less natural than one from a regenerated spruce forest, which is itself less natural than would be a spruce from a primary forest. [...] Adepts of a sharp separation between natural and artificial such as Elliot and Katz will consider that only the spruce from a primary forest is natural. Less dualist (and more logical) aristotelicians would say that, as long as the spruce is growing by itself, it is natural: only the plastic tree is artificial because the result is external to the activity that produced it”—we could add that in a Cartesian point of view, the plastic tree is made of the same atoms as a live tree. Hence, both positions are “true”, according to their own definition of nature: the problem remains that such definition is never openly formulated, whereas this could simplify many scientific debates and allow a better understanding between different traditions of thought. To take another example, Hegel’s vision of nature is close to both the Cartesian and vitalist definitions, as it is both dynamic and holistic. This is why protecting nature from humans may seem pointless in the Hegelian tradition, as Man himself is the truest incarnation of nature: nature converted by Man becomes even more “natural” this way (Sessions, 2006)—this idea could even make us see the Anthropocene event as a “natural thing” (which is true, in this regard). Such conception cannot be erased with the sweep of the hand just because they are opposed to more mainstream ecological world views, but they need to be put in perspective with other widespread conceptions, and discussed on the basis on their own principles. For example, the impoverishment of biodiversity and the decay of ecosystem services decrease the human capability (Holland, 2008) of deploying its progress; hence conservation biology is meaningful even for Hegelians (Hösle, 1991).

Modern biologists’ view of nature

The diversity of meanings of nature also depends on who is using it and in what context (Rolston III, 1997). An extensive study of all these sub-variations inside each sociolinguistic jargon is obviously beyond the scope of the present work, but there is at least one specific vision, which deserves particular attention: the modern biologists’ definition of nature. As said in the introduction, whereas all dictionaries emphasize the semantic ambiguity of this word, there is currently no standard definition of “nature” in the biological literature, and no author appears to cite any reference when using this concept, whereas its use remains widespread, including as a keyword. Hundreds of studies focus on the best ways to protect or to value nature, but none of them deign providing a definition of it: maybe it is precisely because this word is difficult to define that some prominent papers such as

Soulé 1985 pay particular attention at not giving it too much importance. Hence, only an interpretative method can allow us to have a glance at conservation biologists’ vision of nature.

We have said before how the “great divide” between nature and culture in European academics had locked natural scientists in nature, working on a material reality artificially devoid of human influence. Even XXth century academic ecologists have long tried to pretend not to consider mankind in their models, entailing a deep division between scientific and political ecologists (Latour, 1999)—there are even two different words in several languages: in French, “écologue” (scientist) and “écologiste” (political activist). However, ecology in the Anthropocene cannot behave as if mankind did not exist. Hence, conservation biology stands as a revolutionary discipline in that it is both a natural and a social science (Soulé, 1985), breaking the good old academic divide and asking again the question of nature.

Among more “classical” biologists, four of the main specializations can potentially lead to particular visions of nature: ecologists, evolutionists, molecular biologists and conservationists. Conservationists have long had a very “fixed” vision of nature, seen as an heritage to preserve from human disturbance (definition no. 1), and a set of fragile equilibriums that need to stay balanced for life to exist (Simberloff, 2014). However, as conservation dwells on culture, the conservationist tradition has often been conserving cultural representations, seen as the “true” essence of natural places (definition no. 4): this has been particularly discussed about the American concept of wilderness (Nelson and Callicott, 2008), which has long been the main object of protection in America and Australia, in opposition to a more European view of nature as a set of self-producing resources. Such vision has been embodied by Gifford Pinchot in the US, seen as opposed to John Muir’s vision of nature as God’s temple, devoted to remain pristine and free from material relationships with mankind. On the contrary, for XXth century ecologists since Aldo Leopold (Leopold, 1949), and even more for evolutionary biologist, nature can be seen as a stream, closer to the idea of a “specific force at the core of life” (definition no. 3)—at higher scales, paleontology and geology share similar patterns. Such vision entails very specific conceptions of conservation (Sarrazin and Lecomte, 2016). Contemporary ecologists, lastly, have an analytic vision of nature: their aim is to divide it in units and relationships, so the holistic concept appears less useful as nature is mostly an abstract network of many scientific objects. Molecular biologists are close to this approach, as they work at a scale where the difference between humans and nature or even organic and mineral often loses grounding (for example with viruses or molecular engineering): this conception has clear affinities with Descartes’ one (definition no. 2). Hence, it is not surprising if the “Gaia hypothesis” was formulated by a chemist (James Lovelock), as with such point of view a planet and a living being can be considered as virtually indistinguishable.

Once again, none of these definitions is right or wrong: they all stem from the history of sciences, and share analogies with philosophical traditions (Callicott and Ames, 1989), hence the standardization of one synthetic definition for all sciences and publics would probably entail a loss of scientific richness, as no definition is more legitimate than any other, and all possess their particular scientific, intellectual and political fecundity. This idea was formulated by the anthropologist Claude Lévi-Strauss: “the scientist never interacts with the “pure” nature, but with a certain state of the relationship between nature and culture, definable by the historical period in which he is living, his civilization, and his material means” (Lévi-Strauss, 1962). Of course, there has often been a dominant representation in the history of European sciences, in particular the Christian vision (close to the first definition), which may still be dominant in American-influenced

conservation (though conservation itself has now moved away from a too naïve, fixist vision of ecosystems, see Robert et al., 2017). However, with the progress of evolution sciences in ecology and conservation, along with global change as a dynamic evolutionary pressure on life, the evolutionist vision of nature may soon spread to other sciences and popular conceptions. However, such shift must be conscious: it is not about erasing an obsolete vision and replacing it by a more accurate one, but what is at stake is the evolution of a philosophical trend that must keep all of its potential new ways open for future science.

Biological and cultural diversity: how to protect one nature with several representations?

The wide semantic diversity of “nature” obviously makes this word stand out of the scientific lexicon, as it is extremely vague and ambiguous, and lacks any standard definition: all this tend to make it a *panchreston* (Simberloff, 2014). Hence, using it without any definition or context can be pointless when the deal is about proposing a concrete scientific or social project - the “appeal to nature” can even be suspicious in political contexts (Steinbock, 2011). On the other hand, trying to avoid it in conservation sciences seems unrealistic, and even dangerous, as it could make ecologists cutting themselves off from their popular support and flagship. We rather advocate a “wise use” of the term, in the light of its semantic complexity, backed up with clear definition in context and, when needed, replaced by more precise scientific concepts such as “biodiversity”, “evolution”, “ecosystem”, “landscape”, “wildness”, “population”, “community”, etc.

One of the few major works to have taken into account the diversity of natures in the process of nature conservation appears to be the IUCN, through the IUCN protected area categories, first established in 1994 and revised in 2008 (IUCN, 2008). The seven IUCN categories (6 + “1b”) all refer to particular representations of nature. For example, the first category (“strict nature reserve”) spares its areas from human disturbance, hence leaving it to nature considered as in definition no. 1. The category 1b, designated explicitly to accommodate the American concept of “wilderness”, adds an essentialist view as in definition no. 4. The category II (“national park”) aims at “protecting functioning ecosystems”, hence a more dynamic view as in definition no. 3. The category III (“natural monument”) refers to places of spectacular visual interest for mankind, considering natural features in the same way as human achievements. Such vision of conservation is by nature static and fixist, and aims at transmitting such features to the next generations in the same state, hence closer to the fourth definition; it is noteworthy that many places protected under this category shelter hardly any biodiversity (volcanoes, caves, high mountains, etc), diverging with a vitalist vision of nature (as in the third definition). Considering that the vast majority of American protected areas are deserts or high mountains (protected mostly for esthetical reasons), one can say that there is very little “nature” protected in the US by such framework in this regard. Category IV (“Habitat/Species Management Area”) focuses on particular flagship species (Ducarme et al., 2013) as embodiments of nature, and imply, when needed, an active intervention on such species (predator and pest control, translocation, demographic management...), excluding the first definition and approaching more the third and fourth ones. Categories V (“Protected Landscape/Seascape/Area”) and IV (“Protected Area with sustainable use of natural resources”) integrate both quite a fixist vision (helping an object remaining quite the same) but also human use, under some conditions: here again, in opposition to the first definition (and category I), Man is considered as a part of nature, and his activities as objects worth of protection.

This pluralistic grid is especially useful to protect a wide array of very different places, adapting to the numerous conceptions of nature and of its protection. The dualistic American vision of wilderness VS man-devoted places is quite efficient and culturally significant in the US (and a handful of other countries such as Australia), but has neither biological nor cultural groundings in most countries, especially western Europe or India (Guha, 1989). Therefore, sticking artificially such culturally situated grid on inappropriate places or situations has very little chances of success, and faces local population incomprehension or opposition (Campbell et al., 2012) if nothing is done to adapt the methods of nature conservation to what local people think nature is, and what needs to be protected. It is then paramount to document local visions of nature before trying to protect it, if we are to avoid any neo-colonial spirit.

Discussion

Indeed, if the concept of “nature” is more complex and abstract than it seems, the ecological crisis remains a concrete and empirical reality, now affecting everybody whatever be their vision of nature. Then, encompassing the different visions of nature rather than conflicting them appears as one of the seminal challenges to conservationists if they want to bring together as much people as possible under their flag.

There have always been many different policies of nature, and the main reason appears that there are many different conceptions of nature, which do not entail the same priorities, objects, and methods. These conceptions change with philosophical groundings, and are then deeply rooted in people. Hence, science cannot (and must not) artificially standardize them, all the more that science also experiences such philosophical discrepancies. However, this diversity of conceptions of nature can also be seen as a chance for conservation, as it can anchor inspiration for public action, help defining accurate environmental policies and set objectives in human–nature relationship, which are difficult to determine on a strictly scientific point of view. Actually, public policies are probably more inspired by cultural conceptions of nature than by scientific arguments: if conservation gained so much success in the US at the beginning of the twentieth century, it is probably mostly thanks to cultural and religious reasons (Nash, 1967). Hence, a better comprehension of local visions of nature is necessary for local protection of nature, both as a concept and as a reality: semantic and ecological dynamics must converge in order to build relevant scenarios for public policies. On the other hand, more than just forcing different conceptions of nature to cohabit, there may also be a need to engage them in a kind of dialogue. Once the different definitions are clearly stated, each of them can be understood by everyone, and these can be seen as complementary rather than conflicting, putting in light the gray areas of each conception, and helping resolving each other’s issue.

This echoes with what Michael Rosenzweig coined as « reconciliation ecology » (Rosenzweig, 2003), postulating that nature can, in some contexts, coexist with some degree of human presence and activity, and that sometimes such presence can even be favorable to biodiversity (Couvét and Ducarme, 2014). Quite different from the traditional American conception of conservation often limited to the preservation of some remote sanctuaries of pristine wilderness (most often rather poorly productive biologically speaking), reconciliation ecology proposes to develop coexistence conditions between human groups and ecosystems, hence rethinking the direct relationship between mankind and nature. Such idea does not imply the end of the current network of protected areas or the exploitation of wildernesses, as they do embody a conception of nature and a way of conserving a part of this paradigm, but the idea is to add new means of conservation to the current system, embodying other values and protecting

other parts of “nature”, such as important farmland species and landscapes, socio-ecosystem processes or local crop varieties. Apart from IUCN categories, another example of this reconciliation strategy could be found in the network of UNESCO “Biosphere reserves”, which proposes to highlight places where the conservation of biodiversity meets a sustainable use of nature (Batisse, 1982). Some sustainable agriculture labels go the same way, trying to conciliate biological processes with food production, and considering that the reasoned anthropization of an environment is not always its corruption (Doxa et al., 2010). The idea of “cultural ecosystem services” was also coined by the *Millennium Ecosystem Assessment* (Watson et al., 2005), but still lacks proper exploitation for conservation (just like the related concept of “cultural diversity”, but see works by Kai Chan and Ban et al., 2013): yet it could find proper theoretical grounding in the participation of a wider array of populations to conservation policies. The elusive character of nature as a concept may be a fundamental part of its identity (Hadot, 2004): this has long been an issue, but it may turn into an opportunity.

Received: 13 April 2019; Accepted: 7 January 2020;

Published online: 31 January 2020

References

- Ban NC, Mills M, Tam J, Hicks CC, Klain S, Stoeckl N, ... Chan KMA (2013). A social-ecological approach to conservation planning: embedding social considerations. *Front Ecol Environ*, 11(4):130118053603002. <https://doi.org/10.1890/110205>
- Batisse M (1982) The biosphere reserve: a tool for environmental conservation and management. *Environ Conserv* 9(02):101–111
- Benveniste E (1948) Noms d'agent et noms d'action en indo-européen. *Adrien-Maisonneuve*, Paris
- Berque A (2014) Natura natura semper (la nature sera toujours à naître) – un point de vue mésologique. *Nat et Récréation* 1:11–19
- comte de Buffon G-LL (1770) Histoire naturelle des oiseaux. In *Histoire naturelle, générale et particulière, avec la description du Cabinet du Roy*. Imprimerie Royale, Paris
- Callicott JB (1990) Whither conservation ethics? *Conserv Biol* 4(1):15–20
- Callicott JB (2008a) Contemporary criticisms of the received wilderness idea. In: *The wilderness debate rages on: continuing the great new wilderness debate* (M. Nelson & J. Baird Callicott eds), vol. 1. University of Georgia Press, Athens, pp. 24–31
- Callicott JB (2008b) Encyclopedia of environmental ethics and philosophy. In: J. B. Callicott JB, Frodeman R, eds), *Macmillan*
- Callicott JB, Ames RT (1989) The Asian traditions as a conceptual resource for environmental philosophy. In: Callicott JB, Ames RT (eds) *Nature in Asian traditions of thought: essays in environmental philosophy*. SUNY Press, New York, NY, p 335
- Callicott JB, Nelson MP (eds) (1998) *The Great New Wilderness Debate*. University of Georgia Press
- Campbell SJ, Hoey AS, Maynard J, Kartawijaya T, Cinner J, Graham NaJ, Baird AH (2012) Weak compliance undermines the success of no-take zones in a large government-controlled marine protected area. *PLoS ONE* 7(11):e50074
- Charbonnier P (2015) La fin d'un grand partage Nature et société, de Durkheim à Descola. CNRS Editions, Paris
- Couvet D, Ducarme F (2014) Reconciliation ecology, from biological to social challenges. *Rev d'Ethnoécologie* 6:13
- D'Alembert J le R, de Jaucourt L (1765) Nature. In: Diderot D, d'Alembert J (eds) *Encyclopédie ou Dictionnaire raisonné des sciences, des arts et des métiers* (1e ed., vol. 11). Le Breton, Paris
- Dagognet F (1990) *Considérations sur l'idée de nature*. Vrin, Paris
- Darwin C (1861) *On the origin of species*. John Murray, London
- Demeritt D (2002) What is the “social construction of nature?” A typology and sympathetic critique. *Prog Hum Geogr* 26(6):767–790
- Descartes R (1664) *Le Monde, ou Traité de la lumière*. Théodore Girard, Paris
- Descola P (2005) *Par-delà nature et culture*. Bibliothèque des Sciences humaines (Gallimard), Paris
- Doak DF, Bakker VJ, Goldstein BE, Hale B (2014) What is the future of conservation? *Trends Ecol Evolution* 29(2):77–81
- Doxa A, Bas Y, Paracchini ML, Pointereau P, Terres J-M, Jiguet F (2010) Low-intensity agriculture increases farmland bird abundances in France. *J Appl Ecol* 47(6):1348–1356
- Ducarme F, Luque GM, Courchamp F (2013) What are “charismatic species” for conservation biologists? *Biosci Master Rev* 1(July):1–8
- Ellen R (1996) The cognitive geometry of nature. A contextual approach. In: Descola P, Palsson G (eds) *Nature and society. anthropological perspectives*. Routledge, London, pp. 103–123
- Ernout A, Meillet A (1994) *Dictionnaire étymologique de la langue latine-histoire des mots*. Klincksieck, Paris
- François 1er (2015) *Laudato si'*. Encyclical letter, Roma
- Gaffiot F (Ed.) (2000) *Dictionnaire latin-français-le grand Gaffiot*. Hachette, Paris
- Guha R (1989) Radical American Environmentalism and wilderness preservation: a third world critique. *Environ Ethics* 11(8):71–83
- Hadot P (2004) *Le voile d'Isis*. Gallimard, Folio essais, Paris
- Heidegger M (1922) *Interprétations phénoménologiques d'Aristote*. TER, Paris
- Heidegger M (1935) *Introduction à la métaphysique*. Gallimard, coll. Tel (1987), Paris
- Holland B (2008) Justice and the environment in Nussbaum's “capabilities approach. *Political Res Q* 61(2):319–332
- Höslé V (1991) *Philosophie der ökologischen Krise: Moskauer Vorträge*. [Philosophy of the Ecological Crisis: Moscow Lectures.]. C.H.Beck, München
- IUCN (2008) *Guidelines for protected area management categories*. Nigel Dudley, Gland
- Jämsä T (1999) The concept of nature in ancient Finns and Karelians. *Semiotica* 127:345–368
- Kareiva PM, Marvier M (2012) What Is Conservation Science? *BioScience* 62(11):962–969
- Katz E (1992) The big lie: human restoration of nature. *Res Philos Technol* 12:93–107
- Kumaraswamy S, Kunte K (2013) Integrating biodiversity and conservation with modern agricultural landscapes. *Biodivers Conserv* 22(12):2735–2750
- Lalande A (Ed.) (2010) *Vocabulaire technique et critique de la philosophie*. Presses Universitaires de France. Presses universitaires de France, Paris
- Larrère C, Larrère R (2015) *Penser et agir avec la nature. Une enquête philosophique*. La Découverte, Paris
- Latour B (1999) *Politiques de la nature. Comment faire entrer les sciences en démocratie* (Vol. 35). La Découverte, Paris
- Lenoble R (1969) *Histoire de l'idée de nature*. Albin Michel, Paris
- Leopold A (1949) *A Sand County Almanac and Sketches Here and There*. Oxford University Press, New York, NY
- Lévi-Strauss C (1962) *La pensée sauvage*. Plon, Paris
- Lewis SL, Maslin MA (2015) Defining the anthropocene. *Nature* 519(7542):171–180
- Merchant C (1980) *The death of nature: women, ecology, and the scientific revolution*. Harper & Collins, New York
- Merleau-Ponty M (1957) *Cours sur la « Nature » au collège de France*. Seuil, coll. «Traces écrites», Paris
- Mill JS (1874) *On Nature*. In: *Three essays on religion*. London: Longman Green
- Nash RF (1967) *Wilderness and the American Mind*. Yale University Press, New Haven
- Nelson MP, Callicott JB (eds) (2008) *The Wilderness Debate Rages on: Continuing the Great New Wilderness Debate*. University of Georgia Press
- Pellicer A (1966) *Natura, Étude sémantique et historique du mot latin*. *Rev Belg de Philologie et d'Histoire* 47(3):978–982
- Ramade F (2002) *Dictionnaire Encyclopédique de l'écologie et des sciences de l'environnement* (2e édition). Dunod, Paris
- Robert A, Fontaine C, Veron S, Monnet A-C, Legrand M, Clavel J, Chantepie S, Couvet D, Ducarme F, Fontaine B, Jiguet F, Viol IE, Rolland J, Sarrazin F, Teplitsky C, Mouchet M (2017) Fixism and conservation science. *Conservation Biology* 31(4):781–788
- Rolston III H (1997) Nature for real: is nature a social construct? In: Chappell TDJ (ed) *The Philosophy of the Environment*. University of Edinburgh Press, Edinburgh
- Rosenzweig ML (2003) *Win-Win ecology. how the earth's species can survive in the midst of human enterprise*. Oxford University Press, Oxford
- Rotundo A (2013) *Conception of nature as foundation of a non-fundamental ontology Merleau-Ponty between the Nature lectures and The Visible and the Invisible*. *Metodo: Int Stud Phenomenol Philos* 1(2):185–196. <https://doi.org/10.19079/metodo.1.2.185>
- Sarrazin F, Lecomte J (2016) Evolution in the anthropocene. *Science* 351(6276):922–923
- Seddon PJ, Moehrenschrager A, Ewen J (2014) Reintroducing resurrected species: selecting deextinction candidates. *Trends Ecol Evolution* 29(3):140–147
- Sessions G (2006) *Wildness, cyborgs, and our ecological future: reassessing the deep ecology movement*. *Trumpeter* 22(2):121–182
- Simberloff D (2014) The “balance of nature”-evolution of a panchreston. *PLoS Biol* 12(10):e1001963. <https://doi.org/10.1371/journal.pbio.1001963>
- Soulé M (1985) What is conservation biology? *BioScience* 35(11):727–734
- Steinbock B (2011) *The Appeal To Nature*. In: Kaebnick GE (ed) *The Ideal of Nature: Debates about Biotechnology and the Environment*, JHU Press
- Tansley AG (1935) *The use and abuse of vegetational concepts and terms*. *Ecology* 16(3):284–307

- Underwood A, Chapman M, Connell S (2000) Observations in ecology: you can't make progress on processes without understanding the patterns. *J Exp Mar Biol Ecol* 250(1–2):97–115
- Watson RT, Zakri AH, Corvalan C, Hales S, McMichael A (2005) MEA: ecosystem services and human well-being. MEA, Genève
- Weber M (1905) The protestant ethic and the spirit of capitalism. *Archiv für Sozialwissenschaften und Sozialpolitik*, Tübingen
- White L (1966) The historical roots of our ecologic crisis. *Science* 155 (3767):1203–1207
- Wiens JA, Hobbs RJ (2015) Integrating conservation and restoration in a changing world. *BioScience* 65(3):302–312
- Worster D (1994) *Nature's economy: a history of ecological ideas*. Cambridge University Press, New York, NY
- Zarader J-P (Ed.) (2015) *Les grandes notions de la philosophie*. Ellipses, Paris
- Zhang L (2011) What is “nature”. *J Philos Study* 4:84–85

Acknowledgements

We are grateful for their help and insights to Fabrice Flipo, Catherine Larrère, Vincent Devictor, Bernadette Bensaude-Vincent, Philippe Huneman, and all the CESCO lab. Many thanks also to Hélène Sauvageot, who proof-read the manuscript.

Competing interests

The authors declare no competing interests.

Additional information

Correspondence and requests for materials should be addressed to F.D.

Reprints and permission information is available at <http://www.nature.com/reprints>

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>.

© The Author(s) 2020