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"Far from the Shallow"? Aesthetics in Conservation Biology

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Abstract. What role, if any, does aesthetics play in the development of biological conservation strategies? Should we consider beauty – and, more broadly, the aesthetic dimension of human experience – as a source of bias that risks distorting scientific judgments (and, therefore, something to be carefully managed or even eliminated in the pursuit of objective scientific truth)? Or, conversely, might beauty be seen as a legitimate and powerful motivator – an emotional and perceptual force capable of promoting conservation efforts? The interplay between aesthetics, beauty, and scientific inquiry has long been a subject of relevant debate within the philosophy of science. In this paper, I aim to investigate the role that aesthetic values and perceptions play in the context of conservation biology – particularly in light of a growing and renewed interest among conservationists in the aesthetic aspects of nature and environmental engagement. The argument I will make is that eliminativist approaches – which frame the aesthetic *mostly and primarily* as a source of potential distortion – are based on an overly simplistic and impoverished conception of what "aesthetic" means.

Keywords. Biodiversity, bias, truth, knowledge, understanding, beauty, distortion.

1. *Introduction*

The focus of this paper is on the role of aesthetic values and perceptions within the field of conservation biology – particularly in light of the growing scholarly interest in the aesthetic dimension among conservation biologists, as evidenced by a recent increase in critical literature on this subject. My aim in this contribution – which is meant to serve as an introduction to a broader, ongoing project on the conceptual foundations of an *aesthetics of biological conservation* – is to offer a preliminary critical assessment of this recent resurgence. I argue that eliminativist approaches in conservation biology – i.e. approaches which conceptualize the aesthetic as a bias or a potential source of distortion to be carefully managed, minimized or even eliminated in conservation theory and practice – rely on an impoverished notion of the aesthetic. Such perspectives miss the opportunity to reconsider and reimagine both conservation sciences and aesthetics through their rich, dynamic, and mutually transformative relationship.

2. *The state of the art*

The assessment of nature's intangible (i.e., non-material) contributions to human well-being has become a central challenge in contemporary conservation sciences (Dìaz et al. [2018]). Among these contributions, the aesthetic value of nature is particularly salient. As is well known, the Millennium Ecosystem Assessment (2005) included aesthetic values in the set of ecosystem services, i.e. those "benefits" (or services) that nature offers to human beings for free.

More precisely, the aesthetic dimension of nature seems to have a twofold relevance: on the one hand, it is acknowledged for its contribution to psychological and cultural human well-being; on the other hand, particularly in recent years, it has emerged as a crucial asset in motivating and promoting collective commitment to conservation efforts (Tribot et al. [2018]; Tribot et al. [2016]; Stokes [2007]; see also Hettinger [2010], Lintott, Carson [2013]; for a critical assessment, Hall, Brady [2023]). Coming from different perspectives and working on a wide array of case studies, researchers have increasingly realized that human perceptions and attitudes, including *aesthetic* perceptions and attitudes, play a much more relevant role than previously thought for the effective implementation of conservation programs, especially at the local and community level. Natural beauty, thus, seems to be the key to motivate people to protect nature.

What is particularly noteworthy, however, is that this *general* growing recognition of the aesthetic dimension as central in shaping the human experience of the non-human natural world – especially in its motivational role – has, quite paradoxically, gone hand in hand *within the field of conservation biology* with

an increased emphasis on the aesthetic understood as a source of bias. This so-called "aesthetic bias" is perceived as being at odds with the supposed "objective" criteria used to set conservation priorities and it is increasingly framed as a potentially distorting influence on the effective management of nature degradation and biodiversity loss (Shaw et al. [2024]; Bellwood et al. [2020]; see also Troudet et al. [2017]). These two lines of reflection on the role of aesthetics in science are clearly in tension with one another and must be examined and, if possible, reconciled. What follows is a concise review of key studies published over the past few years that have addressed the emerging concern in conservation biology about the "aesthetic bias".

A wide diversity of taxonomic groups have been examined by researchers investigating the aesthetic bias. Studies range from mammals (e.g., Landová et al. [2018]) to snakes (Knight [2008]; Landová et al. [2012]), reptiles more broadly (Janovcová et al. [2019]), birds (Frynta et al. [2010]; Lišková, Frynta [2013]; Brambilla et al. [2013]; Haukka et al. [2023]; Santangeli et al. [2023]), and tropical frogs and insects. Recent efforts to quantify the aesthetic value of coralligenous reefs along the French Mediterranean coast using deep learning techniques (Langlois et al. [2021]; see also Bellwood et al. [2020]) have revealed a potential correlation between aesthetic appeal and ecological significance. However, Langlois et al. (2022) have also emphasized a global mismatch between the aesthetic appeal of reef fishes and their conservation priority. The problematic link between the aesthetic value of ornamental plants and the increased risk of biological invasions is addressed in several studies (e.g., Hu et al. [2023]; Kueffer, Kull [2017]). In botanical research, evidence shows that plant scientists tend to disproportionately focus on colorful, visually striking, and widely distributed alpine flowers – essentially, those with high aesthetic appeal rather than on species most in need of conservation attention (Adamo et al. [2021]). Aesthetic values also influence bird conservation strategies and the dynamics of the wildlife trade (Senior et al. [2022]). Concerning landscapes, research suggests that areas perceived as aesthetically pleasing are more likely to receive public support and protection, often independently of their ecological importance (Gobster et al. [2007]; Lindemann-Matthies et al. [2010]). In the case of butterflies, researchers found that species included in the EU Habitats Directive tend to be rated as more charismatic – a concept closely linked to, although not synonymous with, aesthetic appeal (see Portera [2025], in preparation) – than both conservation-priority species and those not listed at all (Habel et al. [2021]; van Tongeren et al. 2023). Furthermore, the presence of eye-like spots on butterfly wings has been shown to enhance human perception of their attractiveness, thereby shaping conservation attitudes (Manesi et al. [2015]). The potential impact of aesthetic biases – reflected in tendencies such as, "I am more willing to protect what is aesthetically appealing to me rather than what is actually under threat" – is wide: if confirmed, this aesthetic dynamic could become one of

the most powerful drivers of human-mediated evolutionary pressures in the Anthropocene (aesthetic-based anthropogenic selection)[1].

Little wonder then, given the body of research rapidly summarized above, that the *Journal of Aesthetics and Art Criticism* published, in July 2024, a highly critical paper regarding the potential benefits of employing aesthetic arguments and/or aesthetic values in addressing global biodiversity loss (Mikkonen, Raatikainen [2024]). The aim of the paper, as the authors state, was to explore «the possibility of grounding biodiversity conservation on aesthetics» (Ibi: 185). The outcome of this exploration paints a rather pessimistic picture: there is a mismatch, they argue, «between apparent and real biodiversity» (Ibi: 175). People's direct and sensory-based observations and perceptions of biological variety – that is, people's *aesthetic* experience of biological variety, assuming, as the authors do, that the aesthetic is equivalent to the immediate apprehension of what strikes the senses, mostly in the visual domain – is fundamentally different from actual, existing biodiversity. Therefore, they conclude, conservation cannot be based on aesthetic experience.

As already mentioned, I aim to challenge the premises of this conclusion: is understanding aesthetics in terms of a sensorial, superficial, immediate, and largely visual experience of what captivates the senses the only viable approach? Is there no room for aesthetics beyond its role as a distortion of knowledge? Should this be the case, the tension (Plato's "ancient discord", *Rep. X*) between aesthetics and ecology (coming closer to the main topic of this issue, between "landscape" as an aesthetic concept and "sustainability") would be further confirmed, and aesthetics would be seen purely as a disruptive force in scientific discourse. To better understand the point, I suggest we first take a closer look at what conservation science – specifically, conservation biology – is.

3. *Conservation*

3.1. *Before turning into a science*

As Jax ([2024]: 25 ff.) observes, the emergence of the first Western conservation movements in the second half of the nineteenth century was driven not primarily by scientific reasons, but rather by symbolic, cultural, and *aesthetic* motivations. Nature needed to be protected not exclusively nor primarily because biologists or

1 An interdisciplinary research group has been active at the University of Florence since 2021, bringing together researchers from the Department of Humanities and Philosophy (DILEF) and the Department of Biology (BIO) around the topic "aesthetic bias". The group is working on a comprehensive study focused on the identification, evaluation, and re-modulation of aesthetic biases in conservation strategies targeting endangered species. Additional information about the project is available at: www.unveiling.eu.

natural scientists said so or proved it, but because it was beautiful – or because it was felt as part of a community's identity or symbolic heritage. In the wake of the Industrial Revolution on one side, and colonialism and imperialism on the other – for example, just think of the over-collection of beautiful plants and exotic animals as part of colonial trade – a perception of nature as something *beautiful yet increasingly endangered* began to take shape. A growing awareness arose of the imminent loss of a precious and fragile natural diversity (Jax [2024]: 32).

If we focus on the reasons that led to the foundation of the first *animal* protection societies, aesthetic considerations once again emerge as a central factor. The case of birds offers a particularly instructive example: the Society for the Protection of Birds was founded in the United Kingdom in 1889 as a response to the widespread use of bird feathers in women's fashion hats. In this case, aesthetic values – understood in a broad sense – played a dual role: they were implicated both in the problem and in the solution. On the one hand, the aesthetic attractiveness of feathers contributed, within the fashion industry, to the threat of extinction of several species of birds; on the other hand, the beauty of birds – viewed as living organisms in their own natural environments, not just bundles of feathers to be used in millinery – was recognized as a value to be preserved and protected (Jax [2024]: 11; see also Doughty [1975]; Woolf [1920]) (Figure 1).

Figure 1. *The woman behind the gun*, Gordon Ross. N.Y. Published by Keppler & Schwarzmann, Puck Building, 1911 May 24 (Library of Congress Prints and Photographs Division Washington, D.C. 20540 USA)

A similar pattern of prevalence of aesthetic-cultural reasons over scientific ones can be seen in the Netherlands, where the early nature conservation movements (van der Windt [2012]) were strongly influenced by the involvement of amateur naturalists. These amateurs, who, in the initial phases, played a more significant role than professional scientists, were crucial precisely because «they were able to combine different types of academic and non-academic knowledge, ethical and aesthetic arguments for the protection of nature, and organisational and educational practices» (van der Windt [2012]: 231).

3.2. *Conservation as a science*

The integration of Western conservation movements with science and scientific methodologies *strictu sensu* came much later, roughly between the 1970s and 1980s. It was during this period, against the background of ecology and through the application of scientific research methods to conservation practices for the first time, that conservation biology took shape in the form we recognize today. A key moment in this process was marked by Michael Soulé's seminal 1985 paper, *What is Conservation Biology?*, the aim of which was twofold: on the one hand, to establish conservation biology as a scientific discipline; on the other, to emphasize its essential distinctiveness – or at least partial non-assimilability – to other biological disciplines. Soulé ([1985]: 727) writes:

> Conservation biology differs from most other biological sciences in one important way: it is often a crisis discipline. Its relation to biology, particularly ecology, is analogous to that of surgery to physiology and war to political science. In crisis disciplines, one must act before knowing all the facts; crisis disciplines are thus a mixture of science and art, and their pursuit requires intuition as well as information. A conservation biologist may have to make decisions or recommendations about design and management before he or she is completely comfortable with the theoretical and empirical bases of the analysis. Tolerating uncertainty is often necessary.

The epistemological framework of conservation biology as originally formulated by Soulé, (i.e., the idea that conservation biology is a crisis discipline, a mixture of art and science) has been – and continues to be – a subject of debate. A crucial contribution in this ongoing discussion is the paper by Kareiva and Marvier (2012), which suggests that *conservation biology* is replaced with a broader *conservation science*. This approach, the authors argue, would integrate an important element neglected in Soulé's vision: the role of human well-being within conservation practice. As Kareiva and Marvier ([2012]: 968) write: «Our vision of conservation science differs from earlier framings of conservation biology in large part because we believe that nature can prosper so long as people see conservation as something that sustains and enriches their own lives. [W]e

are advocating conservation for people rather than from people» (see also Mace [2014]; on this point, Jax [2024]: 44 ff.).

Setting aside for a moment this still ongoing debate, I suggest that we keep in mind two key points highlighted by Soulé in his paper: 1) conservation biology is a crisis discipline – operating under pressing constraints of time, space, and resources, and in the constant need of making decisions before being completely comfortable with data and evidence; 2) the critical nature of the contexts in which conservation biology operates makes it, I argue, particularly vulnerable to biases; the urgency of action often discourages deep thinking and prioritizes action and immediacy, while marginalizing complexity and multiperspectivality (on this point, Malavasi [2025]). Biases in science can be understood as tendencies, often implicit or unconscious, to deviate from normative standards (see Ballantyne, Dunning [2022]): it seems that the aesthetic, at least according to Soulé-inspired conservation biologists, belongs to the realm of (powerful) biases.

3.3. *The crisis discipline seeks aesthetic shortcuts*

In a leading piece that contributed to the history of the relationships between humans and nature, between art and science, E.O. Wilson makes a point that goes in the direction of what has been argued in the previous paragraph. *Biophilia* – published in 1984, more or less in the same years in which the concept of biodiversity was first coined, also thanks to Wilson's own direct involvement – addresses, among others, the question of the role of beauty (and its related categories, such as elegance and simplicity) in the production of scientific knowledge, from the unique perspective of a passionate naturalist:

> Elegance is more a product of the human mind than of external reality. It is best understood as a product of organic evolution. *The brain depends upon elegance to compensate for its own small size and short lifetime*. As the cerebral cortex grew from apish dimensions through hundreds of thousands of years of evolution, it was forced to rely on tricks to enlarge memory and speed computation. The mind therefore specializes on analogy and metaphor, on a sweeping together of chaotic sensory experience into workable categories labeled by words and stacked into hierarchies for quick recovery. To a considerable degree science consists in originating the maximum amount of information with the minimum expenditure of energy. Beauty is the cleanness of line in such formulations, along with symmetry, surprise, and congruence with other prevailing beliefs. […] Mathematics and *beauty* are *devices by which human beings get through life with the limited intellectual capacity inherited by the species* (Wilson [1986]: 60-61, my emphasis).

In Wilson's understanding, elegance and beauty are devices to get the most effective "combination of effectiveness and economy" in science (see on this point Elgin [2020]). Due to the limited capacities of the human brain and to the

necessity to deal with huge amounts of data and with uncertainty, scientists – even more so, today, conservationists and conservation biologists – chase (consciously or not) after beauty and are vulnerable to its charming allure because beauty subtly promises to simplify their work. We prefer beautiful things over non-beautiful or ugly ones because beauty seems to offer a sort of dynamic tool to master effectively multifaceted hypotheses and overwhelming research materials, and to orient ourselves within complexity.

The point is, since according to Wilson beauty seems to be humeanly «no quality in things themselves: it exists merely in the mind which contemplates them» (Hume [1757]), that there is always a risk that the aesthetic dimension may slip beyond scientists' grasp of reality; to it put differently, that the pursuit of beauty might distance science from "reality", whatever one intends by this term. In contemporary physics, this risk seems to have already taken shape in recent research developments, as physicist Sabine Hossenfelder argues in her book *Lost in Math: How Beauty Leads Physics Astray* (Hossenfelder [2018]). Is conservation biology perhaps also facing the same danger?

Let us summarize our key points so far: conservation, even before establishing itself as a science, is already deeply entangled with aesthetic and cultural values; once it does take shape as a scientific discipline, it is primarily defined as a *crisis discipline*, one operating under intense temporal and resource constraints. I argue that one of the side-effects of this crisis-oriented narrative, with regard to the aesthetic, has been its conceptualization as a bias – a non-cognitive, superficial and immediate apprehension of what strikes the senses, in contrast to the presumed objectivity of science (I shall come back to this point later).

The recent surge, in conservation biology, of papers that explicitly frame the aesthetic as a (negative) bias points in this direction[2]; only within certain limits the aesthetic can perhaps function in a Wilsonian sense as a pragmatic tool for the efficient management of vast and complex material under pressing conditions, but this is more an exception than the rule.

This framework gives rise to a dichotomy within conservation: the dichotomy between aesthetics and science, between (supposed) subjective values and descriptions, between the aesthetic dimension and the "reality" or the "objective fact." This growing divide ultimately betrays the original entanglement between aesthetics and conservation as it was at the time of the Western first conservation movements. To complicate the picture further, the very concept of biodiversity – which is central to conservation science and

2 In a sense, one might perhaps even argue that, as a crisis discipline and in order to protect itself as much as possible from potential distortions due to pervasive time- and resource restrictions, conservation biology tends to be highly alert to potential biases – sometimes so much so that it risks seeing biases where there may be none, or where biases are, at least, not the primary issue at stake.

which I have assumed and employed so far, throughout this paper, in its most common-sense meaning – is multifaceted and difficult to grasp, positioning itself beyond the value-fact dichotomy (see, on this point, Casetta [2018, 2024]; Casetta, Delord [2018]; Casetta, Marques da Silva, Vecchi [2019]). In its standard formulation, biodiversity refers to the «variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems» (UNEP [1992]; for a philosophical discussion, see Casetta, Marques da Silva, Vecchi [2019]). Evidently, we can directly and sensorily perceive only a very narrow portion of biodiversity, *so* defined (Mikkonen, Raatikainen [2024]). But this brings us again to the crucial question: can we really be satisfied, in dealing with conservation, with (1) such a "shallow", immediate, sensory-based role for the aesthetic – and, *therefore* (2), with its almost complete assimilation into the category of a bias? More broadly, can we really be satisfied, in conservation, with the idea of a "pure science" to be liberated as much as possible from values, pleasures and interests?

4. *From the shallow to the deep: rethinking aesthetics in science*

4.1. *Back to Darwin*

When challenges arise within biology, it is always a good idea to return to Darwin's writings for inspiration and possible ways out of the impasse – and the present case is no exception. Darwin offers at least two valuable insights into the relationship between aesthetics and science. First, aesthetics does not emerge at the end of scientific inquiry, but rather precedes and orientates it: it plays a constitutive role in scientific creativity and in theory construction and development – in both the context of discovery and the context of justification (see, on this point, Kohn [1996]; Portera [2015]; Prum [2017], Bartalesi [2024]). Second, the aesthetic should not be regarded as merely superficial, or "shallow". It does not simply reflect or describe how the world presents itself to us in an immediate, purely perceptual way. Instead, it points toward deeper, more intricate dynamics and entanglements (where perception, cognition, emotion, values, and habits deeply intertwine with each other; see Desideri [2011, 2018]; Portera [2020, 2020a]) that shape and modulate what "becomes" visible on the surface. To put it differently, the aesthetic seems to constitute a dynamic experiential field of stratifications and appearances, of deeper forces and superficial trends, of visibility and invisibility. This is expressed with special clarity in the following widely cited passage from the first edition of *On the Origin of Species*:

> *We behold the face of nature bright with gladness*, we often see superabundance of food; we *do not see*, or we forget, that the birds which are idly singing round us mostly live on insects or seeds, and are thus constantly destroying life; or we forget how largely these songsters, or their eggs, or their nestlings, are destroyed by birds and beasts of prey; we do not always bear in mind, that though food may be now superabundant, it is not so at all seasons of each recurring year. (Darwin [1859]: 63, my emphasis)[3]

The fact that, in contemporary conservation science, beauty and the aesthetic are largely understood *only* as immediate sensory appearances – as superficial pleasures that *strike the senses* but remain disconnected from deeper dynamics – suggests that we have not yet fully grasped the implications of Darwin's insights on evolutionary theory and on the relationship between aesthetics and biology, between beauty and science. In his recent work on conservation concepts, Kurt Jax (2024) characterizes nature conservation as a contested field, where competing approaches seek legitimacy and no single, definitive method can claim universal validity. Instead, the challenge lies in identifying approaches appropriate to specific problems, experiences, objectives, and contexts. I suggest that a similar pluralistic perspective should be extended to aesthetics and to its multifaceted role within conservation biology.

4.2. *The aesthetic and the cognitive*

The set of questions raised thus far regarding the role of aesthetics in conservation biology, if pursued in full, would require a substantial reconsideration of at least two foundational assumptions: (a) the predominantly (visual-)perceptualist conception of the aesthetic commonly invoked in conservation discourse; and (b) the dominant framing of conservation biology as a crisis discipline. These two frameworks are closely interlinked – arguably in a near cause-and-effect relationship.

Given the scope and limitations of the present paper, I am unable to develop these two points in detail and must instead postpone their fuller treatment to future work.

Accordingly, rather than offering a comprehensive analysis, I will focus here on a more narrowly defined – though by no means marginal – related issue: the widespread idea (particularly prevalent among conservation biologists) that, once the aesthetic bias is identified – a bias which, like most biases, tends to op-

3 Scholarly work on Darwin has emphasized his integration of the sublime into the category of the beautiful. In Darwin's aesthetic theory, the beautiful – serene, harmonious, and graceful – and the sublime – violent, excessive, powerful, and immense – are conceived as complementary dimensions of a unified aesthetic experience. For an in-depth discussion of this point (among other points on the general topic "Darwin's aesthetics"), see Bartalesi (2012), Portera (2015), and Bartalesi (2024).

erate implicitly and must therefore first be made explicit – scientific knowledge and cognitive information represent the most effective tools for correcting or recalibrating our distorted aesthetic experience of nature. In short, this position advocates for a *cognitively* informed aesthetics – or, I would rather say, for an absorption of the aesthetic (so understood) into the cognitive realm.

As Mikkonen and Raatikainen ([2024]: 185) explicitly argue, cognitivist approaches represent the only viable path for developing an aesthetic framework adequate to conservation/biodiversity, since «non-cognitivist approaches seem ill-suited to the aesthetic appreciation of biological diversity whose assessment is, by definition, part of the cognitive domain» (It is worth noting here the persistence of a sharp division between the cognitive and non-cognitive dimensions of the aesthetic, between facts, values and emotions, as if they were mutually exclusive spheres). But what assumptions underpin this view? What are its implications for how we understand the relationship between aesthetics and knowledge, between aesthetics and science, or between the aesthetic and "objectivity"? Let us begin to tackle some of these questions through a step-by-step approach.

Figure 2. *Eichornia crassipes*, commonly known as water hyacinth (courtesy of Claudia Giuliani and Elena Tricarico).

Research has suggested that informing individuals about the rarity or endangered status of an animal – particularly one they do not initially find aesthetically appealing – can lead to a slight increase in its perceived attractiveness. This effect, however, is not observed when the animal is already regarded as beautiful (Gunnthorsdottir [2001]; Brambilla et al. [2013]; see also Angulo et al. [2009] on the "rarity effect"). Nevertheless, it would be misguided to assume that, under any circumstances, the mere communication of scientific facts regarding an animal's or species' conservation status can fully and durably re-shape, as if by waving a magic wand in a single gesture, the nature of aesthetic appreciations/appearances. What can reasonably be expected is that cognitive information has the potential to re-modulate, through time, repeated embodied exposure and within certain limits, human perceptual and emotional engagement[4]. For instance, a species of butterfly that initially fails to captivate the observer may, upon learning of its endangered status and upon gaining "embodied" experience of it, acquire a new emotional resonance and aesthetic significance[5]; similarly, a visually captivating mountain landscape that reveals itself to us after a long trek does not, upon learning that it is doomed to disappear within fifty or forty years due to anthropogenic glaciers melting, entirely lose its beauty; rather, that beauty acquires a "touch" of melancholy, anger, or sorrow (Saito [2010], Brady [2022]).

The relationship between what we know (about something) and the comprehensive *aesthetic* experience we have (of/with *that* something) is multifaceted and multi-layered. As briefly mentioned above, but now from a different perspective: while contemplating its delicate appearance, are we truly moment-by-moment aware that the water hyacinth, with its vivid shades of blue and lilac glistening in the streams, ponds and lakes that we may frequent, is one of the most invasive alien species ever introduced into our ecosystems (Figure 2)? Aesthetic appearances, *per se*, should not be demonized; rather dynamized.

4.3. *Philosophy of science: where's the "objective truth"?*

Recent discussions in the philosophy of science can offer further valuable insights into the issues with which the previous paragraph concluded, approaching them from an alternative perspective. I will organize my discussion in two

4 On the role of habits and habituation processes in aesthetics and aesthetic experience, also in terms of the re-modulation of aesthetic experiences of nature, see Portera (2020, 2020a, 2022).

5 I do not mean here by *embodied experience* solely or exclusively direct, first-hand experience – something clearly impossible in the case of certain endangered species that are extremely rare or located far from us. Rather, I also refer to the use of narratives, poetry, performances, and the full range of tools offered by the performing arts and literature to give (through time) shape, body and substance – alongside science (not apart from it) – to our experience of the non-human living world. The whole project of contemporary Environmental Humanities relies on this assumption.

parts: first, an examination of the relationship between truth, understanding, and embodied experience in scientific theories and practices; second, an applied discussion of the supposed separability between descriptive and appreciative/evaluative components in conservation biology, with specific reference to the paradigmatic case of the concept of biodiversity.

Let us start from the first point. Lately, scholars have increasingly returned to a focus on the role and status of models, representations, and idealisations within scientific practice. Models and representations are research tools that are frequently employed by scientists without strict regard for their literal truth, and often with full awareness that they are, in fact, false (Cartwright [1983]; Potochnik [2017]; Elgin [2017]). Scientific modelling, in particular, regularly involves the use of distortions, abstractions, and idealisations. For example, economic models typically assume the existence of perfectly rational agents – entities that, strictly speaking, do not exist. Risk prediction models for invasive alien species rely on probabilistic assumptions, which are essential in attempting to estimate, with the highest possible reliability, whether an organism is potentially harmful – without the need to wait for its impacts to become observable. In population biology, likewise, models that attribute population self-regulation to size-dependent mechanisms often presuppose processes that have been only partially clarified by scientists. Nevertheless, this incomplete knowledge does not prevent the formulation of predictions for population dynamics.

The reliance on such idealized constructs has led several philosophers to contend that the primary aim of science is not necessarily to arrive at truth, but rather to promote understanding of the world's underlying patterns (de Regt, Leonelli, Eigner [2009]). In this vein, and following a path already traced by Nelson Goodman regarding the analogies between art, the aesthetic, and science, Elgin has introduced the concept of "felicitous falsehoods" (Elgin 2017, 2022) – i.e. idealized representations whose epistemic value is not undermined by their inaccuracy. She writes: «*felicitous* because their inaccuracies are epistemically fruitful; they are not defects. The falsehoods are inaccurate in ways that enable them to non-accidentally provide epistemic access to obscure or occluded aspects of their targets. Not despite, but because of their inaccuracy, they afford the access that they do» (Elgin [2022]: 12). Elgin, in the framework of a conceptual distinction between scientific knowledge and scientific understanding, suggests that understanding be viewed as a *skill* (or, I would say, as a habit or habitual acquired disposition: Portera [2020]), i.e. the ability to discern, also by direct, transformative intervention in the world (see Leonelli [2009]), how facts cohere within a general framework. In a similar vein and focusing more directly on the role of tools and *knowing-how*, Leonelli (2009) argues that «within most of biology […] the development of skills, procedures, and tools appropriate to researching specific issues is valued as highly as – or, sometimes, even more highly than –

the achievement of theories or data. The evolution of tools and procedures (as in the case of modeling) is not only crucial to furthering theoretical developments: it constitutes an important research goal in its own right» (Leonelli [2009]: 194-195). She makes a persuasive case for the relevance, in the process of gaining biological understanding, of embodied knowledge and of the researcher's sensory experience of the phenomena under scrutiny, up to the point that, according to Leonelli, «understanding a claim or explanation is [particularly in biology] a largely subjective matter. Understanding is not an attribute of knowledge itself, which can be measured quantitatively (as in "how much do you understand?"). Rather, it is a cognitive achievement that is acquired by individuals in a variety of ways and that can therefore take different forms depending on the instruments that are used to obtain it» (Leonelli [2009: 199]). Crucially, this kind of biological understanding, rooted in the skills, habits and embodied abilities possessed by each subject (by each scientist), becomes properly scientific only when it is shared inter-subjectively and it circulates within a community of peers, promoting (indirectly: see Leonelli [2009]: 199) other subjects' chances to gain similar understanding. Might is be the case, as Darwin's biography seems to suggest, that also the scientist's aesthetic experiences play a role in this multifaceted process of understanding (in Leonelli's sense) at the heart of scientific theorizing and practices?

As for the second point, I will restrict myself to a couple of remarks. Conservation, by its very nature, implies as one of its foundational steps a process of prioritization. From a policy-oriented conservationist standpoint – particularly within a crisis-driven framework – not all species or ecosystems can or should be preserved. To what extent can or should our aesthetic engagement with the non-human natural world be guided exclusively by the "objective" conservation priorities set by scientists? More broadly, what kind of concept is the concept of conservation? And, in parallel, what kind of concept is biodiversity – the paradigmatic focus of conservation efforts? Casetta, in numerous contributions, highlights how the concept of biodiversity has been designed, from the very beginning, as an almost inextricable entanglement of facts, values, interests, and demands: a quasi-concept (Casetta [2018]). This quasi-concept reveals that a "pure" science of conservation – entirely free from the entanglement with values, intentions and interests – is, at best, a theoretical fiction. It is worth quoting once again – despite its familiarity – the statement by Dan Janzen, invited by E.O. Wilson to speak at the 1986 Forum that marked the official birth of the very notion of biodiversity:

> The Washington conference? That was an explicit politic event, explicitly designed to make Congress aware of this complexity of species that we're losing. And […] the word was punched into that system at that point deliberately. A lot of us went to that talk on a political mission. (Takacs [1996]: 37)

In a nutshell, the word "biodiversity", when invented, was mainly and primarily intended to serve as a socio-political tool: it was coined in the attempt to gain the attention and support of policy makers, stakeholders, governments and citizens towards the rapid decrease in the number of species all over the world. It has been since the beginning a notion in which scientific facts and values, descriptions, policies and norms deeply and structurally intertwine. Against this background, dismissing the aesthetic in biodiversity conservation because it is merely a "shallow" subjective appearance and *therefore* a bias sounds like throwing the baby out with the bathwater.

By now, it should be clear – if my argument so far has been even minimally convincing – that the dichotomy between biases and "truly objective facts" is an overly simplistic way of framing the discourse on aesthetics in conservation. The point is not whether aesthetic values should be excluded from science nor whether it is possible to "redeem" them by subordinating them to scientific knowledge. Rather, the key issue is how we can reconceptualize and critically reassess the fundamental concepts at play – namely, conservation biology, conservation practices, and aesthetics – by attending to their reciprocal interrelations. I shall restrict myself here to a few preliminary remarks specifically concerning the aesthetic dimension, which I just outline for now, reserving a more thorough exposition and analysis for future work.

In order for the aesthetic to be recognized not just in a negative sense but as playing a constructive role within conservation biology, two conditions must be met: 1) it is necessary to adopt a genuinely *relational* concept of the aesthetic – one that avoids insular or exceptionalist models (such as those drawn exclusively from the art) and capable of overcoming the static dichotomy between an evaluating subject and an evaluated object (see Perullo [2025]); 2) the aesthetic should be conceived as a multi-layered and dynamic field of experience, in which surface appearances and underlying depth, as well as immediate perceptions and mediated understanding, visibility and invisibility are not considered as oppositional or discrete, but as interrelated and mutually shaping dimensions. This second point is relevant since such a framework would allow a focus onto the role of habits (as "second nature"), of embodied experience, and skills in both aesthetic perception and scientific practice (as illustrated, for example, in the work of Leonelli [2009]; see also Portera [2020, 2022]).

A relational and multi-layered perspective on the aesthetic – alongside a reassessment of the crisis-discipline narrative and of the fact-value dichotomy in conservation biology, and together with a transdisciplinary, intersectoral, and community-based approach in conservation science and aesthetics (see Ludwig et al. [2024]; Poliseli, Leite [2021]) – may offer a promising trajectory for articulating a yet-to-be-formulated *aesthetics of biological conservation*.

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